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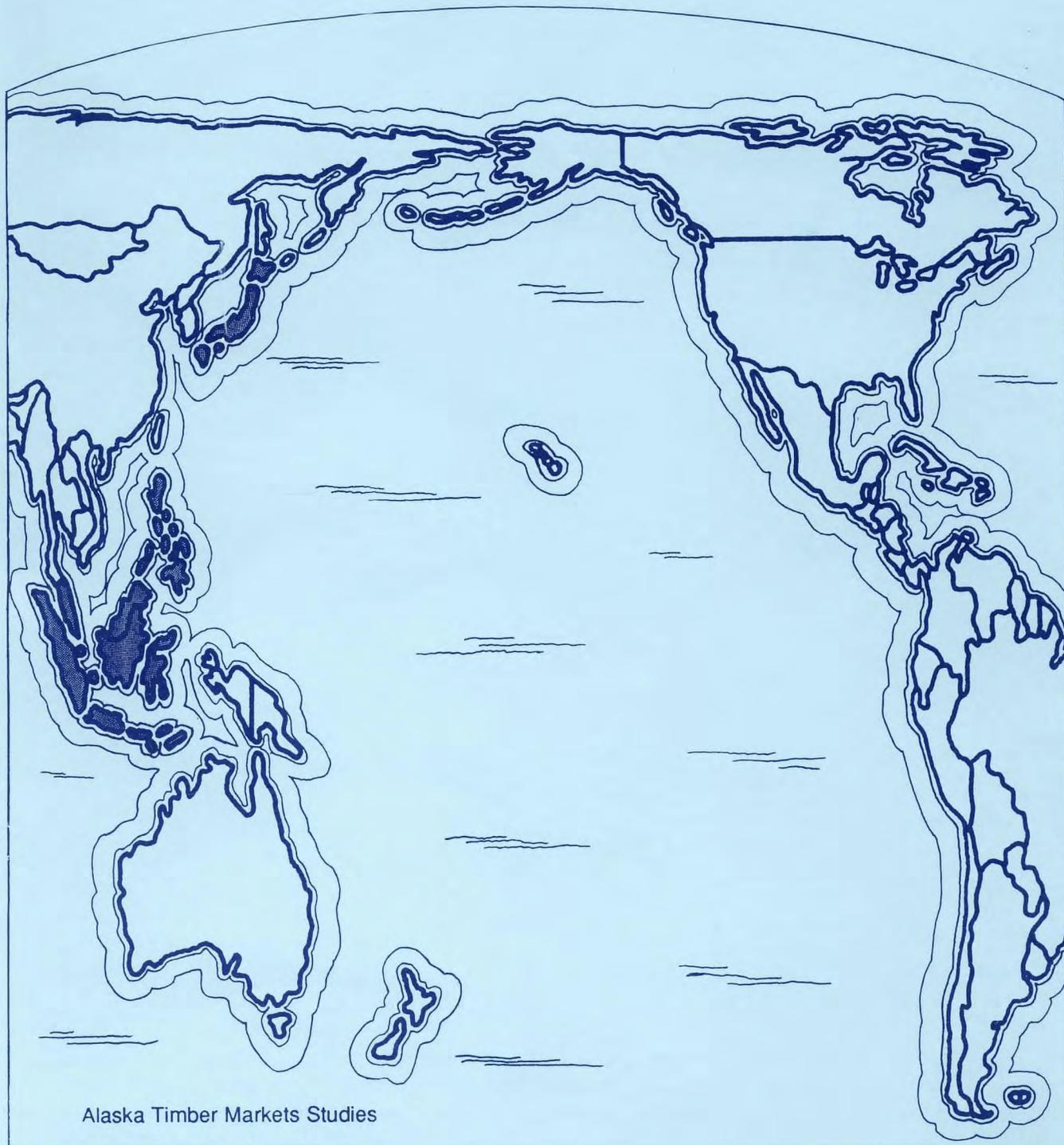
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# An Analysis of the Timber Situation in Alaska: 1970-2010

Richard W. Haynes and David J. Brooks



Alaska Timber Markets Studies

**Authors**

RICHARD W. HAYNES and DAVID J. BROOKS are research foresters, Forestry Sciences Laboratory, P.O. Box 3890, Portland, Oregon 97208-3980, and Forestry Sciences Laboratory, 3200 Jefferson Way, Corvallis, Oregon 97331, respectively.

## **Abstract**

**Haynes, R.W., Brooks, D.J. 1990.** An analysis of the timber situation in Alaska: 1970-2010. Gen. Tech. Rep. PNW-GTR-264. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 33 p.

Current conditions in Alaska timber markets are reviewed relative to the past two decades. Major issues in the outlook for Alaska timber markets are considered. Recent studies are used to develop projections of Alaska timber products output, timber harvest, and timber harvest by owner. The assumptions these projections depend on include the level of harvest on Native lands and consumption of sawn wood in Japan. Total harvest in Alaska is expected to average 660 million board feet per year during the early 1990s, and 545 million feet per year between 1995 and 2005. Harvest from National Forests necessary for total supply to meet expected demand will remain roughly constant at 400 million board feet per year from 1990 to 2010.

**Keywords:** Alaska, international trade, log exports, supply and demand.

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## Introduction

One basis for stewardship decisions in forestry is some notion of future markets for the various products (both commodity and noncommodity) that are the consequence of those decisions. Managers of public resources—and the public for whom they manage—must be convinced that the costs of management actions will be balanced by expected returns. Concerns of this type are openly stated in the evaluation of future demand for timber from the Tongass National Forest in Alaska.

The Alaska National Interest Lands Conservation Act (ANILCA) requires the Secretary of Agriculture to monitor demand for timber produced by the Tongass National Forest. Even without a specific mandate, though, careful consideration of future demand is essential for planning and management of the Forest. Our report analyzes the demand for all Alaska timber and timber products and is designed as a contribution to the land management planning process for the Tongass National Forest.

The demand for National Forest timber in Alaska—almost all of it harvested from the Tongass—declined from 1979 until 1986 (fig. 1). Declining timber harvests, despite higher quantities offered for sale, prompted questions about markets for Alaska timber products. These questions were complicated by the coincidental decline in National Forest harvests and the start of harvesting operations by Alaska Native Corporations.<sup>1</sup> The emergence of a new owner—Native Corporations—with management objectives and market opportunities differing from those of the National Forest changed the pattern of

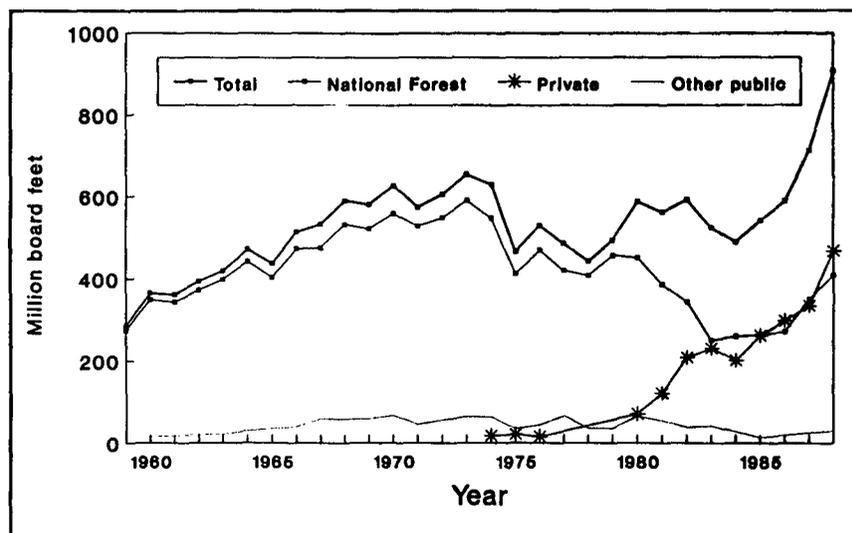


Figure 1—Alaska timber harvest by owner, 1959-88.

<sup>1</sup> The 1971 Alaska Native Claims Settlement Act (ANCSA) established 13 Native Corporations in southeast Alaska that were entitled to select about 550,000 acres of land from the Tongass National Forest. About 90 percent of these lands have been conveyed to Native Corporations with most of the land conveyances occurring in 1979 and 1980. These lands had an estimated standing timber volume of about 10 billion board feet and represented about 7 percent of the standing timber volume in southeast Alaska (Knapp, in press).

Alaska timber harvests.<sup>2</sup> No trend in total Alaska harvest between 1974 and 1987 was obvious, because there was considerable annual fluctuation; part of that was caused by harvests by Native Corporations that grew rapidly after 1980 to more than 300 million board feet. During this period, harvests from the National Forests dropped from an average of 440 million board feet per year (in the 1970s) to 260 million board feet per year in the mid-1980s. In 1988, the Alaska timber harvest was an unprecedented 900 million board feet due to a nearly 500-million-board-foot harvest by Native Corporations and a return of National Forest harvest to a level comparable to the late 1970s.

Some critics of Forest Service policy in the Alaska Region (Region 10) argue that the decline in National Forest timber sales (from a peak in 1973) reflects a long-term decline in the demand for Tongass National Forest timber products, and that Tongass National Forest timber sale and harvest goals should therefore be reduced (The Wilderness Society 1986). The argument is based on the following, broad assumptions: (1) Alaska faces increasing competition in Pacific Rim markets from producers in the U.S. Pacific Northwest (Oregon and Washington), British Columbia, and the South Pacific; (2) consumption of solid wood products in major (existing) markets will increase only modestly and may remain stable or decline; (3) Pacific Rim importers will continue to prefer to import logs rather than cants or lumber; and (4) worldwide demand for dissolving pulp is declining, while competition from other suppliers of dissolving pulp is increasing.

Forest products markets around the Pacific Rim, the primary market for Alaska forest products, have received increasing attention in the past decade, as the volume and value of trade has changed. Although the interest in Pacific Rim markets has resulted in several studies, only a few (Darr and others 1977, Gallagher and Mehrkens 1984, Garrett and Dykstra 1988, The Wilderness Society 1986) have focused on the current and prospective role of Alaska in these markets. For land management planning for the Tongass National Forest, the essential question is, What assumptions about future demand should be used to plan future harvest levels?

A series of six studies collectively known as the Alaska Timber Market Studies (ATMS)<sup>3</sup> was begun to broaden the basis for assumptions about markets for Alaska timber. The first study focused on current and long-term demand (to 2000) demand by the major forest products importers around the Pacific Rim (Japan, Republic of China [Taiwan],

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<sup>2</sup> For example, private owners are not restricted from exporting unprocessed logs.

