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The Rise and Fall of the Pacific Northwest Log Export Market

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The **Forest Service** of the U.S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives—as directed by Congress—to provide increasingly greater service to a growing Nation.

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Abstract

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For decades, softwood log exports were an important component of international wood products trade from the Pacific Northwest (PNW) region of the United States. Log exports to the Pacific Rim began in earnest after the Columbus Day Storm of 1962 generated billions of board feet of salvaged timber. This market was maintained and expanded owing to Japan's demand for high-quality logs for its construction industry. Contentious debate surrounding disproportionate gains and losses to forest product market participants in the PNW (timber owners, mill owners, communities, and consumers) led to government intervention and restriction of volumes available for export. The debate ended and the market declined as a result of three factors: reductions in timber harvesting from PNW forests, changes in Asia's demand, and globalization of wood markets. These changes with implications for trade and timber market participants are discussed.

Keywords: Log exports, forest products trade, softwood log trade, Japan, globalization, Pacific Northwest trade, spotted owl.

Contents

Introduction

The softwood log export trade began in earnest when 11.2 billion board feet of timber was blown down during the Columbus Day Storm in 1962. It evolved to become one of the unique forest product trade flows throughout the 20th century, primarily owing to Japan's demand for high-quality raw materials for their construction industry. Debates surrounding log exports polarized the timber industry for decades and focused on who wins and who loses when excess supply of logs from the Pacific Northwest (PNW) is diverted from domestic markets to satiate demand in international markets. These debates led to drafting of forest management and trade policies designed to redistribute benefits and losses among key stakeholders in the forest sector, including timber owners, mill owners, communities, and consumers.

Today, however, the log export market, along with the contentious log export debate, is virtually nonexistent. The precipitous decline of softwood log exports caused the PNW to lose its position as dominant supplier of building materials to the Pacific Rim. Although trade flows in domestic and international markets have adjusted and stabilized, factors that triggered these changes remain largely unexplored.

The objective of this study is to recount the rise and fall of the PNW softwood log export market. We begin with the rise of the triangular trade flow of logs and lumber among the United States, Japan, and Canada beginning in the early 1960s. A brief discussion of international trade theory, including diagrams of supply and demand for goods in international markets, provides the economic motivation of forces driving these trade flows. Next, a history of trade policies drafted in response to the log export trade debate is presented. Export log and lumber prices are also discussed as the log export price premium played an important role in maintaining the log export market for three decades. For the purposes of this publication, all prices reported in dollars are assumed to be U.S. dollars unless otherwise spe-cified. Next, the fall of the log export market is chronicled with a discussion of three key domestic and international determinants. Finally, implications for trade, timber owners, mill owners, consumers, and communities are explored.

Triangular Trade Flows: the Pacific Northwest, Pacific Rim, and Canada

This section highlights the development of trade flows of softwood logs and softwood lumber between the PNW, the Pacific Rim, and Canada. Log trade from the Pacific Northwest to the Pacific Rim and lumber trade from Canada to the Pacific Rim and United States represent a global triangle of interdependent producers and

consumers of wood products. For the purposes of this study, the Pacific Rim encompasses Japan, China, and South Korea.

As figure 1 shows, the United States consumes the most industrial roundwood, followed by Canada, China, Japan, and South Korea (FAO 1980, 1990, 2000a). Industrial roundwood consumption in the United States, Canada, and China has increased over the three decades, while consumption has decreased in South Korea and Japan, mirroring macroeconomic performance in these two countries.

A brief introduction of international trade theory, including the key concept of comparative advantage, serves as prologue for the discussion.

International Trade Theory

Costs of production differ across countries. A nation is said to have a comparative advantage if it can produce a good at a lower cost relative to other nations. International trade theory suggests that a country gains from trade when it exports goods in which it has a comparative advantage. Each country produces more of the products in which it has a comparative advantage and produces less of other products. This raises world output and allows people to consume more of every product, a result known as the Law of Comparative Advantage (Stockman 1996). Triangular trade flows between Canada, the PNW, and the Pacific Rim resulted from each country's comparative advantage in the production of lumber, logs, and labor-intensive processing, respectively.

Without international trade, each country is limited to consuming only the goods it can produce. International trade allows each country to consume more of every good; how much more is determined by world equilibrium prices. Figure 2 depicts a hypothetical supply and demand schedule for softwood logs traded in international markets, the corresponding world equilibrium price, and the equilibrium exports and imports of each country. Figure 2a shows supply and demand curves for softwood logs in the United States. Without international trade, the U.S. equilibrium price is $100 and the United States produces and consumes 10,000 units of logs. In figure 2b, the equilibrium price is $200 in other countries, and other countries produce 20,000 units when they do not trade. With international trade, the price differs across countries; this difference is what provides an incentive for trade.

With international trade, figure 2c depicts a world equilibrium price of $150. Raising the price of U.S. goods from $100 to $150 in world markets generates excess supply available to trade; the corresponding reduction of price from $200 to $150 in other countries generates excess demand. At a price of $150, 8,000 units are demanded in domestic markets while firms produce and sell 14,000 units,

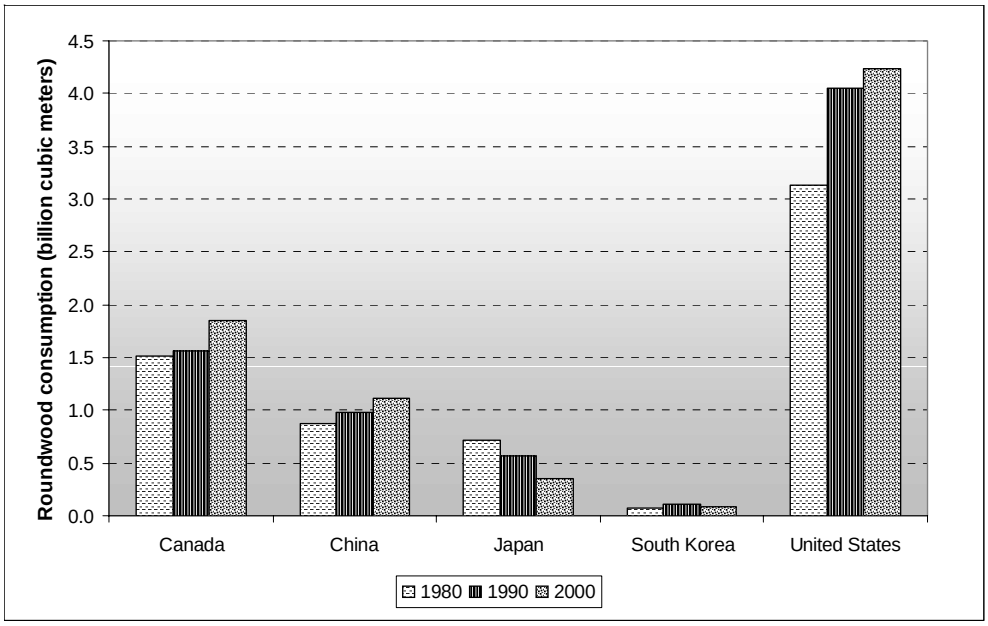

Figure 1—Industrial roundwood consumption of export market participants.

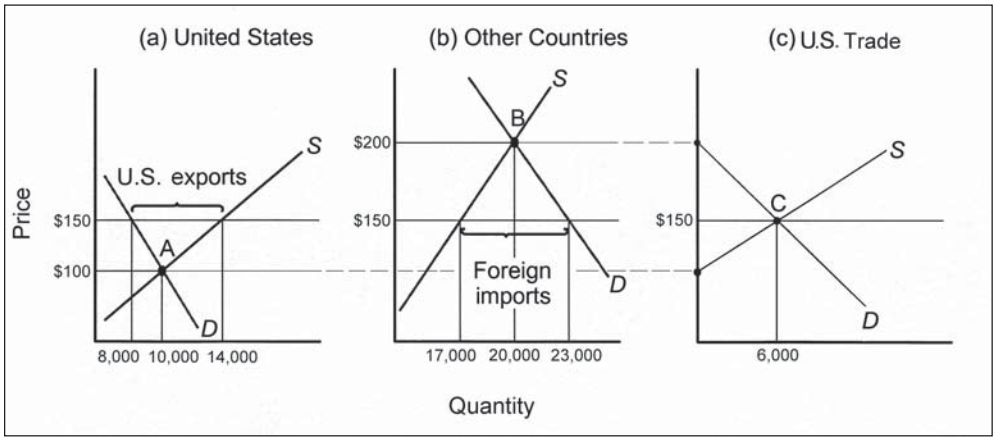

Figure 2—Market equilibrium with international trade.

leaving the United States with 6,000 units of excess supply for export. At $150, other countries demand 23,000 units but only 17,000 units are produced, leaving a shortfall of 6,000 units that is met with imports. The U.S. exports equal imports to other countries; excess supply equals excess demand in equilibrium.

Some people gain and some lose with international trade. In general, consumers in the importing country gain because trade allows them to buy the good at a lower price. Producers in the importing region lose; they sell the good at a lower price and they sell less. Losers include owners of firms that face additional foreign competition and workers at those firms. On the other hand, producers in the

exporting region gain; trade allows them to charge a higher price and sell more goods. Consumers in the exporting region lose because they pay a higher price for the good. As long as gains to winners are greater than losses to losers, trade is said to be efficient.

Comparative advantage is a dynamic concept; it can and does change over time. Better opportunities for alternative trades weaken the bargaining positions of potential trading partners by strengthening competition. In this way, alternative opportunities affect the prices at which nations trade and the way they share the gains from trade. Factors such as quantity and quality of factors of production available, investment in research and development, movements in exchange rates, long-term rates of inflation, and import controls such as tariffs and quotas are important in determining the relative costs of production, and ultimately, affect comparative advantage. Some businesses find they have enjoyed a comparative advantage in one product for several years only to face increasing competition when rival producers from other countries enter their markets.

Pacific Northwest Log Trade With the Pacific Rim

When the Columbus Day Storm occurred in 1962, enormous volumes of downed timber flooded domestic wood markets. The export market, which was relatively small and specialized at the time, was viewed as an outlet for surplus salvaged material. After the salvaged timber was exhausted, log trade expanded owing to excess demand for wood raw materials triggered by economic growth in Pacific Rim nations, especially Japan. This expansion, resulting from excess supply of salvaged logs in the PNW and excess demand for softwood logs in Japan, was the beginning of one of the most influential trade flows of wood in the world (Lane 1998).