<sup>3</sup> The Alaska Timber Market Study was organized as a series of agreements with various universities and the USDA Forest Service, Pacific Northwest Research Station. The project included researchers at the Pacific Northwest Research Station, Portland, Oregon; the Forest Products Laboratory, Madison, Wisconsin; Virginia Polytechnic Institute and State University, Blacksburg, Virginia; the Center for International Trade in Forest Products at the University of Washington, Seattle; and the Alaska Center for International Business at the University of Alaska, Anchorage. Data collection efforts also involved research organizations in each of the major consuming countries (China, Japan, Korea, and Taiwan). A technical oversight committee composed of individuals from interested organizations oversaw the project.

Republic of Korea [Korea], and People's Republic of China [China]). This study differed from past work in its attempt to define and evaluate end-use markets for solid wood products. The second study reviewed the preferences in product mix (for both form and quality) for forest products exports from southeast Alaska. The third study determined the potential for production of market pulp in southeast Alaska. The fourth study evaluated government policies influencing forest products trade and resource management. One part of this study evaluated forest products trade policies within the context of tariff or nontariff barriers to trade. The fifth study analyzed the shipping-cost structure (including port charges) for southeast Alaska relative to the Pacific Northwest. The sixth study reviewed the recent harvest levels on Alaska Native Claims Settlement Act lands and the prospects for future harvests.

Several recent studies present projections of timber harvest for southeast Alaska (summarized in table 1). Methodologies and assumptions differ among them. Studies by The Wilderness Society (1986) and Garrett and Dykstra (1988) generally use an economic context, and those by Darr and others<sup>4</sup> and the USDA Forest Service (1988) look only at timber availability in a physical sense.

**Table 1—Past projections of harvest in Alaska**

Forest Study	Total	Service	Native	Other
	<i>Million board feet</i>			
Darr and others <sup>a</sup>	650-800 <sup>b</sup>			
The Wilderness Society (1986)	515 <sup>c</sup>	245	225	45
Garrett and Dykstra (1988)	663 <sup>d</sup>	398	265	NA
U.S. Department of Agriculture, Forest Service <sup>e</sup>	724 <sup>d</sup>	388	316	20

NA = not available.

<sup>a</sup> Darr, David; Glass, Ronald; Ellis, Thomas; Schmiede, Donald. 1977. An overview of some economic options for southeast Alaskan timber. 219 p. Working draft. On file with Forest Service, Alaska Region, Box 21628, Juneau, AK 99802-1628.

<sup>b</sup> Average for the 1980s, no owner detail.

<sup>c</sup> Average for 1985-95.

<sup>d</sup> Average for 1990-2000.

<sup>e</sup> An analysis of the timber situation in the United States: 1989-2040. Part II: the future resource situation. Review draft. On file with: U.S. Department of Agriculture, Forest Service, Washington, DC 20090-6090.

Some of these analyses illustrate how market conditions from the recent past can influence perceptions. The Wilderness Society (1988) study, for example, uses data collected up to 1985 and portrays the future as a continuation of the low harvest levels of the early 1980s (see fig. 1). Similarly (but with a different effect), National Forest

<sup>4</sup> Darr, David; Glass, Ronald; Ellis, Thomas; Schmiede, Donald. 1977. An overview of some economic options for southeast Alaskan timber. 219 p. Working draft. On file with: Forest Service, Alaska Region, Box 21628, Juneau, AK 99802-1628.

timber sales programs throughout the 1980s were strongly influenced by observations from 1975 to 1980. Darr and others (see footnote 4) comment on the influence of contemporary market conditions on economic perceptions; they point out the special importance of demand cycles (and timber quality) in judging the economic feasibility of timber harvests in Alaska.

Garrett and Dykstra (1988) use data series ending in 1985 to estimate supply and demand relations, and data through 1987 to forecast prices and quantities. These projections are better at tracing the rapid increase in the Alaska timber harvest for 1986 to 1988. Projections to 2000 suggest that National Forest harvests will increase, in spite of expected weak markets for pulp, as Native Corporation harvests decline. These results are highly sensitive to assumptions about the yen-dollar exchange rate.

The 1989 Resources Planning Act (RPA) timber assessment (USDA Forest Service 1988) includes harvest and timber price projections for Alaska. In these projections total removals (all owners) average roughly 650 million board feet (130-135 million cubic feet) per year for 1990 to 2040. Projections of stumpage price (National Forest timber sold in Alaska) are as follows:

<u>Year</u>	<u>1987 dollars per thousand board feet</u>
1987	26.80
2000	34.50
2020	65.80
2040	64.60

These projected prices are similar to those projected for other Pacific Coast States (Washington, Oregon, and California); this is due mainly to Alaska competing with these States for export markets. As do Garrett and Dykstra (1988), the assessment assumes that Native Corporation harvests will decline rapidly from 1990 to 2000; however, in this projection National Forest harvests are assumed to be roughly constant after 1995.

Summaries of market conditions have been available for the last 8 years in the annual timber supply and demand reports required by ANILCA.<sup>5</sup> The latest report (USDA Forest Service 1988) describes the rapid expansion of log exports during 1988 to an all-time high, increases in the harvest from the Tongass National Forest (18 percent), and expected increases in timber harvested from the Tongass National Forest through 1992.

Each study suggests a possible and a more-or-less plausible future for timber harvests in Alaska; however, each study has one or more shortcomings limiting its direct use in a current assessment of the outlook for Alaska forest products. These shortcomings include (1) market conditions in the recent past influencing (or controlling) perceptions and projections; (2) the data and the analysis not being sufficiently contemporary; (3) the study lacking a systematic treatment of all Alaska products and markets; and (4) the study failing to include factors critical in the development of the Alaska timber market.

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<sup>5</sup> These reports are required by section 706 (a).

We had the benefit of reviewing results of studies conducted through the ATMS, so we hoped to avoid these problems. Our approach was to look at the past two decades, examine current market conditions, consider prospective changes in markets, and formulate an outlook for Alaska timber harvests to 2010.

## Production and Export of Forest Products From Alaska

Because Alaska markets are small and transportation costs to other U.S. markets are high, nearly all Alaska's production—of all commodities—is exported to foreign markets.<sup>6</sup> In 1988 the total value of Alaska exports (all commodities) exceeded \$2 billion; forest products were one-fourth of the total. Three commodities dominate Alaska's forest products exports: softwood logs, softwood lumber, and wood pulp. Wood chips (residues from lumber production) are an infrequent, but occasionally significant, export.

### Softwood Lumber

Sawmills throughout southeast and south-central Alaska produce cants (large, roughly squared timber) and lumber for export markets. A small quantity—in most years no more than 5 percent of production—is sold in U.S. markets. Japan has been and remains the primary market for Alaska lumber. In 1988, more than 95 percent of Alaska lumber exports went to Japan; this dependence on a single market is characteristic of the past two decades.

Alaska lumber exports increased in the 1960s, peaked in 1973, and declined in two stages (1973-78 and 1979-85) until 1985 (fig. 2). Only in the past few years (1986-88) has there been a change in this trend and modest growth in lumber exports. The decline in Alaska lumber exports began with a sharp drop in Japanese housing starts (along with a decline in the share of wood-based houses) and increased competition from lumber producers in the Pacific Northwest and British Columbia.

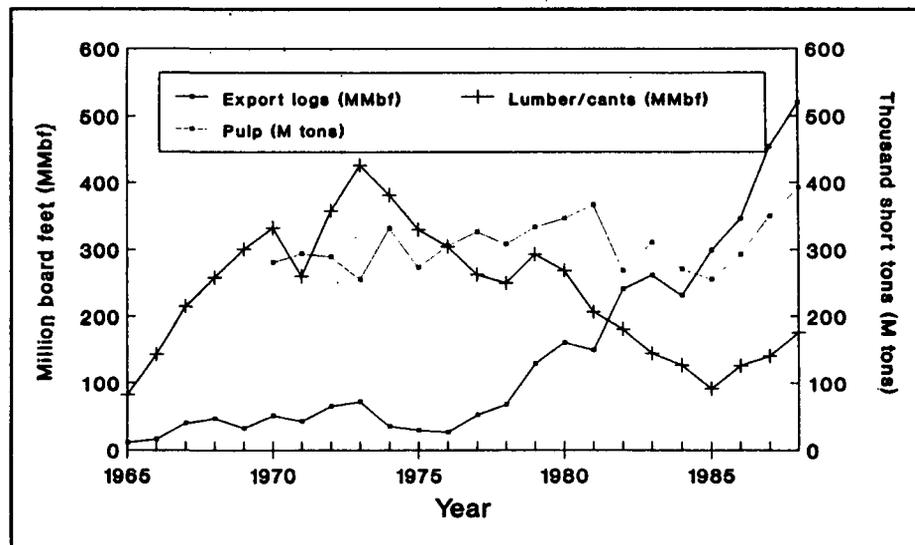


Figure 2—Alaska production of forest products, 1965-88.

<sup>6</sup> The exception to this is crude oil; crude oil shipments are restricted to the lower 48 States and are not included in the total value of Alaska exports.

Residential construction is the primary end use for Alaska lumber in Japan (Kim and others, in press). Japanese housing starts dropped sharply in 1973 and began a long-term decline reflecting structural economic changes and changes in demographic patterns in Japan. Japanese softwood lumber consumption fell 22 percent between 1973 and 1985; however, Alaska's exports to Japan and total production fell even more steeply, declining by 78 percent over the same period.

Although some of the decline in lumber exports from Alaska over the past two decades can be attributed to conditions in the Japanese market, increased competition made a significant contribution to the decline. In the mid-1970s lumber producers in the Pacific Northwest began to look beyond the United States for markets; this was a response to long-term trends in U.S. markets and an effort to find outlets for products during U.S. recessions. At the same time and for similar reasons, producers in British Columbia also increased shipments to overseas markets. Alaska's role in Pacific Rim markets was sharply diminished as a result. Alaska's share of North American softwood lumber exports to Japan fell from 42 percent in 1972 to 6 percent in 1985 (fig. 3).

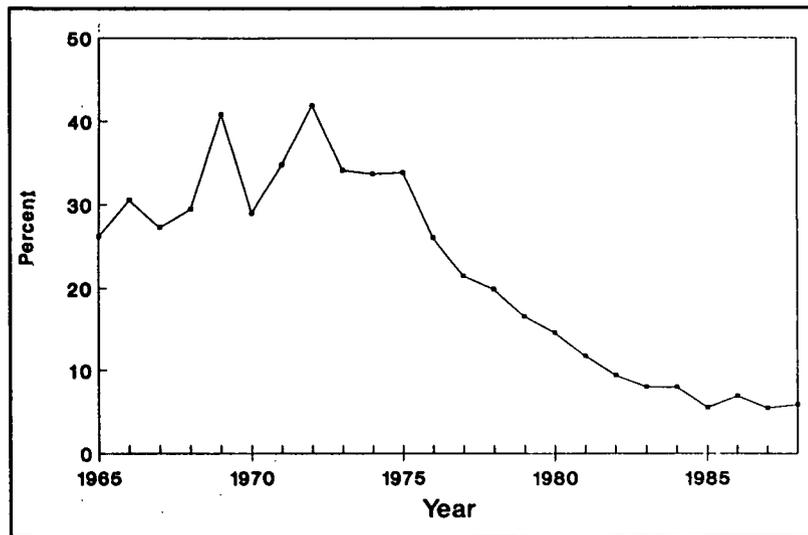


Figure 3—Alaska share of softwood lumber shipments from North America to Japan.

Increases in Japanese consumption (1986-88) and Japanese imports (1985-88) of softwood lumber have benefitted all North American exporters; however, those in the Pacific Northwest and Canada gained more (in absolute quantity) than producers in Alaska. As the Japanese market strengthened, Alaska producers did not increase their share of North American exports. Although Alaska timber is highly valued for clear wood and tight grain, lumber producers in other regions have been better able to adapt to changing markets and economic conditions.

Alaska's prospects for shipping softwood lumber to other markets around the Pacific Rim—Korea, Taiwan, and China—are also limited because these are smaller markets not having well-established preferences for the high-quality material for which Alaska may have a relative advantage.<sup>7</sup> As a result, these countries—to the extent that they consume imported softwood lumber—have been willing to substitute lower grades, and less select species when cost savings are significant. Competition from producers in the Pacific Northwest, British Columbia, and the South Pacific limits Alaska's ability to expand shipments to markets other than Japan.

## Wood Pulp

Alaska has been a producer and exporter of market pulp since the late 1950s when two mills were established in southeast Alaska. The primary product of both mills is dissolving grade pulp, although in most years small quantities of paper grade (sulfite) pulp are also produced. Most dissolving pulp produced in Alaska is bought by rayon manufacturers for textile production; some pulp is used in cellophane production, and a small quantity is sold in other, highly specialized markets (Durbak, in press).

No trend in Alaska pulp production has emerged over the past two decades, but production has ranged widely with economic cycles (fig. 2). In 1988, Alaska pulp exports were the highest in history; the previous peak in exports (and production) was in 1979-80. Both Alaska mills operated at maximum capacity in 1988 (Durbak, in press). Alaska accounts for about 30 percent of U.S. dissolving pulp production and one-third of U.S. exports.

Although there is little or no long-term trend in Alaska pulp production, the timber harvest necessary to support a given level of pulp production has declined over time. In spite of declining lumber production, increasing residue usage rates have allowed residues to become a significant share of pulped fiber in the Alaska mills. We estimate that residues accounted for roughly 35 percent of fiber consumption in the Alaska mills in 1988. At the same time, residue exports (reported as wood chips) have been significant in some years.

Consumption, total imports, and imports by source for the major world markets for dissolving pulp are summarized in table 2. Because pulp is an industrial commodity, even farther removed from final consumers than softwood lumber, the location of these markets reflects the distribution of production facilities (primarily rayon and textile manufacturing) rather than the pattern of consumption. The United States is the world's leading producer and consumer of dissolving pulp, but Alaska's access to this market is limited by transportation facilities and costs. Canadian mills ship to U.S. markets more than twice the quantity shipped by the Alaska mills.

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<sup>7</sup> This potential advantage is based on Alaska's share of harvestable old-growth timber increasing as stocks are depleted or removed from production in Washington, Oregon, and Canada.

**Table 2—Consumption and imports of dissolving pulp by country of origin for selected countries, 1985<sup>a</sup>**

Country	Consumption	Imports from:					
		All sources	United States		South Africa	Canada	Other
			Total	Alaska			
<i>Thousand metric tons</i>							
Japan	506.0	262.2	166.7	79.0	74.0	28.1	2.2
India	262.5	62.5	44.8	40.2	11.9	5.8	
Taiwan	134.1	61.1	34.1	10.0	17.1	—	9.9
China	91.0e	60.0	23.2	16.9	—	6.5	30.3
Korea	18.0	18.0	7.0	.3	—	11.0	—
United States	618.9	158.8	460.1	40.0e	58.0	99.2	1.6
West Germany	281.4	161.0	80.4	1.6	9.7	5.9	65.0
United Kingdom	168.0	171.0	46.0	—	106.6	8.4	10.0

<sup>a</sup> The letter "e" after a value indicates an estimate by the authors. Source: American Paper Institute (1986, 1988). These data are primarily importer reports; "imports" by the United States from the United States are shipments of U.S. production to domestic markets. Data for Alaska are compilations of unpublished data from the U.S. Department of Commerce.

Alaska's dissolving pulp markets are considerably more diversified than are markets for softwood lumber, and a larger share of total pulp production than lumber production—15 to 20 percent—is shipped to customers in U.S. markets. In export markets, dependence on Japan has decreased over time; in 1988 less than half of Alaska pulp exports were to Japan compared to two-thirds before 1980. Changes in the pattern of shipments follow, to a large extent, the worldwide relocation of textile manufacturing. Countries with relatively low labor costs—India, Taiwan, and China—are increasingly important markets for Alaska's dissolving pulp. In the past decade, Eastern Europe and the Soviet Union have also emerged as significant markets; however, underutilized dissolving pulp capacity in the Soviet Union makes these unreliable markets for the long term (Durbak, in press).

Over the past two decades there has been increasing and successful competition from other natural fibers and from synthetic fibers in the primary end-use market for dissolving pulp (Durbak, in press). Declining consumption worldwide, and especially in Japan—still the largest single market for Alaska pulp—lead some to conclude that future prospects for dissolving pulp are not good (The Wilderness Society 1986). After 1985, however, the worldwide decline in dissolving pulp consumption was reversed. Declines in Japanese consumption were offset, for Alaska producers, by increased shipments to other markets.

The strength of current markets for Alaska dissolving pulp is the result of increased demand for rayon fabric and reductions in world dissolving pulp capacity (Durbak, in press). Although markets will continue to be subject to short-term cycles, and the

long-term decline in end-use markets may continue, Alaska producers seem well positioned in this specialty market. Capacity adjustments (primarily shifts from dissolving pulp production to production of paper-grade pulps) improved the competitive position for remaining producers, among them the Alaska mills. But Alaska's competitive position relies on the price premium commanded by the specialty characteristics of dissolving pulp. Alaska's opportunities to expand or convert pulp production to paper pulp (on a large scale) are limited. A detailed examination of the prospects for market pulp production in Alaska indicates no particular advantage and numerous disadvantages for Alaska producers (Stevens and Adams, in press).

## Softwood Logs

Logs exported in unprocessed form have been part of Alaska's timber economy for more than two decades (fig. 2). Exports of National Forest timber have been restricted, however, since 1926 (Hines 1987). Before Federal timberland was transferred to private ownership, log exports were composed of the relatively small volume of timber that could not be processed locally. This volume seldom exceeded 50 million board feet per year.

Log exports increased sharply in 1979 when private owners, operating without being required to seek local processing, acquired significant timber volume. Private owners in Alaska entered well-developed Pacific Rim log markets with high-quality raw material when logs of comparable characteristics and quality were increasingly scarce. Alaska log exports doubled between 1979 and 1983 and doubled again between 1983 and 1988. The share of the total timber harvest exported as logs increased from 15 percent in 1978 to 60 percent in 1988.

In spite of the sharp increases in Alaska log exports, Alaska accounted for only 10 percent of North American softwood log exports and 6 percent of Pacific Rim log exports in 1988 (see fig. 4). Alaska's share of exports from North America to Japan—the major importer of logs from North America—was comparable. In 1988, Alaska logs accounted for 8 percent of Japanese softwood log imports and 4 percent of Japanese softwood log consumption.

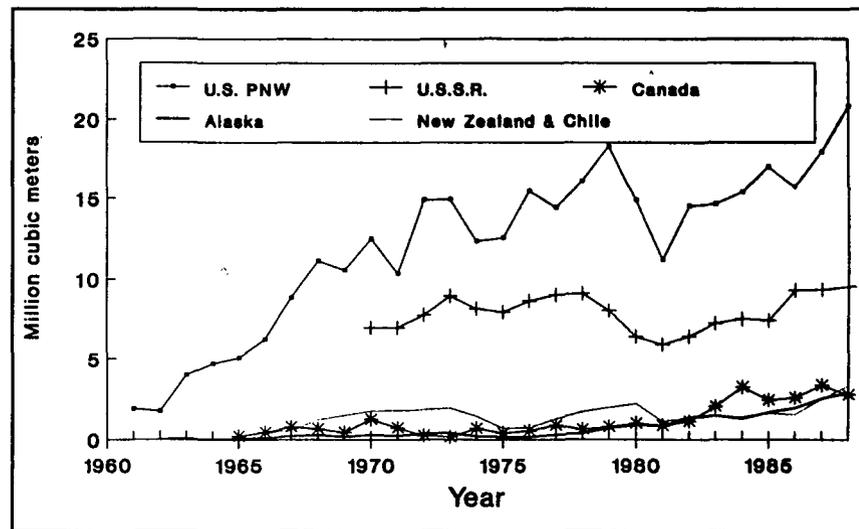


Figure 4—Softwood log exports around the Pacific Rim, 1960-88.

Japan is the largest and the dominant market for Alaska softwood logs. Japan's share of Alaska log exports has decreased though, as exports have increased. Although this may not have been a deliberate effort to diversify markets, the process of finding new markets for an increasing volume and wider variety of logs increased shipments from Alaska to several markets, including South Korea and Canada. And as has been the case with dissolving pulp, the changing pattern of log shipments is partly a consequence of the relocation of manufacturing to countries having low labor costs compared to Japan.

Over the past two decades, Japanese manufacturers have imported logs of species similar in appearance to domestic species. The preference for logs over lumber imports enables the Japanese to have maximum control over the variety and quality of products and maintain domestic employment. Preferences of this sort are less well established in Taiwan and Korea. Like Japan, China can also be expected to continue to prefer log imports; low labor costs and limited foreign exchange are particular encouragements for domestic processing of forest products.

### Issues in Alaska Forest Products Markets

Several factors have particular influence on Alaska's timber economy. One factor is costs: both logging and milling costs are high in Alaska, relative to other producing regions. Inevitably, this reduces Alaska's competitiveness in world markets. A second factor is Alaska's almost complete dependence on export markets. Alaska has minimal access to the world's largest market for softwood forest products—the U.S. market. Finally, the wide range of Alaska's timber values, a span greater than in any softwood forest region of the world, make a simple characterization of the Alaska timber economy difficult. At the upper end of the value spectrum lie the highest priced softwoods found around the Pacific Rim; at the low end is timber failing to be economically accessible in even the strongest markets.

These factors lead to two issues often discussed for exports of forest products from Alaska. The first is the issue of quality in log export markets. The log export market is not homogenous; the relevant question, therefore, is, What are the market prospects for the range of log qualities available from Alaska? A second, related question is, To what extent have increases in log exports come at the expense of lumber (cant) exports?