Figure 3 shows the relative proportion of logs exported from the PNW arriving at each Pacific Rim destination, total log exports to the Pacific Rim, and total log exports to the world from 1961 to 2001. Several key points are apparent. The majority of total softwood logs exported from the PNW was destined for Pacific Rim locations. Log trade with Japan drove the expansion of log exports after 1962, drawing purchasers from South Korea in 1971 and China in 1980. After China's entry, the proportion of Pacific Rim exports going to Japan decreased only to increase again after Chinese imports declined rapidly after peaking in 1988. After 1990, the log market declined and world trend followed Japan's trend. Exports to all Pacific Rim locations and to the world decreased rapidly to the low levels observed today. Declining log exports from the PNW resulted from both supply

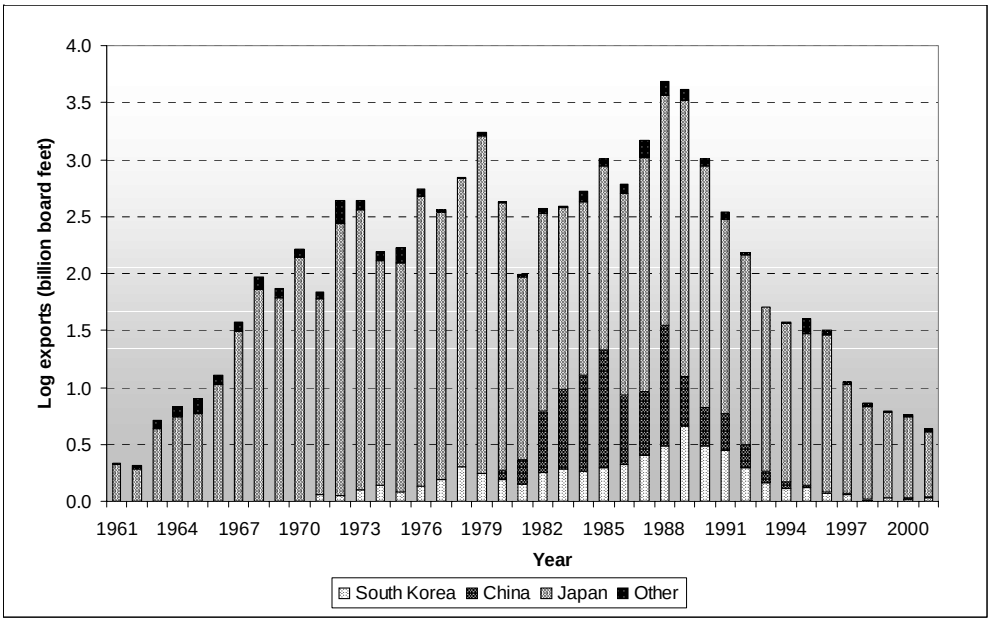

Figure 3—Pacific Northwest log exports by destination.

and demand side shocks, which are discussed later. A detailed description of the log trade to these three countries follows, with emphasis on Japan as the dominant international market for PNW logs.

Japan—

Japan has been by far the dominant purchaser of PNW softwood logs. The expansion of the log trade to Japan, in terms of volume and prices, is depicted in figure 4. Comparison with figure 3 demonstrates that most of the variation in export volumes to the world experienced until about 1982 occurred in exports to Japan, reinforcing that Japan dominated the market. Export prices rose over time as well, with peaks experienced in 1973 and 1980. Export volume to Japan remained relatively flat until the late 1980s; prices remained relatively constant as well with slight declines from 1980 until 1987. In 1987, prices began rising dramatically to peak at just over $1,000 per thousand board feet in 1993. These high prices persisted for a few years and then rapidly declined as markets adjusted after 1995. Exports to Japan declined about 70 percent from their 1989 peak of 2.4 billion board feet to 706,000 board feet in 2000.

Although it was the dominant purchaser of PNW logs, Japan has extensive forest resources, owing to its planting efforts following World War II. Over 12 million hectares of forest plantations were reforested to replenish timber stocks. Japan's forests now contain approximately 3.48 billion cubic meters of timber growing stock, two-thirds of which is softwood species (Eastin et al. 2002).

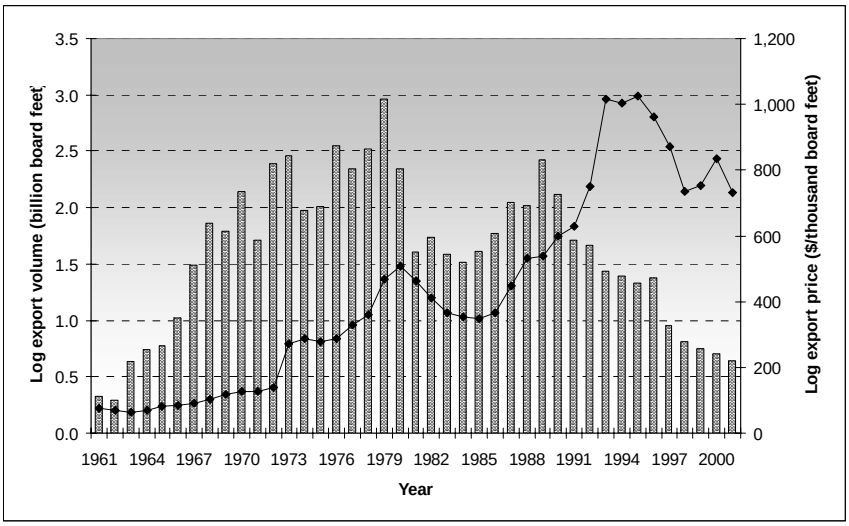

Figure 4—Volume and nominal prices of Pacific Northwest softwood log exports to Japan.

Plantations are approaching maturity and, if harvested, the estimated potential supply could impact world timber markets (Blandon 1999).

Although Japan has abundant domestic forest resources, Japanese firms preferred to import unprocessed logs from PNW suppliers for several reasons. First, Japan's domestic forest sector suffered from weakened profitability. Declining stumpage prices combined with price competition from imported timber and rising costs associated with logging wages, road construction, harvesting, and transportation depressed Japan's forest sector. In addition, private forest land ownership is characterized by large numbers of landowners, the majority of whom own between 1 and 10 hectares each. Small parcel size restricts the ability of landowners to reap positive financial returns from harvesting their forests (Moffett and Waggener 1992). Lackluster incentives for forest management translate to declining output from Japan's domestic forests.

Trends in Japan's sawmilling capacity also contributed to rising demand for log imports. After World War II, Japan made large investments in its domestic processing industries. Large-capacity inland mills were relocated to the coast to reduce hauling costs, because imported logs were brought in by ship. These imported logs were manufactured into domestic lumber and consumed in Japan's domestic market. Relocation of processing facilities ensured that imports replaced Japan's own forests as the primary source of wood for domestic processing, and conversely, that domestic processors became dependent upon imported logs to supply mill capacity.

Sawmills in Japan had greater raw material efficiency than those in the United States. That, along with meticulous sawing practices, enabled Japan's sawmills to get greater product recovery from logs than PNW sawmills (70 vs. 50 percent). In addition, because Japan had abundant and low-cost labor, real wages in Japan were far below those in the United States in the 1960s; labor availability and wages were not limiting factors in production (Flora et al. 1993). Japan's advantage in labor-intensive wood processing meant they were better served by importing raw materials than finished products, resulting in log export stumpage price premiums enjoyed by PNW forest landowners for decades (Darr 1975a, Darr et al.1980, Flora et al. 1993, Hamilton 1971, Wiseman and Sedjo 1981).

Japan's demand for PNW softwood logs was also driven by rapid economic expansion in Japan after World War II. Japan's economic growth during the 1960s was estimated to average 10 percent per year. Although sensitive to macroeconomic trends, Japan's stellar economic growth continued until the early 1990s. Rapid economic expansion led to a prolonged period of new housing demand by Japanese consumers (fig. 5). Japan is unique among Asian nations in its strong preference for wooden housing.

Consumer preference for wooden homes created and sustained demand for wood that exceeded supplies available from domestic sources or processed imports from other countries. Japan's housing is characterized by two major segments,

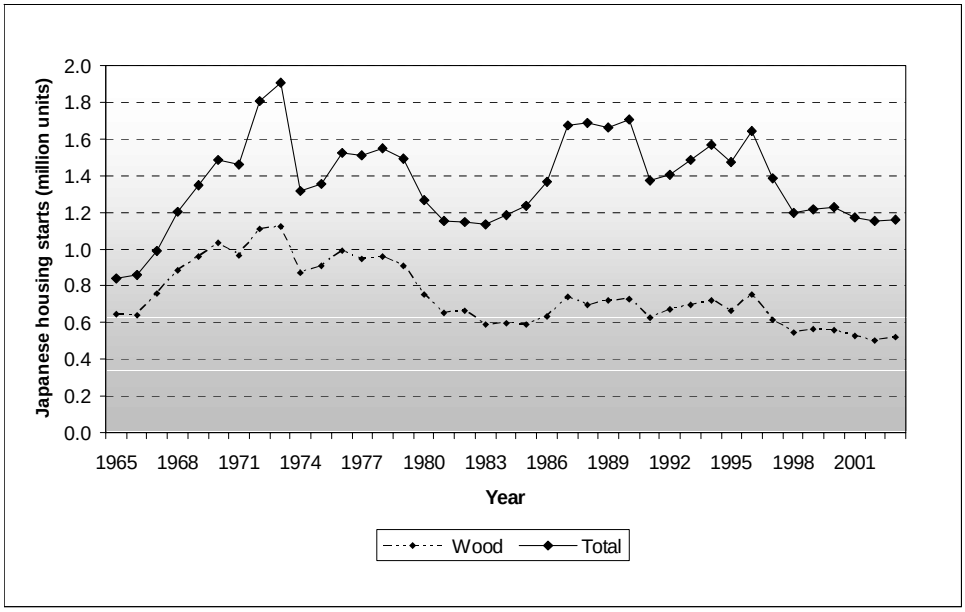

Figure 5—Japanese housing starts.

wood frame and nonwood frame housing. The wood frame sector has three subsectors: traditional post and beam construction, Japanese light frame construction, and prefabricated structures. Post and beam housing dominates the wood frame sector with over 80 percent share; PNW logs possess qualities well suited to traditional post and beam construction (UN ECE 2000).