**Timber quality in offshore markets for Alaska logs**—Recent efforts to forecast roundwood markets in Alaska have involved recognizing different quality logs, each with different market prospects (Flora and McGinnis 1989). At the lowest level are utility grade logs, useful within Alaska for chips, but because of their shortness, broken ends, decayed centers, or crookedness, unmarketable for other products. A second stratum, construction grades,<sup>8</sup> represents timber just below the economic threshold during the midpart of the timber market cycle, as in 1985-87. The third stratum, performance grades,<sup>9</sup> regularly enter timber markets and account for about 80 percent of Alaska's log exports.

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<sup>8</sup> Construction grade logs are, or compete with, No. 3 saw logs with scaling diameters between 6 and 12 inches and are capable of producing at least one-third of their volume in standard grades of lumber.

<sup>9</sup> These logs compete with the export equivalent of Pacific Northwest No. 2 saw logs. They are long (36-40 feet) and straight, have small knots, have negligible defect, come from old-growth stands, and exceed 12 inches in scaling diameter.

The fourth and highest valued group is termed selects. These are premium logs, also known in Japan as piano grade, and are expected to sell at prices at least 10 times logging costs, regardless of business cycles.

We focus here on market prospects for the two most important grades of Alaska logs: construction grades and performance grades. The outlook for select grade and utility grade logs is not addressed. The former because only physical availability limits market potential; the latter because their highest valued use in most markets is as raw material for pulp.

Demand and supply estimates for Pacific Rim markets (Japan, Korea, Taiwan, and China) and suppliers (United States, U.S.S.R., Chile, New Zealand, and Canada) indicate that demand for construction grade logs can be expected to expand steadily and keep pace with supply (Flora and Vlosky 1986). Supplying countries will compete intensely for shares of these expanding markets. As a result, prices of construction grade logs, adjusted for inflation, are expected to remain stable until the mid-1990s. After 1995, supplies are expected to increase faster than demand, and prices are expected to decline between 1995 and 2000 (Flora and Vlosky 1986). Alaska exports of construction grade logs, negligible in 1985-87, therefore are not expected to improve<sup>10</sup> (Flora 1985, 1988; Flora and Vlosky 1986).

These projections assume that future demand and supply will follow recent trends. In fact, Alaska competes in markets having highly cyclic demand and relatively stable supplies. A consequence is that prices seldom remain stable or follow smooth trends. In 1989, near the peak of an economic cycle, Alaska enjoyed a brisk export trade in construction grade logs and higher than expected prices. Declines in prices should be expected in the next decade and will coincide with downturns in Pacific Rim economies.

Alaska's performance grade logs are also subject to market cycles but seldom pass completely from the market as do construction grades. Marketed mostly in Japan, Alaska logs in this grade enjoy a special role among roundwood supplies. Competing supplies (exports of old-growth logs) are restricted by British Columbia and are prohibited from U.S. National Forests. Private timberlands are the source of most U.S. log exports, and these lands contain little old-growth timber (Haynes 1986).

Because supplies are limited, prices of performance grade logs are expected to increase significantly by 1995 (relative to 1985-87); a further, but more modest increase is expected between 1995 and 2000 (Flora and McGinnis 1989). By 1989, these price gains had already been realized. As with construction grades, however, these were record breaking high prices and are unlikely to be sustained through future recessions.

**Market tradeoffs between cants and logs in Alaska**—Until the mid-1970s, export trade in solid wood products in Alaska was primarily cants (lumber of relatively large dimensions) sawn from timber harvested on the Tongass National Forest. In the late 1970s, log

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<sup>10</sup> Flora, Donald F. 1988. The opportunity triangle: market prospects for Alaska's smaller timber. 10 p. Unpublished report. On file with: Forest Investment, Marketing and Trade Research, Forestry Sciences Laboratory, 4043 Roosevelt Way, NE, Seattle, WA 98105.

exports from newly established Native timberlands became a significant share of trade in solid wood products, and lumber exports declined until the mid-1980s (see fig. 2).

The tradeoff between cants and logs long has been an issue in Alaska. Gallagher and Mehrkens (1984) conclude that in the hemlock (*Tsuga* spp.) and the construction grade markets, logs have the potential to displace cants. In their view, the extent of displacement depends on levels of Japanese demand and the availability of log supplies from the Pacific Northwest. This issue retains its relevance because Alaska log exports from Native timberlands are expected to decline. Will the reduction in these log exports (in the early 1990s) induce an expansion of the market for cants?

Flora and others (1989) reexamined this question by analyzing demand and supply for both commodities. They examined different circumstances that could account for changes in exports of both cants and logs and found that a combination of circumstances accounted for export-volume patterns in the 1970s and 1980s. First, during the period of decline in cant exports, Japanese demand fell, thereby affecting both cants and logs (see fig. 2). Second, Alaska's select grade wood-products sector is price inelastic.<sup>11</sup> Increasing harvests on private lands (stimulated by considerations largely independent of timber markets) increased log exports, despite lower offshore prices for logs in general. These two factors are sufficient to explain the market shifts, but they seem to have operated in concert with two additional circumstances: First, Japanese prices for select logs rose relative to prices for select grades of lumber, thereby reinforcing the shift to logs from cants. Second, inelastic offshore demand for select logs and cants permitted increased log supplies from private lands to encroach on the market share of cants (Flora and others 1989).

This discussion, in particular the implication of substitution between logs and cants, does not apply to other grades of Alaska logs and cants. For grades other than selects, log and cant exports have risen and fallen in tandem, responding in similar ways to market signals.

## Markets for Alaska Forest Products

Alaska forest products are shipped throughout the world, but for all commodities, the majority of shipments are to markets around the Pacific Rim. Japan has been and remains the single most important market for all products. Other Pacific Rim countries—South Korea, Taiwan, and China—are smaller but important markets for softwood logs, pulp, and (to a much smaller degree) softwood lumber. In addition to Pacific Rim markets, Alaska pulp is shipped to India, the Middle East, and Eastern Europe.

### Japan

For many years, Japan was virtually the only market for Alaska forest products; for softwood lumber, this is still the case. The share of Alaska logs shipped to Japan in 1988 declined to 62 percent, from 97 percent in 1980; the share of dissolving pulp exports shipped to Japan in 1988 was 43 percent, compared to 68 percent in 1980. No similar trend is true for softwood lumber: shipments to Japan accounted for 95 percent of Alaska's exports in 1988.

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<sup>11</sup> Economic relations are said to be price inelastic when, expressed in terms of percentage of change, the change in quantity (either produced or consumed) is smaller than the change in price.

Japan uses softwood logs and lumber in a pattern similar to the United States: residential construction accounts for most consumption; packaging, manufacturing, and nonresidential construction account for most of the rest (see table 3). Alaska logs and sawn wood are used primarily in residential construction in Japan (Kim and others, in press). As a result, structural change, and trends in the Japanese housing market have had a significant impact on Alaska producers. Declines in the number of housing starts—and even sharper declines in the share of the total accounted for by wood-based houses—contributed to a shrinking market for producers in Alaska and other parts of North America between 1973 and 1985.

**Table 3—End uses for sawn wood in selected Pacific Rim countries**

Country	Residential construction	Packaging	Manufacturing	Other construction	Other uses	Total
<i>Million cubic meters</i>						
Japan <sup>a</sup>	22.1	2.8	1.7	1.0	1.0	28.6
Korea <sup>b</sup>	1.0	.1	2.3	.7	.7	4.8
Taiwan <sup>c</sup>	.8	.1	3.0	.1	.6	4.6
China <sup>c</sup>	55.2	8.0	5.8	4.1	1.1	74.2

<sup>a</sup> Data are for 1986. These are shipments of domestically produced sawn wood; total consumption, including imports was 34.2 million cubic meters.

<sup>b</sup> Data are for 1986.

<sup>c</sup> Data are for 1987.

Source: Kim and others (in press).

Part of the decline in Japanese sawn-wood consumption can also be attributed to restrictions on trade in tropical logs. Japanese consumption of hardwood sawn wood (almost all tropical) declined by 50 percent between 1973 and 1985; Japanese production (from imported logs) fell by two-thirds over the same period. Japanese production and consumption of plywood (the primary use of tropical logs in Japan) fell even more sharply. Although disruptions in tropical log markets contributed to a modest increase in the share of total sawn-wood consumption accounted for by softwoods, these disruptions have also contributed to the development of nonwood materials for use in housing.

Japanese consumption of sawn wood in 1986 was 34.2 million cubic meters (about 15 billion board feet), or roughly one-third the U.S. market. Softwood species were nearly 84 percent of the total, and imports (in product form) accounted for 16 percent of consumption. Product imports have been increasing (doubling between 1981 and 1988), but Japan still relies heavily on imports of raw material to sustain both consumption and domestic industries. In 1988, product imports were 22 percent of sawn-wood consumption, and imported logs accounted for 60 percent of the raw material used in domestic manufacture of sawn wood.

In the mid-1980s Japan implemented policies designed to stimulate its housing market, partly as a result of pressure from the United States (arguing that Japan must increase imports) and partly in response to domestic pressures. The effect of this effort has been to reverse the trend (from 1973 to 1985) and increase both housing starts and sawn-wood consumption. Projections of Japanese sawn-wood consumption expect at least modest growth to 2000 (see, for example, Food and Agriculture Organization 1986).

The need for materials for musical instruments, primarily pianos, creates a small, but valuable specialty market for Alaska timber in Japan. Japan dominates the manufacture of high-quality pianos, and Alaska Sitka spruce (*Picea sitchensis* (Bong.) Carr.) is preferred over alternative timber (Kim and others, in press). Another specialty market, in which Alaska timber is highly competitive in Japan, is for interior, decorative trim (such as posts, door trim, and door rails). Based in part on this market, old-growth western hemlock (*Tsuga heterophylla* (Raf.) Sarg.) from Alaska currently commands a 30- to 40-percent price premium over hemlock from the Cascade Range in Oregon and Washington (Japan Forest Products Journal 1989).

Japan is also one of the world's largest markets for dissolving pulp and the second-largest market around the Pacific Rim (after the United States). Although Japanese consumption of dissolving pulp declined steadily from 1970 to 1988, imports increased. Imports accounted for 60 percent of Japanese dissolving pulp consumption in 1988 compared to 25 percent in 1970. Over the past decade, Alaska's share of U.S. exports to Japan, total Japanese imports, and Japanese consumption nevertheless have remained relatively stable. Increased competition (from other U.S. producers and from South Africa) and strong alternative markets have kept Alaska's share of the Japanese market at about 25 percent.

#### **Korea, Taiwan, and China**

Other Pacific Rim markets differ markedly from Japan and from each other (see table 3). Korea and Taiwan are small, export-oriented markets. Furniture and musical instruments (both included in manufacturing uses) dominate wood use. In both countries, these industries rely on export markets, mainly the United States and Japan. Wood-using, export-based industries in Korea and Taiwan have grown rapidly over the past decade. In Taiwan, for example, consumption of wood in furniture manufacturing increased more than threefold between 1980 and 1986 (Kim and others, in press).