Traditional post and beam construction involved cutting and notching large wood beams and posts by skilled carpenters at the construction site. Because labor was inexpensive and freely available, the Japanese used a wide variety of specifications and customization of lumber in their construction techniques. Raw logs were preferred to U.S. lumber; standardized U.S. lumber specifications and grades did not comply with Japanese preference for custom cutting and measurements.

Japan's post and beam construction emphasized aesthetic qualities with greater use of exposed wooden structural elements and trim than construction methods used in the United States. Emphasis on finished wood appearance applications meant the Japanese sought only high-quality softwood logs. The U.S. domestic log market did not demand high-quality stumpage materials, which helps explain why high-quality logs were diverted into the export market. Darr (1975a) found that log export volume was concentrated in the No. 2 and better saw log grades, whereas domestic sales were concentrated in the No. 2 and lower quality saw log grades. In 1973, No. 2 and better saw log grades comprised 82.3 percent of log export sales, whereas the same grades made up only 50.5 percent of domestic sales.

Japan's demand for high-quality PNW softwood logs was also characterized by a strong preference for light-colored, defect-free logs with high ring count. Ring count was especially important in the definition of higher grades for Japan. Flora et al. (1993) reported that 8 to 12 rings per inch, the standard usually associated with old-growth timber, were common thresholds.

Associated with log quality was a strong species preference by Japanese importers for PNW logs. Since 1980, most of Japan's imports have consisted of high-quality Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) (fig. 6). Douglas-fir logs are sawn for a variety of high-valued products in Japan. Primary among these is production of major support beams used in traditional post and beam housing, a use reflecting its superior structural characteristics. The dark color and high pitch content of Douglas-fir limited its use in exposed posts, which are another major element in traditional housing in Japan (Robertson and Waggener 1995).

Although Douglas-fir was favored for structural applications, western hemlock *(Tsuga heterophylla* (Raf.) Sarg.) was used for vertical posts and other exposed applications inside traditional housing. Clear wood produced from old-growth

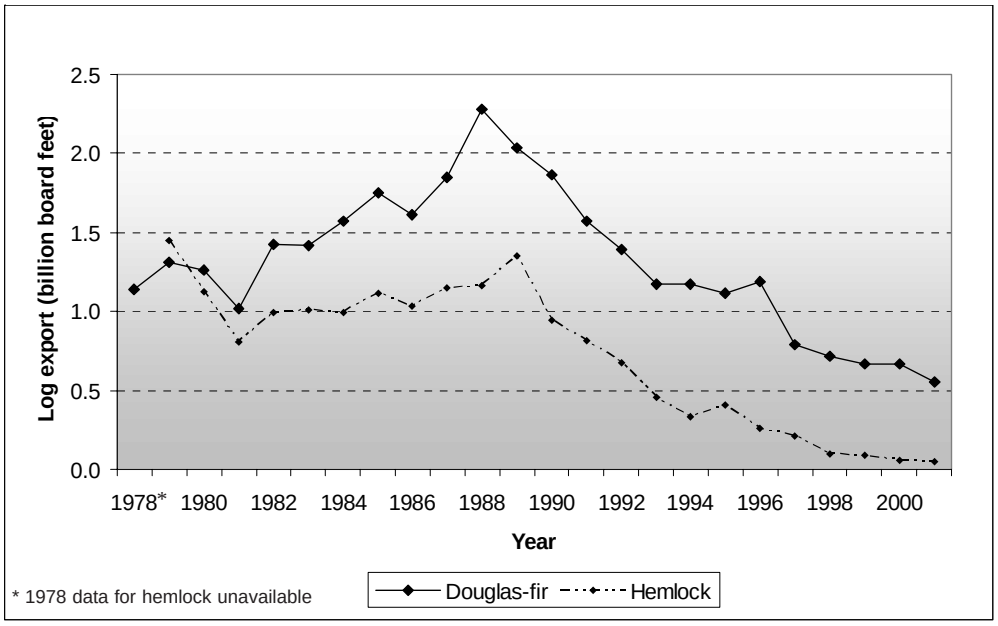

Figure 6—Volume of Pacific Northwest Douglas-fir and hemlock exports to all countries.

hemlock was especially popular. In addition, its light color resembled that of the favored Japanese domestic species Sugi (*Cryptomeria japonica (*D.) Don) for exposed applications. The popularity of western hemlock, stemming from its aesthetic qualities, made it the second leading import species by volume. Other species imported from the PNW included Sitka (*Picea sitchensis* (Bong.) Carr.) and other spruces, true fir (*Abies* spp.), pine (*Pinus* spp.), and cedar (*Thuja* spp.). Prices were especially high for old-growth Select grades in spruce, hemlock, and true firs (Flora et al. 1991).

Asian importers preferred a reliable and stable supply to reduce price volatility and paid higher prices for guaranteed long-term stable supply. This desire for a stable supply is reflected in the larger share of high-grade logs sold under established trading relationships rather than in spot markets. A premium for ensured supplies was most prevalent for higher grade logs because of their scarcity and the consequent difficulty of finding substitute sources (Flora et al. 1993).

Japan's preference for high-quality logs, along with its willingness to pay top prices to ensure a continuous supply, meant it had no trouble finding willing suppliers. The seemingly inexhaustible supply of logs in the PNW met Japan's demand for high-quality construction materials for over three decades.

Although Japan traditionally has been the largest purchaser of logs exported from the PNW, South Korea and the People's Republic of China also participated in the log export trade.

South Korea—

South Korea, like Japan, has an existing domestic forest. Like Japan's, most of South Korea's merchantable timber was cut during World War II, and an aggressive tree planting campaign was undertaken after the war. Currently, the domestic forest is primarily even aged and approaching maturity. Domestic production of wood has increased, but consumption has increased at a much faster rate. Korea is predicted to remain a net importer of forest products, at least until 2020 (Schreuder et al. 1987).

South Korea historically played an important role in global forest products trade. It was one of the dominant producers of hardwood plywood throughout the 1970s. Indonesia was South Korea's main supplier of hardwood logs for domestic plywood production until Indonesia implemented a total ban on log exports in 1981 and installed competing plywood manufacturing capacity. Although South Korea's declining plywood industry still uses tropical hardwood logs, the expanding sawmilling industry uses softwood logs for construction and carpentry applications. Thus, South Korea's demand for softwood logs has grown.

Trade in softwood logs between the PNW and South Korea began in earnest in the late 1970s. Traded volumes increased steadily until a recession in South Korea from 1978 to 1982. After the recession, South Korea's gross domestic product (GDP) grew dramatically, mostly from increased domestic demand. Excess demand led to increased PNW log exports to South Korea every year after 1982, peaking at 685 million board feet in 1990 (fig. 7).

After 1990, log trade with South Korea declined steadily to the low levels observed today. This decline is attributed to two factors: (1) escalated price of PNW logs following supply-side shocks and (2) market share gained through price competition by low-cost radiata pine (*Pinus radiata* D. Don) suppliers from Chile and New Zealand. South Korea has greater sensitivity to price than Japan; after prices for PNW logs rose to a peak of $842 per thousand board feet in 1993, lower cost suppliers gained market advantage. Currently, South Korea imports most of its industrial roundwood from New Zealand and Chile.

China—

Reliable data on China's domestic timber supply is difficult to obtain. Although it is known that China too began a series of afforestation campaigns following World War II, success of these efforts is difficult to quantify owing to lack of accurate, systematically compiled time-series data (Lovett and Dean-Lovett 1986). More recently (over the past 15 years) China has planted over 17.5 million hectares in forest, resulting in a large young even-aged plantation resource (FAO 2000b).

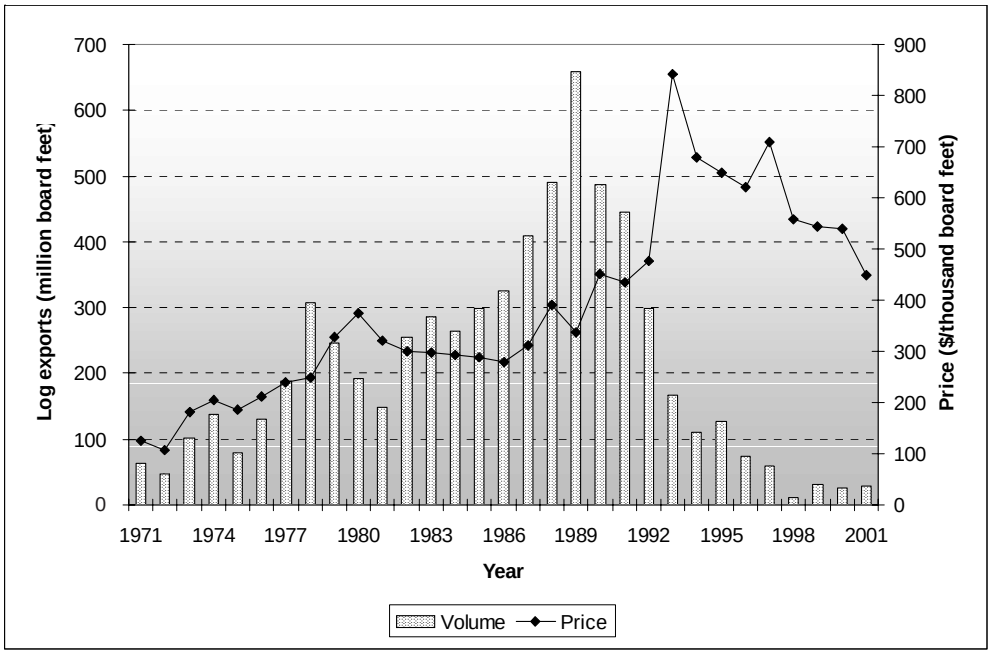

Figure 7—Volume and nominal prices of Pacific Northwest softwood log exports to South Korea.

Figure 8 shows that trade in PNW logs to China began in 1980 with total shipments of 88 million board feet. This figure increased more than seven times to 728 million board feet by 1983. Chinese log imports peaked at 1,052 million board feet in 1988 and then declined rapidly when prices escalated after 1989. China faced the same rising PNW log prices experienced by Korea with a similar result: price sensitivity caused the PNW to lose market share to competing supply regions. Today, PNW log imports are almost nonexistent in China; China meets the vast majority of its demand for softwood logs with imports from Russia.