Korea has been the primary destination for the shift in Alaska's softwood log exports; Korea now accounts for 20 percent of Alaska's log exports. These shipments are the result of burgeoning furniture and musical instrument industries in Korea (that compete vigorously with Japan) and a period of strong economic growth and associated construction. (Kim and others, in press).

Construction uses of wood account for a much smaller share of consumption in Korea and Taiwan than in Japan or China. Compared to Japan (or the United States), the quality of wood used in construction is lower. This is due, in part, to well-established usage patterns resulting from the low quality and limited quantity of domestic timber resources. Both Korea and Taiwan rely heavily on nonwood materials for housing. In spite of expected increases in new housing construction, increases in wood consumption for residential construction in Korea and Taiwan are uncertain at best (Kim and others, in press).

Taiwan has been an increasingly important market for Alaska dissolving pulp; between 1980 and 1988 shipments to Taiwan increased threefold. This mainly has been a direct substitution for shipments previously going to Japan. In 1988, Taiwan was the destination for 20 percent of Alaska's exports. Relocation of pulp-consuming industries (rayon manufacturers) from Japan to countries offering lower labor costs (among them, Taiwan and Indonesia) have resulted in changes in patterns of pulp shipments. Changes in total pulp exports from Alaska are attributable to exchange rates and to reductions in supply by competing regions. Other major markets for Alaska pulp (such as China, Egypt, India, and Thailand) are countries where textile manufacturing and exporting are important components of the economy.

In spite of its population, China is an uncertain market for North American forest products. Although the potential is great (see, for example, Lovett and Dean-Lovett 1986), economic and institutional factors are limiting. And the Soviet Union has advantages over other suppliers to the Chinese market; foremost are location and experience in barter trade (Kim and others, in press). China has also been a customer for increased log exports from Chile (Kim and others, in press). Projections of Chinese forest products consumption to 2000 show little potential expansion of the role of foreign suppliers (Fournier 1986).

China's preference for logs, and use of material of low quality provide limited market opportunity for Alaska producers. In addition, since entering Pacific Rim markets in 1980, China has been an unpredictable customer. Time spent in understanding and penetrating Chinese markets will have an uncertain return at best.

## **Alaska's Competitors**

Alaska faces competition in all markets from three sources: (1) traditional exporting regions—Washington and Oregon, Canada, and the Soviet Union; (2) emerging exporting regions—Chile and New Zealand; and (3) domestic resources in the Asian market countries—Japan, China, South Korea, and Taiwan. Each source of competition poses a different set of challenges for Alaska producers.

Alaska timber and timber products are similar to those exported by other Pacific Coast producers and, for the most part, are sold in the same markets. Minimizing production and delivery costs and maintaining product quality are the primary bases for competition in export markets. Timber from the emerging producing regions is generally of lower quality than timber from North America (in solid wood products), but production costs are lower, and timber growth rates are substantially higher. Emerging regions have a potential advantage in fiber-based products (pulp) and in increasingly important reconstituted timber products (nonveneer panels and laminated products). Local timber in Asian markets has the inherent advantage of familiarity; however, its scarcity and cost have provided the opportunity for producers from North America and the South Pacific to penetrate and substitute imported timber.

A comparison of Alaska resources and harvests to those of its markets and its competitors provides one perspective for evaluating the outlook for Alaska's forest products. Summary data on Pacific Rim softwood forest resources, as of 1985, are given in table 4. These data are based on a recent summary of world forest resources that focused on Pacific Rim softwood resources (Brooks 1989).

**Table 4—Coniferous forest resources, reforestation, and timber production in selected countries around the Pacific Rim, 1985**

Region	Forest or plantation area	Annual planting	Growing stock	Annual harvest
	<i>Thousand ha</i>	<i>Thousand ha/yr</i>	<i>Million m<sup>3</sup></i>	<i>Million m<sup>3</sup>/yr</i>
United States:				
Pacific Northwest				
West side	7,388	119.2	2,588.0	73.2
East side	6,988	23.4	1,078.0	14.4
Southeast Alaska	2,556	.5	1,012.0	2.5
British Columbia, Canada:				
Coastal	13,140	43.9	2,626.8	34.7
Interior	28,139	61.6	4,809.1	39.8
Soviet Union:				
Far East	25,578	—	3,555.0	16.7
Siberia	157,200	—	20,343.0	94.6
Coniferous plantation resources <sup>a</sup> :				
New Zealand	87	849.0	116.0	9.0
Chile	1,040	77.0	100.0	9.0
Australia	832	30.7	109.9	5.8
Asian importers:				
Japan	9,917	106.3	1,343.3	20.6
South Korea	3,269	69.0	75.2	1.2
China	15,500	250.0	1,506.0	50.0
Taiwan	417	5.0	94.9	.3

<sup>a</sup> Primarily radiata pine (*Pinus radiata* (D. Don)).  
Source: Brooks (1989).

The forests of southeast Alaska are 3 percent of the area and 6 percent of the growing stock of the traditional producing regions shown in table 4 (excluding Siberia) but account for less than 2 percent of the timber harvest. Production from the emerging regions—New Zealand, Chile, and Australia—from stocks one-third as large is more than 10 times that of Alaska. The most intense, direct competition to Alaska producers still is from British Columbia, Washington, and Oregon. In addition to competing with Alaska in Pacific Rim markets, producers in these regions also have access to the considerable U.S. market.

### Timber Production In Competing Regions

**Pacific Northwest**—The U.S. Pacific Northwest (and especially the Douglas-fir region) is one of the main competitors Alaska has in Pacific Rim markets. For the past several decades, softwood timber inventories (available for harvest) in this region have been falling, while harvest levels (ignoring business cycles) have been roughly constant. Inventories declined nearly 15 percent between 1970 and 1986, while harvest in 1986 was slightly higher than that in 1970. These trends are expected to continue through 2000 but should change afterwards.

In recent projections (USDA Forest Service 1988), harvest levels in the Pacific Northwest (primarily of second growth) start to rise after 2000, thereby making the region more competitive in domestic and international markets for commodity grade solid wood products. These projections also suggest that little of the traditional, high-valued export timber (destined primarily for Japan) will be available from private timberlands after 1995. In fact, second-growth logs already comprise a significant proportion of Pacific Northwest log exports. These declines in size and quality of timber increase market opportunities for Alaska log exporters, who will still have access to large, old-growth timber.

**British Columbia**—In supplying timber products to the Japanese market, British Columbia is second only to the State of Washington. Unlike Washington, Oregon, and Alaska, though, most exports from British Columbia to Pacific Rim countries are as lumber, particularly hemlock lumber. This emphasis on product exports is due, in part, to long-term restrictions on log exports.<sup>12</sup>

Timber supply prospects for British Columbia are mixed in the short term. Declines are expected in the coastal region, but some increases are possible in the interior. A recent Canadian report (Woodbridge, Reed and Associates 1988) describes a future where, in spite of reductions in overall lumber production, Canadian producers remain competitive in Pacific Rim lumber markets by specializing in higher quality lumber products manufactured from old-growth hemlock. In the pulp and paper sector, generally tight fiber supply is expected to stimulate a conversion from market pulp production to production of newsprint and printing and writing papers for Pacific Rim markets.

**Soviet Union**—Forest resources in Siberia and the Far East of the Soviet Union are substantial; if data for Siberia are included, these regions account for two-thirds of the area and stock of coniferous forests in the Pacific Rim and nearly one-third of the harvest (table 4). If only data for the Far East (the region closest to Pacific Rim markets) are considered, the forest resources are roughly equivalent to interior British Columbia in area, and to Washington and Oregon (both west and east of the Cascade Range) in growing stock volume. The harvest is only slightly larger than that for the east side of Washington and Oregon. There is considerable potential for increasing production and export of logs, sawn wood, or both; however, the outlook for forestry production in the Soviet Union is an area of considerable uncertainty.

Projections of harvests in Siberia and the Far East of the Soviet Union range from a gradual decline (continuing a trend that started in the mid-1970s) to a dramatic increase. Sharp increases are unlikely because they will require considerable investment of capital needed for industrial projects throughout the country. Previous infrastructure investments (such as the Baikal-Amur-Magistral railroad) make sharp declines in timber production unlikely as well. Continued and possibly even expanded exploitation of the eastern U.S.S.R. forests is inevitable, but it is unlikely to be a high priority in planning in the Soviet Union. Some production from the eastern forests will probably be used to substitute for declining harvests in the forests of the European Soviet Union (west of the Ural Mountains). Efforts to restructure the economy are also likely to focus timber production (and conversion to products) in regions (and products) best able to satisfy domestic consumption.

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<sup>12</sup> See Hines (1987) for a brief history of West Coast log export restrictions.

Although the U.S.S.R. has the forest resources to compete with all producers in all Pacific Rim markets, most exports from eastern ports are logs, and the only significant markets are Japan and China. Log exports from the Soviet Union are generally at the low end of quality and price ranges; low prices and proximity have allowed Soviet exports to China to increase significantly since 1975. Soviet log and lumber exports to Japan are also generally lower quality material. In spite of Japanese preferences for North American timber (see Kim and others, in press), Soviet log exports are 50-60 percent of North American log exports to Japan and more than double the shipments from Alaska to Japan. Lumber exports from the Soviet Union to Japan are less than 5 percent of North American exports to this market.

**New Zealand and Chile**—Exotic softwood plantations cover nearly 2 million hectares (5 million acres) in New Zealand and Chile (see table 4). Until recently, afforestation increased the area of these forests by roughly 7 percent per year; since the mid-1980s an increasing share of the planting program of both countries has been directed at reforestation of harvested plantations. Although the majority of the plantation area is relatively young (most plantations are less than 20 years old), rotations are short and growth rates are high. Most of these plantations will be harvested before age 40, and some as early as age 25. Aggregate growth rates (total, net growth expressed as a percentage of growing stock) average more than 10 percent in both countries. Timber harvests in New Zealand in the mid to late 1980s have been relatively stable at roughly 9 million cubic meters (320 million cubic feet) per year. Restructuring of public ownership and management of forest resources may have contributed to this lack of expansion. In Chile, timber harvests increased by 50 percent between 1985 and 1988 to roughly 14 million cubic meters (500 million cubic feet). Harvests in both countries are expected to increase substantially and perhaps double between 1990 and 2000.

Concomitant with the establishment of a resource base, both Chile and New Zealand have promoted and fostered the development of an aggressive export-oriented forest industry. In 1985, 40 percent of the timber harvest in New Zealand was exported, although only 12 percent was exported as logs.<sup>13</sup> Over 50 percent of Chile's timber harvest was exported, roughly 25 percent as logs. Although log exports from the two countries (combined) doubled between 1985 and 1988 to more than 3 million cubic meters (106 million cubic feet), processed products dominate forest products exports. Product exports are dominated by paper grade market pulp, paper products, and sawn wood (used primarily in lower valued manufacturing, construction, and packaging end uses).