Although China's forest products industry has historically demonstrated a preference for low-cost logs, the underlying factor limiting China's imports was the availability of foreign exchange. State policy dictates that foreign exchange reserves must be used judiciously; barter trade is preferred wherever the import situation allows. Competing supply regions willing to engage in barter trade with China have captured the market share lost by the PNW, which explains why most of China's log imports currently originate in Russia.

Although China is expected to remain a net importer of wood, trends indicate that product mix is shifting from unprocessed logs to processed softwood products. China's economy is growing at unprecedented rates; GDP increases have averaged 9 percent per year over the past decade. Total lumber production from domestic and imported logs in 1985 was 20 million cubic meters and is projected to increase to 35 million cubic meters by 2000, primarily for construction end uses. Because of

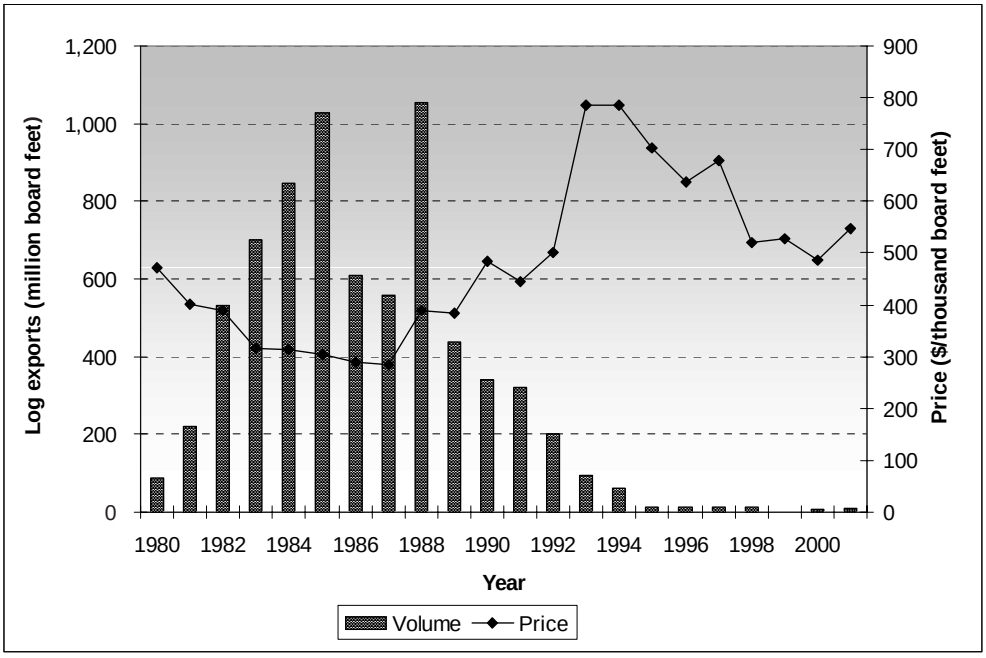

Figure 8—Volume and nominal prices of Pacific Northwest softwood log exports to China.

insufficient lumber processing capacity, China's sawmills will be unable to meet predicted lumber demands without massive expansion. Many suppliers, including the United States, see China as a huge emerging market for wood product exports.

The combined expansion of China's and Korea's log imports during the 1980s provided a lift to log exporters when Japan's imports remained flat (fig. 3). The effect of losing these two markets to lower cost producers and the subsequent loss of Japan's market for logs led to a cumulative negative impact on log exporters in the region that remains today. Log export levels have returned to those observed in the early 1960s and are likely to stay there. The reasons are explored later.

Pacific Northwest Lumber Trade

Although attention generally centered on log exports, the PNW has also had a history of exporting softwood lumber. Japan traditionally has been the dominant purchaser of PNW lumber. Total lumber exports remained flat, and lumber exports to Japan were inconsequential until 1973. In that year, PNW lumber exporters saw a fivefold increase in lumber exports worldwide; most of this increase consisted of expanded exports to Japan, which increased sixfold. This was the first of a series of market cycles experienced in lumber exports (fig. 9).

Generally, upturns and downturns in the developing lumber export markets were triggered by macroeconomic trends in the U.S. economy. During recessionary periods, lumber processors expanded overseas trade to compensate for slumping

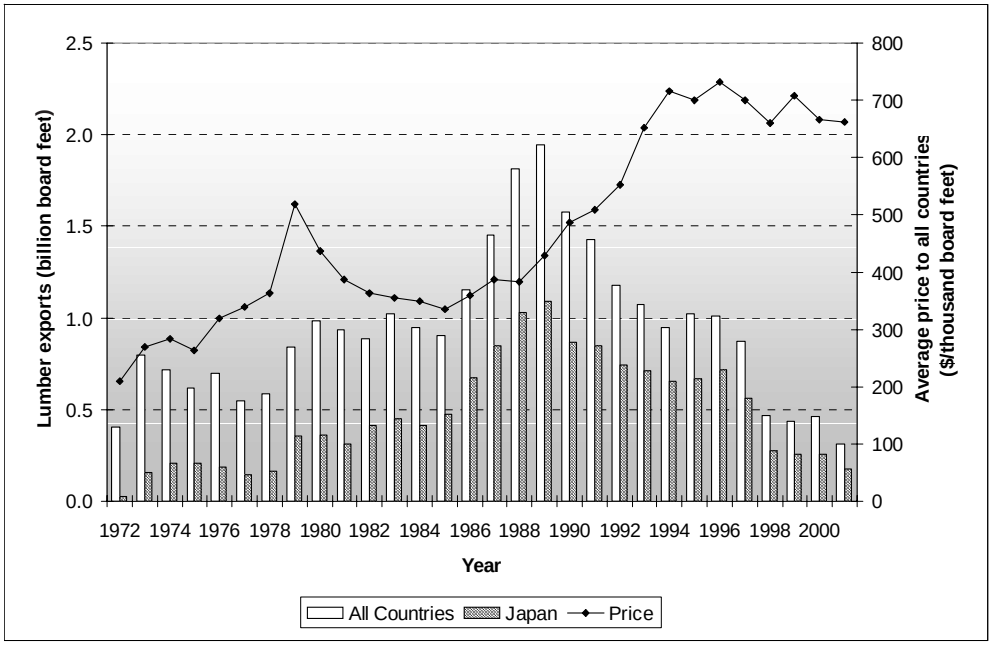

Figure 9—Pacific Northwest lumber exports.

domestic demand generated from reductions in housing starts. Producers sought out new markets in anticipation of lackluster domestic demand triggered by downturns in the U.S. economy. On the other hand, during economic boom times, lumber exports declined as domestic purchasers competed amongst themselves and with overseas purchasers for lumber supplies. When the U.S. economy recovered, exports declined as lumber was redirected into domestic markets to meet demand, predominantly for housing construction. Prices trend in the same manner, recession brings lower prices from reduced demand, whereas expansion raises prices as high demand forces purchasers to compete for available supply.

Lumber export volume and prices followed this predicable model of market behavior until the late 1980s. After another export expansion triggered in 1986, total lumber exports peaked at 1,944 million board feet in 1989 while prices increased 20 percent to $430 per thousand board feet. After this peak, export volumes gradually contracted back to levels experienced in the 1970s while export prices continued to climb to a record $732 per thousand board feet in 1996.

High prices eventually caused a market shift as foreign lumber purchasers easily found lower cost suppliers. Between 1988 and 1993, softwood lumber exports to Canada dropped almost 50 percent from 494 million board feet to 267 million board feet. Japan reduced imports to levels maintained in the mid-1970s. Until this market shift, volume exported to all countries and volume exported to

Japan moved together, demonstrating the prominent role Japan played in this market. Japan's demand has sustained both PNW log and lumber exports for decades.

Canada's Lumber Trade With the Pacific Rim

Canada's forest products industry, especially in British Columbia, also expanded after World War II. Canada's forest ownership is dominated by government holdings, with a longstanding ban on exports of unprocessed logs except for material declared surplus to domestic needs. While the PNW was developing its log export industry, Canada focused on developing its domestic lumber processing industry and exporting processed wood products. Figure 10 illustrates the profound difference between exported volumes of lumber and raw logs from British Columbia from 1965 to 2000. Today, Canada accounts for 20 percent of the total global softwood lumber production. This is second only to the United States, whose production share is 25 percent.

Canada is the main competitor for the United States in Pacific Rim markets. The Pacific Rim is Canada's second largest export destination for softwood lumber (the first being the United States) with over 7 million cubic meters shipped in 1996. Canada's lumber increased market share in Japan after adding capacity in new areas to access timber resources in provinces east of British Columbia. Another round of capacity investment in the late 1980s and 1990s led to further expansion of lumber exports. Interior mills focused on supplying developing markets in the United States, while British Columbia expanded exports to the Pacific Rim. After the new mills were built, the Canadians became effective competitors in international lumber markets.[1] Canadian suppliers benefited from cost competitiveness, favorable exchange rates, and willingness to cut custom lengths for immediate use by Japanese clients.

Japan is the largest Pacific Rim importer of Canadian softwood lumber (fig. 11). Rapid economic growth, a growing need for housing, and a dependence on imports increased Canada's lumber exports to Japan in the same way it increased PNW log exports. In 1996, Japan's imports of Canadian softwood lumber peaked at 2,600 million board feet, representing over 90 percent of total Canadian

[1] Lippke, B.; Perez-Garcia, J. 1998. Factors affecting timber prices. Unpublished report. On file with: either author at the Center for International Trade in Forest Products, University of Washington College of Forest Resources, Box 352100, Seattle, WA 98195.