Unlike the situation faced by Alaska, Japan is not the most important market for either New Zealand or Chile. This, combined with differences in product mix and quality, suggests that these countries present Alaska producers with little direct competition. But, New Zealand and Chile have abundant softwood fiber and aggressively market it to price-sensitive markets; in the long term, this may have a significant impact on Alaska and other North American producers.

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<sup>13</sup> For comparison, 60 percent of Alaska's timber harvest in 1988 was exported as logs.

## Timber Production in Market Countries

Timber harvests in major markets for Alaska timber have declined over the recent past, thereby indicating to some observers a bright future for Alaska producers. These declines are expected to continue to 2000 in Japan, China, and Taiwan. Recent, modest gains in timber production in South Korea are unlikely to continue. After 2000, only timber harvests in Japan are likely to increase.

**Japan**—Japan's softwood forest resources are the most substantial in Asia (table 4). Although smaller in area than the coniferous forests of China, Japan's 10 million hectares (25 million acres) of plantations are more concentrated and more productive. An additional 4 million hectares (10 million acres) of natural forest sustain the bulk of current softwood timber production. Total timber harvest in Japan nevertheless declined steadily from a peak in 1968; the decline in coniferous harvest began even earlier. Coniferous log imports now equal domestic coniferous harvest.

Japan's plantation resource, although considerable, is young. It is composed of native species. More than 80 percent of the plantations are less than 40 years old and more than 30 years from maturity. Timber produced from Japan's domestic forests is also expensive because of the scarcity of mature stands, high logging costs, and high labor costs. The substitution of imported for domestic timber has been a natural response to relative costs; changes in exchange rates in recent years have only magnified the differential. The potential output from Japan's coniferous plantations by 2020 is 60 million cubic meters per year or roughly three times current harvest. This considerable resource can be used as either an economic or a strategic reserve.

**China**—Although China's timber resources appear substantial (larger in area but lower in volume than those of coastal British Columbia) they are widely disbursed and much more heavily exploited. Total timber harvest in China was more than five times the planned harvest shown in table 4 and exceeded annual growth (Fournier 1986). Sustained pressure on domestic forests has led to policies and legislation designed to restrict timber use (Lovett and Dean-Lovett 1986). Starting in 1980, timber imports increased sharply until they were limited by foreign exchange budget allocations and government internal policy.

China has few opportunities to substantially increase domestic timber production; nearly 80 percent of total production is not planned, and roughly 40 percent of total harvest is for household fuel. Forecasts of total production in 2000 (Fournier 1986) suggest that a 1- to 2-percent increase per year is possible, but increasing or even maintaining current production will damage long-term productivity and cannot be sustained beyond 2000.

**Korea**—Like Japan, Korea has nearly completed a reforestation program, although on a more modest scale and begun only 20 years ago. Domestic timber production may not decline in the short term, but it is unlikely to increase. More than half of the domestic harvest is used for pitprops in mining, and most of the remainder is used for pulp. Increases in Korea's wood consumption, and especially wood used in export-based industries will rely on imported forest products.

**Taiwan**—In the last two decades, domestic timber production in Taiwan has fallen even more dramatically than that in Japan. Although always small in comparison to Japan's harvest, the production of Taiwan's forests is now roughly one-fourth the level it was in 1970. Unlike conditions in Japan, there is no reasonable prospect of an increase in domestic production given the current resource situation. Any expansion of Taiwanese timber consumption for either domestic use or export-based industries, will depend on imported timber.

## Issues in Pacific Rim Forest Products Trade

Some general trade issues affect Pacific Rim forest products trade and may have an impact on Alaska. One current issue is the barriers Japan places on imports of lumber and plywood from North America. A second issue is various types of government intervention through trade policies and resource policies, around the Pacific Rim. A third long-standing issue is the effect of transport costs on forest products trade and, in particular, the effect of the Jones Act on intracoastal trade. Related to this is the supposition that Alaska's location relative to Pacific Rim markets gives it a transportation cost advantage over other North American suppliers.

## Trade Barriers

Among Pacific Rim countries, tariff and nontariff barriers distort trade flows to various degrees (Naumann, in press). Most barriers were erected to protect domestic industries. Currently, most attention and criticism are directed by U.S. lumber producers at Japan. Many claims by the U.S. industry were substantiated in a recent report that found that Japan's import barriers sharply curtail the market for U.S. lumber and plywood (U.S. Department of Commerce 1989).

Most U.S. exporters feel that strong governmental pressure is the only way to reduce trade barriers (Naumann, in press). Until that is accomplished, trade flows will be hindered by real or perceived restrictions on market access for exporters.

**Tariffs**—Tariffs imposed on forest products imports are a factor in all Pacific Rim markets and especially in Japan, Korea, Taiwan, and China. Additionally, tariff escalation<sup>14</sup> creates a significant impediment to trade in value-added forest products (Naumann, in press). Government-to-government talks organized within the MOSS (market-oriented, sector-specific) framework have resulted in reduced tariff levels in Japan; however, remaining tariffs are still high enough to provide a major distortion to trade due to the size of the Japanese market and the volume of products affected (U.S. Department of Commerce 1989).

High tariffs, combined with institutional and other factors, are also sufficient to deter most U.S. softwood exporters from attempting to enter markets in Korea, Taiwan, and China. Although logs enter these markets with low or no duty, value-added products face significant tariff escalation such that trade is curtailed. Tariff levels in Korea and Taiwan are important trade issues for exporters (Naumann, in press). In China, nontariff barriers are also significant in addition to high tariffs that limit trade flows.

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<sup>14</sup> Tariff escalation is a practice normally used by developing countries to protect infant industries. It establishes low or zero tariffs on raw materials but substantially higher tariffs on more processed products (for example, lumber, veneer, and plywood). Some producers in the United States argue that tariff escalation is used by developed countries around the Pacific Rim to impede imports of further processed products to protect uncompetitive industries.

**Nontariff barriers**—Forest products trade flows are distorted by nontariff barriers. Although many types of nontariff trade barriers have been attributed to Japan, Naumann (in press) found that only adverse exchange rates and unique product specifications are major concerns of U.S. exporters. Concerns over exchange rates were also based on historical experiences (until 1986), not on the current rate (1986-89). Product specifications and standards continue to be a problem, however, but uniformity on this issue is lacking (Naumann, in press).

From his survey of U.S. exporters, Naumann (in press) identified nontariff trade barriers in Korea and Taiwan as direct subsidies or price supports to domestic firms, port of entry taxes or levies, import quotas or restrictions, import licensing requirements, and adverse exchange rates. Nontariff trade barriers limiting entry to markets in China were import quotas, import licensing requirements, domestic laws restricting foreign business and adverse exchange rates (Naumann, in press). Some firms in the United States perceive an interlocking network of nontariff barriers in Pacific Rim countries. Some of these barriers may not seem in isolation to be "unfair," but when combined with a group of practices, they form highly effective protective systems to keep markets closed to value-added products. This and the pervasiveness of tariff escalation stifles new markets for value-added products. Producers in Alaska are particularly affected by these barriers because of their almost complete dependence on these Pacific Rim markets. It must be remembered, though, that any removal of trade barriers will not benefit producers in Alaska more than it will benefit producers in Washington, Oregon, or British Columbia. Freer access to Pacific Rim markets will result in more competitive markets, in which Alaska producers will have no assurance of success.

## **Government Intervention**

The Pacific Rim and Asia-Pacific (India to Oceania) nations possess relatively abundant forest resources. Softwood resources (described earlier) are somewhat limited, but the tropical timber resources of the Asia-Pacific nations are substantial. The Pacific Rim and Asia-Pacific nations also have about 50 percent of the world's population and low per capita gross domestic products. In almost all countries in these regions, governments have intervened in markets and in the development of forest resources. Government policies tend to facilitate stewardship actions and promote forest industries.

Government ownership of forest resources is common; Canada, Indonesia, and the U.S.S.R. are notable examples of dominant ownership of resources by a central or regional government. Government ownership is also an important factor in markets in the United States, Japan, and until recently, New Zealand. Besides ownership and direct management of resources, restrictions on management practices of all owners are common. In most developing countries (especially the tropical timber-producing countries), forest practices have been guided by short-term economic development goals rather than long-term, sustained-yield resource management practices.

Governments have tried to influence the evolution of the forest products industry. Canadian provinces, for example, have pursued progressive policies to foster improved use and deal with increasingly competitive conditions occurring under liberalized trade (Woodbridge, Reed, and Associates 1988). Indonesia banned log exports in 1985 to induce the development of a locally owned forest products industry. Even in the United

States, which has a mix of public and private timberland ownership, forest policy debates continue on the role of government in sustaining a viable industry. Intervention, either through public land management (consider the old-growth and Tongass debates) or by increasing timber supplies on private, nonindustrial timberlands, is advocated by many interested parties.

In North America, the U.S.S.R., Chile, New Zealand, and Japan, government policies favor continued development of softwood forest resources. These countries (except the U.S.S.R.) are relying increasingly on managed stands to meet expected softwood demands and (again, excepting the U.S.S.R.) use a mix of public and private ownership to meet policy goals.

## **Transportation Costs**

**The Jones Act**—The Merchant Marine Act of 1920 (the Jones Act) extended U.S. maritime law to include all domestic waterborne vessels. This law requires all shipments between any two U.S. ports to be carried on vessels constructed, owned, operated, and maintained under U.S. laws. Because geographical conditions in Alaska dictate that most transportation of primary and finished forest products be done on waterborne carriers, the Jones Act has a significant impact on Alaska forest products markets (Jackson and McKetta 1986). The majority of forest products shipments from Alaska are to foreign destinations, however, and therefore are not regulated by the Jones Act. Few shipments of Alaska forest products are made to U.S. markets, although most of the forest products consumed within the State are shipped from the Pacific Northwest (on vessels regulated by the Jones Act).

Jackson and McKetta (1986) estimated the economic impact of the Jones Act on timber producers, consumers, and shippers in Alaska. They found that differential freight rates for domestic and export shipments exist on Alaska waterborne transportation routes. The direct effect during their study period (1982) was a reduction in income for Alaska resource owners and consumers of forest products equivalent to less than 1 percent of total trade value for that year. This reduction in income was evenly shared between the owners of Alaska-grown timber and the consumers of forest products imported from the Pacific Northwest to Alaska.

The effect of the Jones Act on Alaska forest products markets is obviously small; changes in transportation rates did not seem to be a major factor in market determination. Differences in market prices seemed to have more control over the final destination of Alaska products than did transportation cost changes for all but the lowest valued products. High-valued products, such as pulp, lumber, and cants, will continue to be shipped overseas, unaffected by the Jones Act restrictions (Jackson and McKetta 1986).

Changing market conditions will not alter these results. Under improved market conditions, the transportation differential may change and become an even smaller proportion of rising product prices, thereby making trade diversion attributable to the Jones Act even more unlikely. Structural or policy changes affecting prices in one market, and not in others, could cause changes in patterns of shipments, regardless of Jones Act restrictions.

**Transport costs**—Promoters of commodity-based resource development in Alaska argue that Alaska's proximity to Pacific Rim markets provides it with a transportation cost advantage when compared to other U.S. regions (for example, Puget Sound). This contention was examined by Wisdom (in press) who found that differences in transport rates do not support this argument. No examples of cost advantage to Alaska can be attributed to shorter trips; for example, although transportation costs for western hemlock logs indicate an advantage for Alaska, rates for cants are lower for Puget Sound (table 5). Transport rates for wood pulp are also higher from Alaska relative to Puget Sound ports. Distance cannot be used to explain these differences in costs (Wisdom, in press).

**Table 5—Average transportation costs for softwood logs, cants, and wood pulp from Puget Sound and Alaska ports to Pacific Rim markets, 1988**

Product and origin	Market			
	Japan	South Korea	Taiwan	Hong Kong
<i>Dollars per thousand board feet</i>				
Softwood logs:				
Puget Sound <sup>a</sup>	174	199	203	224
Alaska <sup>b</sup>	148	157	157	194
Softwood cants:				
Puget Sound <sup>a</sup>	118	134	137	151
Alaska <sup>b</sup>	148	157	157	194
<i>Dollars per metric ton</i>				
Wood pulp:				
Puget Sound <sup>c</sup>	70	66	66	74
Alaska <sup>d</sup>	97	101	83	NA

NA = not available.

<sup>a</sup> Western hemlock.

<sup>b</sup> Softwood logs and cants.

<sup>c</sup> Average for Bellingham, Everett, Tacoma, and Seattle.

<sup>d</sup> Average for Sitka and Ketchikan.

Source: Wisdom (in press).

The relation between distance and ocean freight rates for logs and cants shipped out of Pacific Coast ports supports the perception that ocean transport costs are influenced by route distance. The failure of Alaska rates to be sensitive to distance underscores the importance of differences in route characteristics. Differences in distance among Alaska ports and between Alaska and Puget Sound ports to Pacific Rim markets are overwhelmed by factors such as weather, volume of trade on routes, and backhaul opportunities. There are significant differences in rates among logs and cants when rates are expressed on a board-foot basis, because of volume-weight differences between logs and cants.

The volume of trade can have a particularly strong effect on transportation costs. The rates shown in table 5 reflect charter rates; these rates are generally lower than liner rates, thereby reflecting the ability of large-volume shippers to negotiate lower rates and the advantages to carriers of securing shipload contracts. Charter rates are set by short-term demand and supply conditions in the ocean transportation market and are subject to wide fluctuations owing to changes in world demand. Global economic expansions and contractions are usually accompanied by expansion and contraction of international trade that induces, in turn, severe swings in the demand for ocean transportation services. The mid-1988 expansion of trade, for example, was exaggerated by large wheat shipments to Russia, which led to sharp increases in charter rates that declined quickly once wheat shipments ended.

Product characteristics can also affect the transportation cost differential. Stowage (the ratio of the volume occupied [in transport] to the actual volume of the product) is one factor determining shipping costs. Logs shipped from Alaska generally have greater taper than logs shipped from Puget Sound. This increases the stowage factor and, therefore, increases the unit cost for shipments from Alaska.

## Projections of Forest Products Output

Here we bring together information discussed in the foregoing and additional information to make projections of Alaska forest products output, timber harvest by product, and timber harvest by owner. Table 6 summarizes historical data for 1973 to 1988 and projections for the period 1989 to 2010; data are shown as 5-year averages centered on the midpoints and end points of decades.

**Table 6—Summary of historical and projected periodic Alaska timber harvest by owner, harvest by product, and production of forest products, 1970-2010<sup>a</sup>**

### 6A—Timber harvest by owner and timber imports

Period	All owners	National Forest	Private	Other public	Timber imports
<i>Million board feet</i>					
1975	554.7	489.4	17.7	54.6	0
1980	537.4	411.0	133.8	46.1	25.5
1985	572.7	280.7	266.2	25.8	34.5
1990	787.5	381.5	376.0	30.0	13.7
1995	595.5	403.5	162.0	30.0	15.0
2000	538.2	403.2	105.0	30.0	15.0
2005	527.1	397.1	100.0	30.0	15.0
2010	530.8	400.8	100.0	30.0	15.0

## 6B—Harvest by product<sup>b</sup>

Period	Total	Export logs	Lumber	Pulp
<i>Million board feet, roundwood equivalent</i>				
1975	561.1	42.9	292.8	225.5
1980	524.9	149.5	188.5	87.0
1985	567.7	318.4	114.2	135.2
1990	783.2	399.1	168.7	215.4
1995	595.5	181.4	192.7	221.4
2000	538.2	123.5	227.6	187.1
2005	527.1	117.0	227.6	182.5
2010	530.8	117.0	225.8	188.0

## 6C—Production of forest products<sup>c</sup>

Period	Export logs	Lumber	Pulp	Wood chips
<i>Million board feet</i>		<i>Thousand short tons</i>		
1975	42.9	341.2	298.8	56.5
1980	149.5	239.9	324.9	83.7
1985	318.4	125.7	296.1	4.6
1990	399.1	185.8	379.6	35.4
1995	181.4	217.8	387.5	44.5
2000	123.5	262.8	362.0	51.2
2005	117.0	268.5	353.2	49.8
2010	117.0	270.9	356.3	48.3

<sup>a</sup> Data are averages centered on the year they are reported for, except 2010 reports the average for 2008-2010. Annual data are reported in Brooks and Haynes (in press).

<sup>b</sup> Data are estimated for 1975, 1980, and 1985; see Brooks and Haynes (in press) for details. Data shown for 1900 include estimates for 1988 and projections for 1989-92; data for all other years are projections.

<sup>c</sup> Lumber and pulp production data include both offshore exports and (estimated) shipments to domestic markets. Wood chips are residuals from lumber production; only offshore exports are shown.

## Methodology

The method used to develop the projections begins with estimating Alaska forest products output (by product), which is followed by calculating the raw material requirements necessary to support this production. Total raw material requirements are combined with projections of timber harvest by private owners and harvest by non-National Forest public owners. Projected harvest by private owners (Native Corporations) was based on data from Knapp (in press); projected harvest by other public owners was based on historical data. Projected National Forest harvest is the quantity of timber that would be required to satisfy the projected derived demand for Alaska timber, given harvest by other owners. Complete details of the projections summarized here are available in a companion report (Brooks and Haynes, in press).

The major assumptions used in developing these projections followed from the historical data and drew heavily on recent analyses of Pacific Rim and Alaska forest products markets, including the ATMS studies. The major assumptions in these projections are summarized below, for each product.

#### **Sawnwood—**

1. There will be steady but modest growth in Japanese sawn-wood consumption, with an increasing share for softwoods (see for example, FAO 1986, Garrett and Dykstra 1988, Kim and others<sup>15</sup>).
2. Imports will account for an increasing share of Japanese softwood sawn-wood consumption; this share will increase to 33 percent by 2000 (from 21 percent in 1988), and remain constant thereafter.
3. The share of Japanese imports accounted for by North America will remain high (94 percent, compared to an average 92 percent for 1980-88); the Alaska share of exports from North America to Japan will remain at the level of the mid to late 1980s (5-6 percent).
4. The majority of Alaska exports (95 percent) will continue to go to Japan, and the majority of Alaska production (95 percent) will be exported.

#### **Pulp—**

1. More than 90 percent of pulp production will be dissolving grades, with a small quantity of paper-grade pulp produced; most production will be exported (80 percent in most years).
2. Markets for dissolving pulp will remain strong in most years of the projection period; except for those years when slow economic growth is forecast (Wharton Econometric Forecasting Associates 1988), the Alaska mills will operate at or above 90 percent of capacity.
3. During periods of slow economic growth (1990, 1998, 2003), production will drop as a result of weakness in primary end-use markets (textiles); following each recession production will not return to prerecession levels owing to long-term adjustments in end-use markets (see Durbak, in press).

#### **Export logs—**

1. The volume of logs exported from Alaska will fall in nearly direct proportion to the decline in private timber harvest; most (80 to 90 percent) of the private timber harvest will go to export markets.
2. A small portion (about 5 percent) of the National Forest harvest will be exported as logs.

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<sup>15</sup> Kim, John C.; Kim, Young K.; Low, Christopher [and others]. 1989. Forecast of end-use markets for Tongass forest products in Japan, Korea, and Taiwan. Unpublished document. On file with: Forest Investment, Marketing and Trade Research, Forestry Sciences Laboratory, Pacific Northwest Research Station. P.O. Box 3890, Portland, OR 97208-3890.

## Summary of Projections

Table 6 summarizes the projections in three dimensions of the projected future of the Alaska forest sector: production of forest products, the timber harvest attributable to each product (derived demand), and the harvest (for each owner) that is consistent with the projected demand.

Production of logs for export is projected to fall sharply after 1990, as a consequence of the decline in private (Native Corporation) timber harvest. We anticipate no change in either the export orientation of private timber owners or the restrictions on export of logs harvested from public forests. Production of lumber (including cants) is expected to increase over the next two decades, from a trough in 1985. By the end of the projection period, lumber production approaches average production of the mid-1970's. The export market (almost exclusively Japan) will be the destination for nearly all lumber produced.

Pulp production is also expected to remain high, although it will decline from the capacity-limited level of the late 1980s. Worldwide capacity adjustments (made in the mid-1980s) are expected to provide Alaska mills with a reasonably secure market niche. End-use markets for dissolving pulp are expected to weaken over the long term, however, after periods of slow economic growth. As a result, Alaska production will peak in the mid-1990s. As with lumber, dependence on export markets is expected to continue for dissolving pulp.

Wood chip exports (residues from lumber production) are expected to continue. Although chip exports have been extremely volatile, increasing lumber production will provide steady supplies for use in Alaska pulp production and the export market. Location of new capacity for lumber production outside southeast Alaska will provide added strength to the chip export potential.

Trends in the derived demand for timber (harvest by product) are similar to projected trends in product output. We assume there will be no significant changes in production technologies for either lumber or pulp. Generation and recovery of residues for pulp (and for export) is projected to continue at rates comparable to current practice. The decline in log exports will result in an increase in the share of total harvest used for production of lumber and pulp. Harvest for lumber will increase in both relative and absolute terms and will approach the share of total harvest (roughly 50 percent) of the mid-1970s. Harvest for pulp will decline in absolute terms, as total production declines (slightly), and residues will contribute more than 30 percent of raw material requirements.

Table 6 indicates that National Forest timber harvests in Alaska are expected to be stable over the projection period and at a level comparable to that of 1980. The peak in total Alaska timber harvest, reflected in averages for 1985 and 1990, is primarily a consequence of harvests by private owners (Native Corporations) from 1982 to 1991. As harvests by these owners fall to sustainable levels after 1995, total Alaska harvest will stabilize at an average annual rate of about 530 million board feet. The average annual timber harvest in Alaska for the 20 years before 1985 was 547 million board feet. Harvest by other public owners and timber imports are assumed in these projections to remain constant at levels roughly equivalent to the late 1980s.