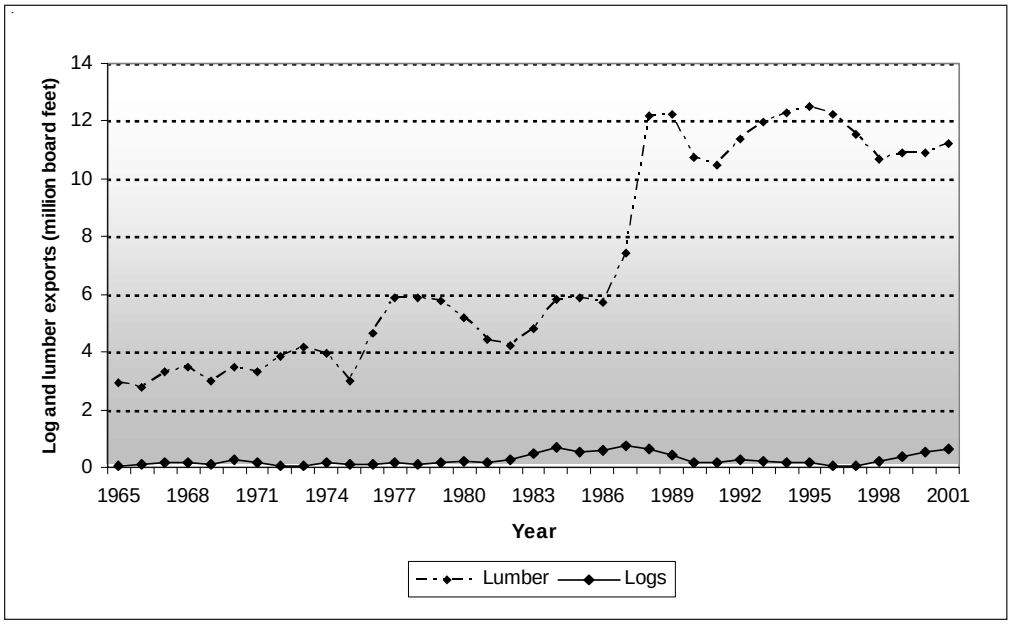

Figure 10—British Columbia exports to all countries, lumber vs. logs.

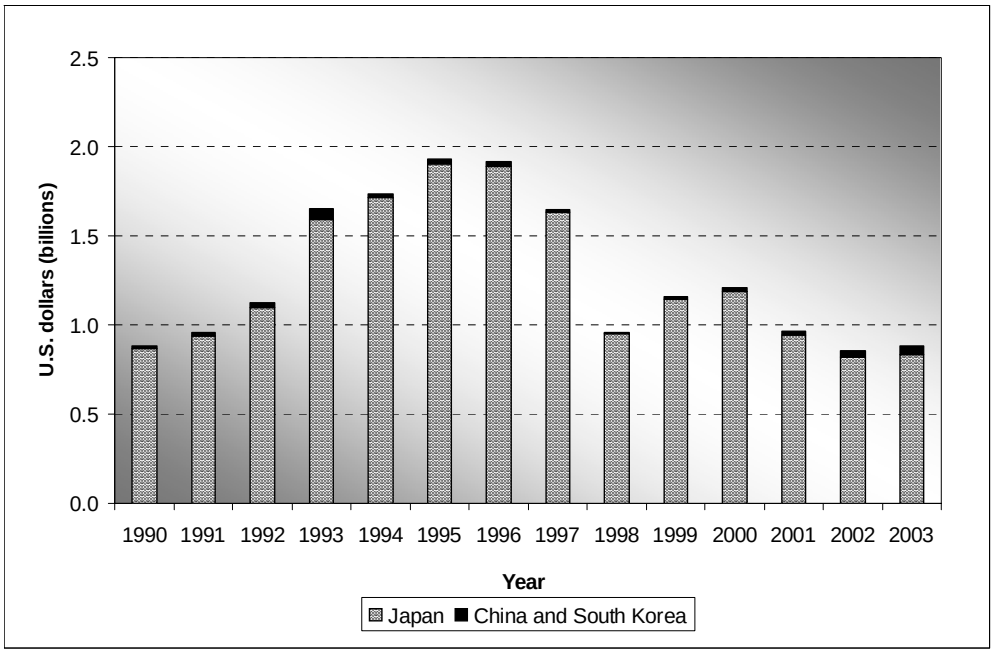

Figure 11—Value of Canadian lumber exports to the Pacific Rim in nominal United States dollars.

softwood exports to the Pacific Rim region that year. Most of Canada's lumber exports to Japan originate from British Columbia. British Columbia consistently had greater presence in Japan's lumber markets than PNW exporters, especially after 1990 (fig. 12).

Canada's Lumber Trade With the United States

Canadian lumber exports began making substantial inroads in the United States in the 1970s. When the "baby boom" generation reached household-forming age, the United States experienced unprecedented demand for new housing. New housing starts increased by 65 percent between 1970 and 1972 (fig. 13). Frenzied demand for housing construction forced intense competition for wood supply between lumber producers, driving up domestic product prices. Production could not keep pace with consumption and the United States was unable to rely solely on domestic resources.

Internationally, trade flows were redirected to compensate for the shortfall between U.S. supply and consumption. Canada, already a low-cost provider of lumber, began gaining market share in the United States. By the mid-1970s, about 20 percent of U.S. softwood lumber demand was met with Canadian imports.

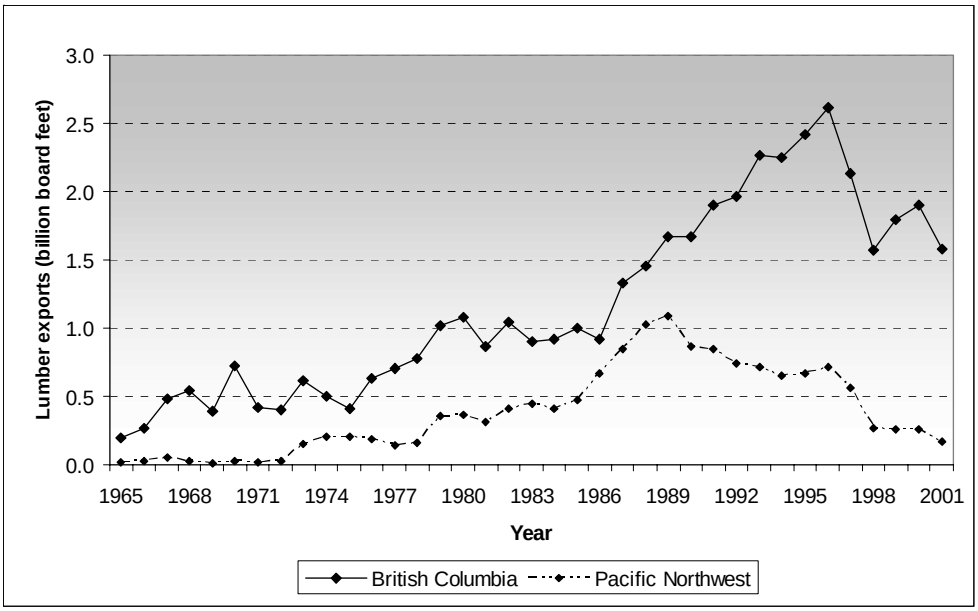

Figure 12—A comparison of lumber exports to Japan.

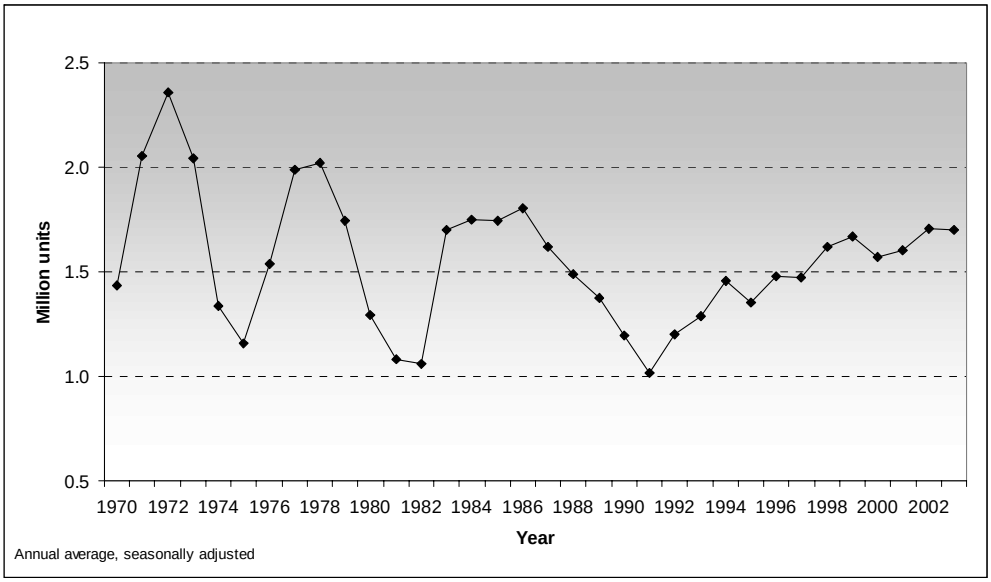

Figure 13—United States housing starts, 1970 to 2003.

Penetration into U.S. markets triggered investments to expand Canada's lumber processing capacity. Expanding lumber production was predicted to lead to greater Canadian gains from trade, especially after forest managers accessed untapped timber resources and used more intensive timber management strategies. Projections estimated that Canadian softwood lumber output would double to 22 billion board feet from 1975 to 2000 (Darr et al. 1980).

By the end of the 1970s, U.S. imports of Canadian lumber had doubled. Figure 14 shows softwood lumber import volume from Canada between 1978 and 2002. Recessionary pressure on the U.S. economy in 1980 caused Canada's lumber exports to the United States to decline only to rebound and make further gains following economic recovery. By the late 1980s, dramatic increases in the Canadian lumber market share in the United States began to concern U.S. domestic lumber producers. With the exception of the recession period of 1990 and 1991, imports have remained high ever since. Growth of the U.S. economy throughout the 1990s triggered gains for Canadian lumber producers as imports increased by 54 percent between 1991 and 1996.

During the nineties, the regional distribution of Canadian lumber production began shifting. After World War II, lumber production was dominated by British Columbia. Although British Columbia remains Canada's largest producer of softwood lumber, its share of total production peaked in 1990 at 63 percent and has since declined. By contrast, the interior provinces of Quebec, Ontario, and Alberta have increased production share since 1991 and now compete with British Columbia in lumber processing (fig. 15). Although strides are being made to access

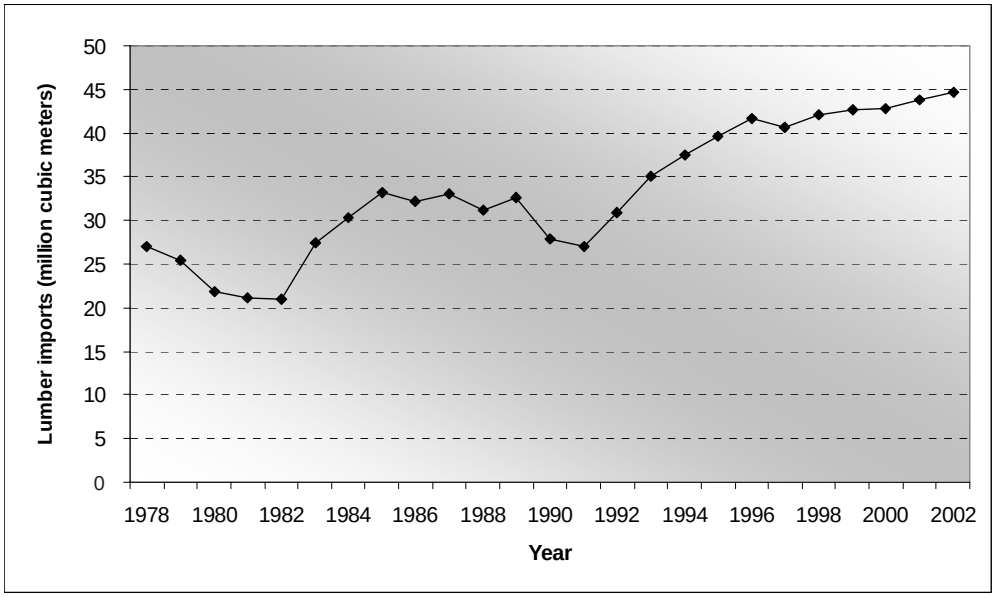

Figure 14—United States softwood imports from Canada, 1978 to 2002.

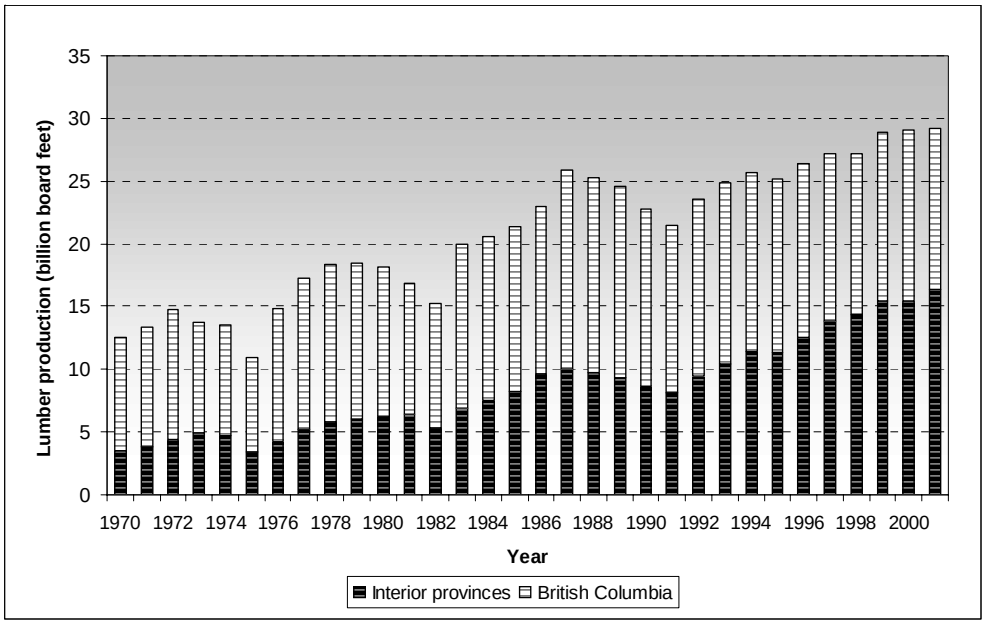

Figure 15—Canada lumber production—interior provinces vs. British Columbia

offshore markets, especially Japan and the United Kingdom, the majority of Canadian interior production consists of dimension lumber products for the domestic Canadian and U.S. housing markets.

The 1990s saw debates surrounding gains Canadian lumber producers were making in U.S. markets. Lower cost Canadian producers made rapid gains in lumber delivery into U.S. markets, rekindling the long-standing softwood lumber

trade dispute. United States producers complained that Canada could provide lumber to U.S. markets at lower prices because the Canadian government subsidized the lumber industry. In 1996, after the United States threatened to file a countervailing duty case against Canada, the two governments established the Canadian Softwood Lumber Agreement to limit lumber exports from Canada to the United States.

In 2004, softwood lumber trade between Canada and the United States remains a major global forest product trade flow. Residential construction, repair, and remodeling, especially in the United States, persist as the predominant end uses for Canadian softwood lumber. Canada remains the largest exporter of lumber in the world, and the United States is the largest importer of Canadian lumber. Although the United States remains Canada's strongest competitor, nontraditional suppliers of softwood lumber such as New Zealand, Chile, and Scandinavia have established themselves as competitors in international markets. The softwood lumber dispute with Canada remains unresolved; it has impacted lumber trade flow between Canada and the United States with some unintended consequences, which are discussed later.

Trade Policy

Trade policy has influenced the triangular relationship of wood product trade flows between the United States, Canada, and Japan. In general, the goal of trade policies is to increase or decrease imports or exports to improve the advantage of domestic producers over competing producers in other regions. Restrictive trade policies develop owing to political lobbying from industries that perceive themselves as adversely affected by trade. When U.S. domestic processors began to feel threatened by log exports, the stage was set for U.S. log export restrictions.

United States Log Export Debate

Current U.S. log export restrictions resulted from expanding trade in logs to Japan. Massive increases in PNW log exports, accounting for an increasing share of annual harvests from PNW forests, raised concerns about the disproportionate impacts of log exports on stakeholders in domestic markets (fig. 16). The debate that ensued included participants representing a variety of stakeholders. Timber owners, domestic processors, consumers, and communities each argued either for or against log export restriction, depending on if that group had been positively or negatively affected by foreign competition. The traditional position of each of these four interest groups is not surprising (Haynes 1976).

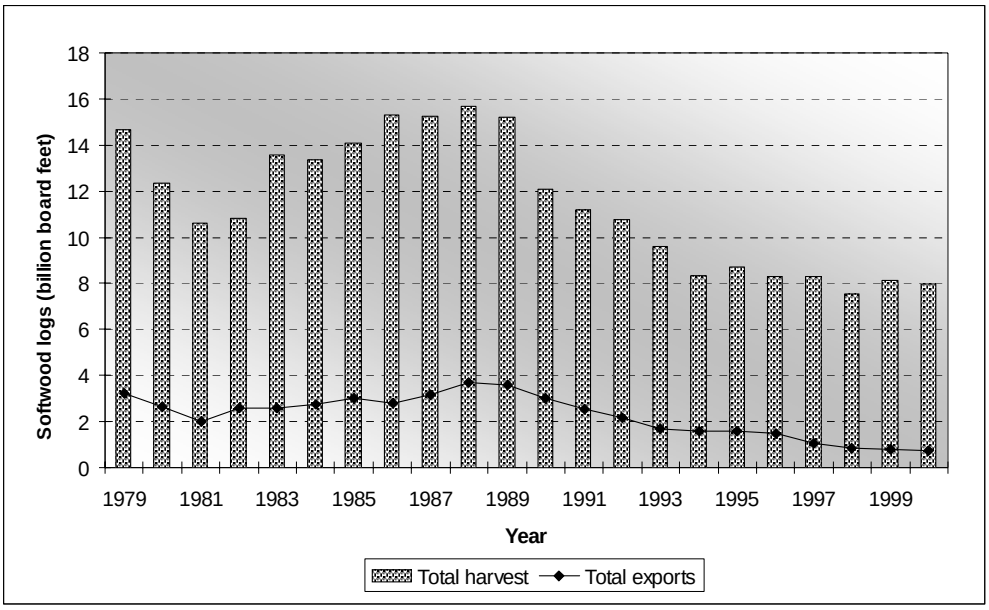

Figure 16—Washington and Oregon harvest exported in log form.

Timber owners—

Opposition to log export restrictions is led by public and private stumpage owners, firms involved in logging, transporting, and processing logs for export, and others receiving gains from trade. Forest landowners with access to export markets captured a price premium for softwood logs, increasing their revenues and providing more capital for reinvestment. Higher stumpage prices for export logs provided landowners with incentive for more intensive forest management and more efficient wood utilization.

Domestic processors—

Proponents of log export restrictions included domestic mill owners who competed with exporters to purchase stumpage and the U.S. construction industry. These factions asserted that export markets drove up stumpage prices because importers paid a price premium for logs of desired quality. Higher stumpage prices meant higher lumber prices and higher U.S. housing costs. Additionally, foreign buyers increased competition for stumpage, reducing the total supply of logs available to domestic processors. Therefore, mill owners favored export restrictions to ensure viability of the domestic timber processing industry.

Proponents of restrictions assert that higher stumpage prices and reduced supplies of available timber make PNW mills less competitive in domestic markets compared to other U.S. and Canadian firms. By protecting domestic processors from increased raw material costs, more lumber could be produced in the PNW for

domestic use, resulting in lower domestic lumber prices, lower housing costs, larger processing industry, and greater employment.

Consumers—

The effects of log exports on consumers also have been debated. Prices of products available to consumers, such as housing, could be reduced if domestic producers were not forced to compete for logs with overseas importers. By restricting log exports, more products would be available in-country at lower prices. In addition, restricting log exports could increase societal welfare by allowing low-cost housing through reduced costs of raw material inputs for construction.

Communities—

The availability of natural resources is generally considered the basis for growth and development of resource-dependent communities in rural locations. Many communities in the Pacific Northwest relied almost solely on timber harvesting and manufacturing of wood products for economic well-being, especially in rural areas where the local mill may be the only employer. Changes in log availability or market demand have a direct impact on economies with few alternative industries (Darr 1975a). Residents feared that overseas importers would divert large volumes away from domestic mills, causing mill closures and regional unemployment. Restrictions were seen as a way to protect community well-being. On the other hand, port communities relied heavily on export trade; restrictions may have harshly affected them (Hamilton 1971).