We also estimated timber harvest by product for each owner. Because reports of timber harvest (for example, USDA Forest Service 1989) do not include sufficient detail to compile this information we estimated these data for both the historical and the projection periods. For the historical period, our estimates are roughly equal to estimated derived demand by product. Data on shares of National Forest harvest were computed for 1978-86 (from USDA Forest Service 1989) and were estimated for other years. For other owners, estimates were made that are more or less consistent with oblique references in the literature (see for example, Garrett and Dykstra 1988). These estimates display changes in the mix of timber products from each owner that are consistent with an overall balance between derived demand and total supply.

The most important result in the projected data is an increasing demand for saw logs in Alaska; this is an increase in volume as well as in share of total harvest. This is not a surprising result: total sawn-wood production is projected to increase while pulp production is projected to remain roughly stable. In addition, 25-35 percent of fiber requirements for pulp are derived from residues from sawn-wood production. Because National Forest timber is the primary source of raw material for Alaska sawn-wood and pulp production, most of this adjustment must come in the product mix of National Forest harvests. These projections indicate that the demand for pulp logs will decline to about 40 percent of total National Forest harvest, compared to 53 percent (average) for 1980 to 1988. We did not examine the timber inventory for Alaska National Forests to determine whether this adjustment is possible.

## Sensitivity Analysis

All projections depend on assumptions; earlier we indicated the key assumptions influencing our results. In table 7, we illustrate the sensitivity of projections of the derived demand for National Forest timber to changes in selected assumptions. There are two objectives in this analysis. The first is an examination of the variability in model output (in particular, the derived demand for National Forest timber) when exogenous data are changed. If the derived demand is extremely variable as assumptions change, our projections may not be reliable; however, if projections change relatively little when key assumptions vary within reasonable bounds, we can assert that the model and its results are robust.

**Table 7—Alternative projections of the derived demand for Alaska National Forest timber<sup>a</sup>**

Period	Base <sup>b</sup>	Alternative number				
		1	2	3	4	5
<i>Million board feet</i>						
1970	539.5	539.5	539.5	539.5	539.5	539.5
1975	489.4	489.4	489.4	489.5	489.4	489.4
1980	411.0	411.0	411.0	411.0	411.0	411.0
1985	280.7	280.7	280.7	280.7	280.7	280.7
1990	381.5	353.6	378.4	381.5	379.4	377.3
1995	403.5	367.6	389.5	403.6	385.8	398.1
2000	403.2	371.6	361.2	404.1	372.9	386.1
2005	397.1	366.3	335.3	399.1	366.9	377.1
2010	400.8	367.8	323.0	403.2	370.6	380.8

<sup>a</sup> Data are annual averages centered on the year they are reported for, except 2010 reports the average for 2008-2010.

<sup>b</sup> Data reported in table 6.

The second objective of the sensitivity analysis is to display projections resulting from sets of assumptions that may be more plausible to some readers. We compare the projections resulting from these revised assumptions to the projection that is the product of the assumptions which we consider most reasonable (the “base”).

In the first alternative projection, we reduce the estimate of total pulp production by reducing the share of pulp production shipped to domestic markets. In the base projection, we assumed that exports account for 80 percent of total production in most years of the projection; in this alternative projection, exports are assumed to account for 90 percent of total production. (The quantity of pulp assumed to be shipped to domestic markets is reduced by 50 percent.) The derived demand for National Forest timber is reduced by less than 10 percent (roughly 8 percent by 2010) when this alternative assumption is made.

In the second alternative projection, Alaska’s share of North American softwood lumber exports to Japan is reduced to 2 percent by 2010 (in a steady downward trend) from the 5-6 percent share assumed in the base projection. In the base projection, average annual lumber production in Alaska is projected to increase to 270 million board feet. When Alaska’s share of North American exports of softwood lumber to Japan is assumed to decrease (rather than holding roughly steady), and Alaska is assumed to remain almost completely dependent on the Japanese market, the result is a decrease in projected lumber production. Compared to the base projection, average annual lumber production is lower by nearly 60 percent in 2010. Because lumber production in Alaska depends almost entirely on National Forest timber, the derived demand for National Forest timber is lower, but by only approximately 20 percent (by 2010).

In the third alternative projection, we change two assumptions. First, Japanese sawn-wood consumption is reduced compared to the base. Annual growth in Japanese sawn-wood consumption is assumed to be 0.5 percent instead of 0.7 percent. The second change is a reduction in Alaska’s dependence on the Japanese market. The share of exports of softwood lumber going to Japan is reduced to 90 percent by 2010 (in a steady trend downward) from 95.4 percent (constant over the projection) as is assumed in the base; that is, Alaska shipments to markets other than Japan are assumed to increase. These changes are based on the market outlook described by Kim and others (see footnote 15) and have roughly offsetting impacts. Kim and others (see footnote 15) expect slow growth in the Japanese market, but they expect significant growth in other markets (Taiwan and Korea) for Alaska sawn-wood products. In this third alternative projection, Alaska lumber production and the derived demand for National Forest timber are almost exactly equal to those in the base projection.

The fourth alternative projection incorporates the revised assumptions made in the third alternative and illustrates the impact of assuming, in addition, that access to Japanese markets will be more restricted than in the base. The share of the Japanese softwood sawn-wood market held by imports is reduced in the fourth alternative; the maximum import market share is assumed to be 25 percent (reached in 1990). This share is held constant at 25 percent 1999-2010. In the base projection, the import share of the Japanese market for softwood sawn wood increases to a maximum of 33 percent (reached in 1998). The result of this change is a 30-percent reduction in projected lumber production (compared to the base) and an 8-percent reduction in the derived demand for National Forest timber.

In the fifth and final alternative projection, we examine the impact of changes in harvest by private owners in Alaska. All observers expect harvest by private owners (Alaska Native Corporations) to decline from current levels (we estimate the 1989 harvest at 610 million board feet); however, the timing and the extent of the drop in harvest are disputed. Therefore in this alternative we assume that private timber harvests in Alaska are higher than the base for all years of the projection. The sustainable harvest for private owners is assumed to be 200 million board feet of timber harvest per year, compared to 100 million in the base projection. All other assumptions are as in the base projection. This change has only a modest impact on the derived demand for National Forest timber because the majority of the private harvest is assumed to be exported. In all projections, we assumed that the share of private harvests exported decreases over time, but only to 80 percent by 2010. Therefore the most significant change as a result of changing projected harvest by private owners is an increase in log exports from Alaska. The derived demand for National Forest timber drops by about 5 percent, which reflects a modest increase in pulpwood supplied by private owners.

The general conclusion we draw from these alternative projections is that our projections of the derived demand for Alaska National Forest timber are not extremely sensitive to significant changes in the major assumptions. Even when projected lumber production that is almost entirely dependent on National Forest timber is reduced by 60 percent, the derived demand for National Forest timber declines by only 20 percent. In this fairly extreme case (alternative 2), timber demanded for lumber production declines, but the demand for roundwood pulpwood increases because of reduced production of residues from lumber manufacturing. It is important to keep in mind, however, that these are projections of the derived demand for National Forest timber conditioned on assumptions specific to each projection and on the general assumption that there are no structural changes in markets.

### **Implications for the Alaska Forest Sector**

Although Alaska is well endowed with timber resources, this does not guarantee competitiveness in domestic and international markets in the future. Competition in any market is measured by relative delivered-product costs; that is, the summation of raw material costs, manufacturing costs, and product transportation costs. Manufacturing costs and transportation costs to existing markets are relatively uniform for most producers in North America; Alaska producers are generally at the high end of the range for both cost categories. Raw material costs (stumpage fees and logging costs) differ widely across competing regions, however.

In offshore markets, Alaska will face increasing competition from producers in the Pacific Northwest, British Columbia, Chile, and New Zealand. Production of premium products will remain Alaska's competitive advantage. This is an advantage over Chile and New Zealand (at least in the near term) for many products. The advantage relative to other North American producers is less clear and, if it exists, is true for only a small group of products. Producers in British Columbia, Washington, and Oregon are expected to lose some share of the U.S. domestic market to the Southern States, where timber production is expanding on private timberland that is relatively inexpensive to log (USDA Forest Service 1988). This may increase the attention these producers focus on Pacific Rim markets and the intensity of the competition faced by Alaska producers. Knowing this, we can predict that marketing efforts may be important determinants of competitiveness. Kim and others (in press) point out the role of marketing in expanding Alaska forest products output.

Competitiveness in offshore markets relative to producers in other countries is and will continue to be strongly influenced by exchange rates. Consumers in Japan, Australia, and other countries are willing to pay a premium for high-quality lumber and logs from North America. A high-valued U.S. dollar will increase prices in the local currency and encourage these countries to substitute domestic timber products, and those from other countries, for the preferred North American products. Changes in exchange rates will not have an effect on producers in Alaska that is different from the effect on producers in Washington and Oregon; however, Alaska producers are considerably more dependent on offshore markets and therefore more vulnerable to unfavorable changes in exchange rates.

The relative advantage Alaska has in forest products, which is shared to some extent with British Columbia, has been in possessing high concentrations of raw material (particularly old-growth hemlock) that can be manufactured into high-valued products. Alaska's future role as a forest products producer will depend on timber management and marketing strategies recognizing that consumers will continue to pay a premium for high-quality products and that cost competitiveness is a necessity.

This study focused primarily on southeast Alaska, but there are other important forest resources in Alaska. Globally there is growing interest in boreal forest resources, some of which are located in Alaska.<sup>16</sup> In the Nordic countries, boreal forests are managed on a sustained yield basis. In other areas (notably the U.S.S.R., Canada, and Alaska), these resources are exploited to various degrees but are not yet systematically managed. Concerns that heavy use, or atmospheric pollution will damage these ecosystems may lead to future conflicts over the management and use of these forest resources.

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<sup>16</sup> For example see, Kuusela, Kullervo. 1987. Northern boreal forest resources, their utilization and ecology. 46 p. On file with: The Forest Research Institute, Unioninkatu 40 A, SF - 00170 Helsinki, Finland.

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Current conditions in Alaska timber markets are reviewed relative to the past two decades. Major issues in the outlook for Alaska timber markets are considered. Recent studies are used to develop projections of Alaska timber products output, timber harvest, and timber harvest by owner. The assumptions these projections depend on include the level of harvest on Native lands and consumption of sawn wood in Japan. Total harvest in Alaska is expected to average 660 million board feet per year during the early 1990s, and 545 million feet per year between 1995 and 2005. Harvest from National Forests necessary for total supply to meet expected demand will remain roughly constant at 400 million board feet per year from 1990 to 2010.

**Keywords:** Alaska, international trade, log exports, supply and demand

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