Discussion of log export trade policies at the community level focused on implications for employment, value, and community stability. Darr (1975a) estimated direct and indirect value and employment tradeoffs associated with log exports versus domestic processing. Direct employment per thousand board feet of logs was higher in the domestic market than the export market. His calculation that domestic processing in Washington and Oregon in 1973 required 12.58 person-hours per thousand board feet for the lumber industry and 19.47 person-hours for the plywood and veneer industries while the log export industry required only 4.72 person-hours fueled arguments that log exports made little contribution to regional employment. Figure 17 illustrates employment in the wood products industry in the Pacific Northwest from 1965 to 2002. Note the greater volatility in employment in the lumber producing sector versus the paper producing sector.

Although log exports brought fewer direct employment opportunities, higher values obtained for stumpage in the export market were a boost to rural economies. Indirect impacts of log export and domestic industries in the PNW occurred when

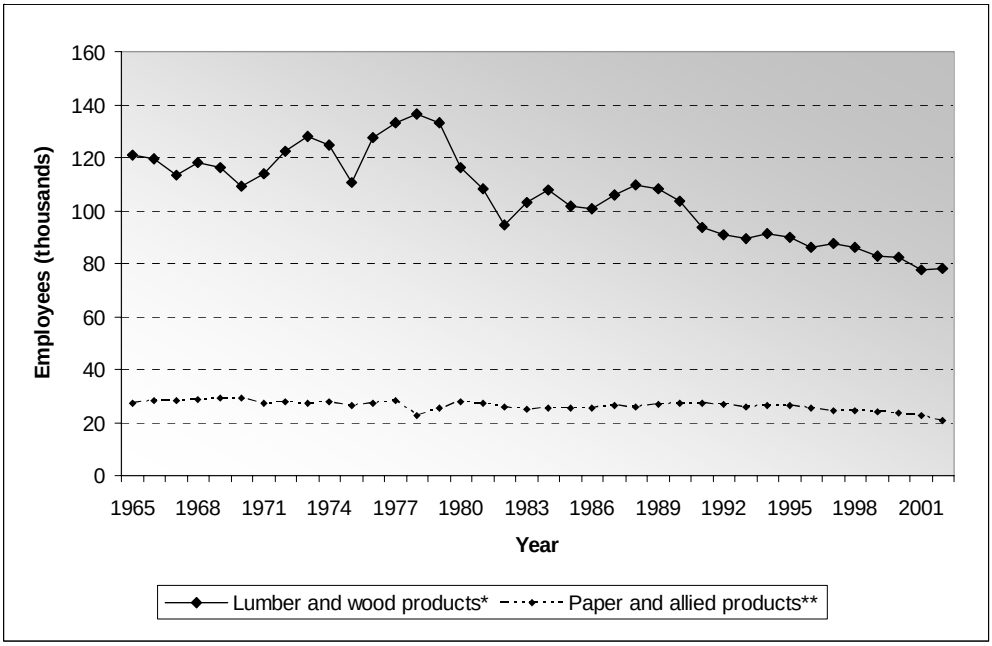

Figure 17—Employment in forest products industry, Washington and Oregon.
* Lumber and plywood products industry includes logging, lumber, plywood, poles, pilings, and miscellaneous wood products, excluding furniture.
** Paper and allied products industry includes pulp, paper, paperboard, and building board products.

companies and their employees spent the income received from stumpage or timber processing. These receipts determine the investment levels and other expenditures affecting employment in supporting industries. Money continues to change hands, creating a multiplier effect that stops when the money leaves the region. By spending profits locally after harvesting, stumpage owners were believed to contribute to the indirect multiplier effect. Unfortunately, difficulty in tracking how PNW stumpage owners actually spend receipts precludes testing the validity of this claim.

Community stability in forested areas is linked to concerns for social and economic well-being of community members whose fortunes are somehow tied to the allocation of forest resources (Society of American Foresters 1989). In this view, community stability is associated with jobs and income generated directly or indirectly through the harvest and processing of forest products. Diversity of economic base is often absent; forest sector shocks dominate economic trends because dependence on forest industry reduces adaptive capability in communities. In these areas, stability depended on market demand and a steady reliable supply of forest output. Community well-being was gauged solely as a function of forest sector health; log exports were viewed as a threat to regional stability.

This perspective on community stability ignores that the presence of intact, healthy forests is often linked to higher quality of life. The prosperity of a region increasingly depends on the ability to attract and retain skilled workers. Availability of nontimber resources and amenities, such as tourism, recreation, and opportunity for personal enjoyment contributes to overall attractiveness of a community (Niemi et al. 2000). Because it fails to incorporate social as well as economic factors to gauge community well-being, the community stability argument has been criticized in recent years.

Macroeconomic Factors Influence the Debate

One major impetus for debate over log exports in the United States involves changes in macroeconomic activity. Once trade flows are established, they continue to be influenced by a variety of macroeconomic factors, both domestically and internationally. Interactions among these factors influence international and domestic supply, demand, prices, and trade policies. Housing starts, business cycles, gains from trade, interest rates, currency exchange rates, and governmental subsidies impact both domestic forest industry and forest product trade.

Housing starts—

Trends in housing are a key indicator for forecasting demand for wood products, both in the United States and internationally. Change in the rate of housing starts indicates change in wood product demand in nations that use wood building materials for housing construction. In the United States, demand for wood products is driven primarily from demand for new housing, although the repair/remodel sector is growing. Cycles in home construction activity lead to volatility in the timber industry. Periods of high housing demand are accompanied by an increase in the price of lumber as a construction input and stumpage as a component of lumber. Periods of low housing demand predictably have the opposite effect; lumber and stumpage prices fall. Periods of high housing demand force greater competition among stumpage purchasers in both domestic and export markets in response to supply constraints. Housing starts for the United States are displayed in figure 13.

Business cycles—

The periods between recessions and expansions are called business cycles. According to the National Bureau of Economic Research, there have been 11 recessions in the U.S. economy since World War II (table 1). In general, during recessionary periods, demand for construction materials declines because housing demand

Table 1—United States business cycles

Business cycle		Trough from previous trough	Peak from previous peak
Trough	**Peak**		
		Months	
October 1945	November 1948	88	45
October 1949	July 1953	48	56
May 1954	August 1957	55	49
April 1958	April 1960	47	32
February 1961	December 1969	34	116
November 1970	November 1973	117	47
March 1975	January 1980	52	74
July 1980	July 1981	64	18
November 1982	July 1990	28	108
March 1991	March 2001	100	128
March 2001	November 2001	128	

Source: National Bureau of Economic Research 2003.

declines. Domestic timber markets are depressed from reduced demand for lumber and other wood products, resulting in low timber and commodity prices, mill shutdowns, and unemployment.

Recessions had major impacts on the timber industry in the 1970s, the 1980s, and the 1990s. However, strong housing demand was maintained during the recession of 2001, demonstrating that exceptions to the pattern exist. During times of domestic economic slowdown, log exports are perceived more positively by the industry. Exports provide returns to timber owners, generate foreign exchange, and improve the competitive position of U.S. forest products in international markets.

In contrast, when the United States has periods of high economic activity (an expansion), housing demand increases. Demand for wood construction materials prompts an increase in forest sector employment. Prices for timber and lumber soar, and domestic mills must compete for logs with exporters. These market conditions consistently resurrected the log export controversy as domestic producers who perceive themselves injured by declining log availability sought relief through governmental intervention (Wiseman and Sedjo 1985).

As the world economy moves toward globalization, periods of expansion and recession are more likely to encompass many countries at the same time. Countries experiencing economic growth simultaneously have a global impact on demand, resulting in higher prices in both domestic and international markets. On the other hand, recessions in the United States are more likely to spill over to trading partners from industrial countries in Europe and the Pacific Rim. Slowing foreign

demand slows purchases of U.S. wood product exports, compounding negative effects already felt in the United States. Thus, business cycles have a global as well as domestic dimension.

Interest rates—

Monetary policy, in the form of interest rates, has played an important role in causing business cycles in the United States. Interest rates are a crucial determinant of how much firms and consumers will invest. If interest rates are low, consumers borrow more. Purchases of new homes increase because favorable lending rates make mortgage payments more affordable. In general, low interest rates trigger more consumer spending and less saving.

High interest rates have the opposite effect, less spending and more saving. Terms of lending make investment less affordable and raise monthly mortgage payments. A firm faced with high interest rates may postpone building a new factory because the cost of borrowing is too high. Consumers may postpone decisions to purchase a new home until rates are more favorable.

Because interest rates play a key role in consumer decisions to invest in housing, they are a key factor affecting the housing construction industry, which in turn affects the timber industry. By influencing mortgage rates for housing, interest rates indirectly influence wood demand.

Currency exchange rates—

Fluctuations in currency cause fluctuations in the supply of imported or exported raw materials and finished products. Weakening currency loses value relative to other currencies; lower price of exports compared with other countries increases volume of exports demanded. For example, when the dollar is weak compared to other currencies, U.S. exports become cheaper to import, and demand for U.S. goods abroad increases. However, when the dollar is strong compared to other currencies, U.S. exports become more expensive to import and overseas demand for U.S. goods declines. Figure 18 displays the exchange rate of Japanese yen per one U.S. dollar between 1970 and 2002.

In the log export market, variation in the exchange rate between two currencies can cause price variation regardless of other log supply or demand factors. Currency exchange volatility also helps explain log purchaser behavior patterns that seem unusual or illogical. Japan does not experience PNW domestic prices; they only experience prices in yen. Curious trends in Japan's demand for PNW logs can be explained by simply converting log prices from dollars to yen. For example, in the late eighties, export log prices reached record highs, yet strangely, Japan was

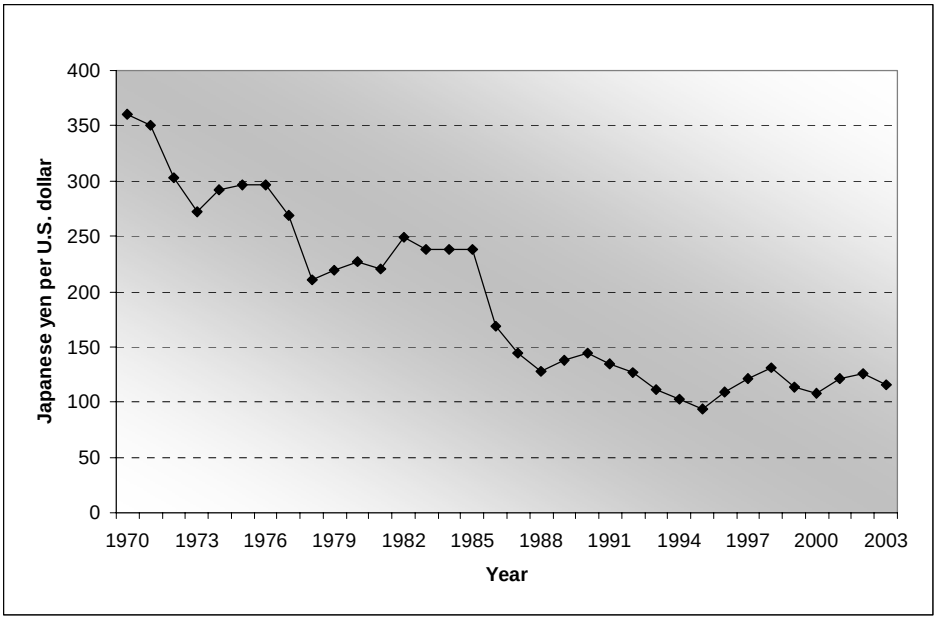

Figure 18—Currency exchange: yen per dollar.

increasing log purchases. Because of a strong yen, U.S. dollar prices in yen were favorable enough to continue PNW log purchases.

Holding the 1968 U.S. dollar price per thousand board feet of logs constant illustrates the percentage reduction in log prices in yen strictly attributable to exchange rates (fig. 19). Allowed to float in 1971, the yen has experienced periods of strengthening and weakening like any other currency. In periods of strengthened yen, goods like logs become appreciably cheaper for Japanese importers. On the other hand, weakening of the yen results in greater costs to Japanese importers. Thus, the yen price fluctuates with exchange rates, which, among other factors, contributes to the relative attractiveness of one supply region over another. Japan's decisions on purchases between competing suppliers are influenced by exchange rates between yen and the currency of that supplier. Although, in reality, PNW log prices are not held constant, this example highlights the role that exchange rates play in the decisionmaking of importing countries.

Government assistance—

An interesting outcome of the early 1980s recession was the USDA timber sales subsidies and buy-back program. Traditionally, contract arrangements for federal timber allowed firms to purchase cutting rights for standing timber and then delay harvesting for 2 to 5 years until market conditions became favorable. This policy

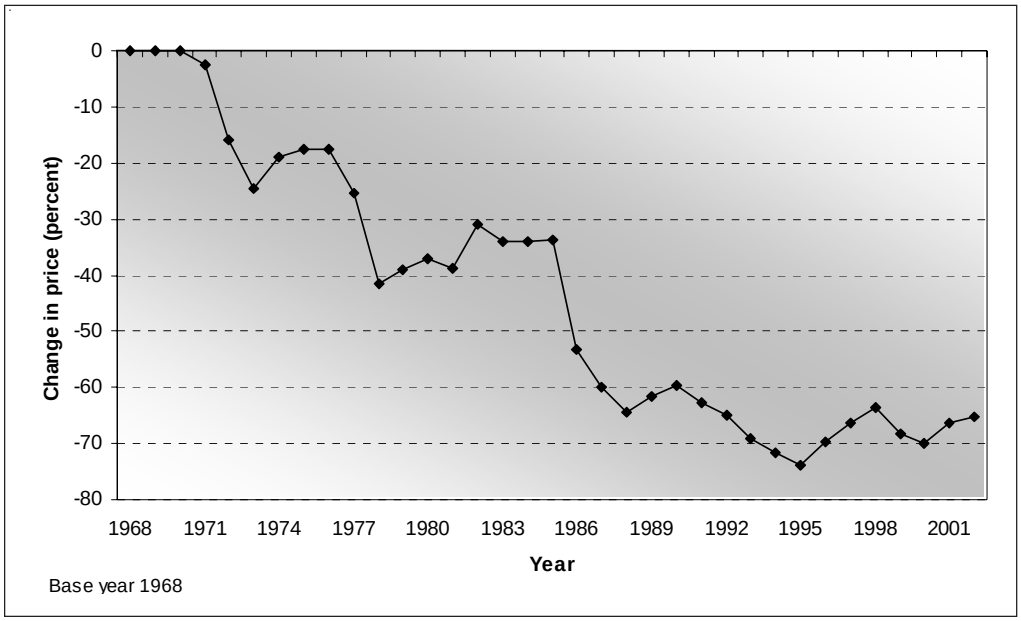

Figure 19—Reduction in log cost attributable to dollar and yen exchange rates.

led to widespread speculation because, in the seventies, companies could buy a contract for federal timber and count on it being worth far more by the time it was harvested because of increasing prices.

When the recession hit, stumpage prices dropped owing to lower inflation rates and housing demand. Timber firms were left holding vast inventories of uncut federal timber that were overpriced relative to declining domestic prices. In other words, companies purchased stumpage during the high inflation period of 1979 through 1980 and were faced with having to harvest the timber in the recessionary environment in the early eighties. High-priced stumpage purchased before the recession became unprofitable to harvest. To illustrate, the average stumpage price of timber sold on public lands in the PNW west side dropped from $311 per thousand board feet in 1980 to $83 in 1982 (Ruderman 1985).

Legislation introduced to give relief to holders of these federal timber contracts was signed by President Reagan in 1984. This legislation released firms from contracts for billions of board feet of uncut timber and then resold the same sales back to the companies at recession-level prices. The USDA Forest Service bought back bankrupt contracts from stumpage purchasers, which sharply increased supply of federal timber. All in all, the industry sold about 10 billion board feet of uncut timber back to the federal government.

Log Export Legislation

Most log export debate and subsequent trade restriction occurred during times of economic boom when high domestic demand caused the simultaneous decrease in log availability and increase in log price in both domestic and international markets. Proponents of restricting log exports argued that logs would be diverted back into domestic markets, making more volume available for domestic product manufacture. In 1968, domestic processors successfully lobbied for the first legislation to restrict log exports from federal lands. A brief discussion of subsequent log export restrictions follows. Lane (1998) provides an intensive treatment of this subject for readers interested in further information.

Joint Determination by Secretaries of Agriculture and Interior (1968)—
On April 16, 1968, the Secretaries of Agriculture and the Interior issued a joint determination that log exports from Forest Service (USFS) and Bureau of Land Management (BLM) lands in western Oregon and western Washington be restricted to maintain a viable domestic wood processing industry. Volume for export was limited to 350 million board feet annually to be divided between USFS and BLM lands in both states. The joint determination was scheduled for review and renewal in June 30, 1969, but was superseded by the Morse Amendment on January 1, 1969.

Morse Amendment to Foreign Assistance Act (1968)—
This act legislated the same log export quotas initiated by the joint determination but extended area under restriction to include all federal lands west of the 100th meridian. The 350 million board feet of exempted volume was redistributed between federal lands in Washington, Oregon, and California. This legislation also authorized regulations to prevent substitution of federal timber for nonfederal timber eligible for export. This was the first mention of substitution, whereby timber owners not subject to the ban are prohibited from expanding exports from their own holdings by substituting timber purchased from federal lands in domestic uses (Lindell 1978).

Department of the Interior and Related Agencies Appropriations Acts (Appropriations Rider) (1974)—
Congress attached a rider to Department of the Interior and Related Agencies Appropriation Act, which initiated a near total ban on unprocessed timber exports from federal lands west of the 100th meridian. This legislation, which constituted a

complete export ban on federal timber, was considerably more restrictive than provisions imposed under the Morse amendment. Additionally, the appropriations rider issued an actual directive to prohibit substitution. Formerly, the Secretaries of Agriculture and the Interior were only authorized to enact regulations to prevent substitution. Federal lands in Alaska were not included; log exports from Alaska were restricted by the Organic Administration Act of 1897.

Log exports from state-owned lands in Oregon and California were banned in 1961 and 1972, respectively. After the ban on exports from federal lands, private timber owners in Washington and Oregon and Washington state lands managed by the Department of Natural Resources (DNR) became virtually the only sources of softwood log exports. Attempts to extend legislation to impose restrictions on exports from Washington state lands were common (Parks and Cox 1985).

Forest Resources Conservation and Shortage Relief Act (1990)— This act was passed in response to sharply constrained timber supplies following the listing of the northern spotted owl as threatened. It was the first legislation to restrict individual states from exporting unprocessed timber from state-owned lands. The intent of the law was to promote conservation of forest resources, ensure U.S. for-est resources were not exhausted, and guarantee constant and available supply to meet domestic needs. Also, the act greatly restricted substitution and prohibited indirect substitution for the first time. Timber sold from DNR lands in Washington was required to be given primary processing in the United States. This was the first time state timber was included in the log export ban. Thus, as a result of efforts to protect domestic processors from export competition, only timber supplied from private landowners was eligible for export from the PNW (Lippke 1994).

Legislation prohibiting log exports from public lands was the first in a series of supply and demand side shocks disrupting triangular trade flows. The tendency, beginning in 1968, to limit softwood logs exported from Western forests continues today. The effectiveness, winners, and losers of this evolution in trade policy have been debated (Perez-Garcia et al. 1994, Sedjo and Wiseman 1983, Sedjo et al. 1992).

United States Lumber Import Restrictions

Another example of government policies designed to protect the domestic processing industry centers around the lumber trade with Canada. The United States and Canada have been involved in a trade dispute since the 1980s. This dispute was initiated by the U.S. softwood lumber industry in response to rapid expansion of

softwood lumber imports from Canada. United States domestic producers sought to use trade restrictions to limit imports of less expensive Canadian softwood lumber, claiming that Canada's stumpage pricing system subsidized lumber producers.

The Canadian Softwood Lumber Agreement (1996)—
In May 1996, this bilateral trade dispute was temporarily settled by the Canadian Softwood Lumber Agreement (SLA) between the United States and Canada (Fukuda 2001). The SLA was a 5-year voluntary agreement whereby producers from Canada's four largest lumber producing provinces could export up to 14.7 billion board feet of softwood lumber into the United States without export fee. These provinces were British Columbia, Ontario, Alberta, and Quebec. High fees were imposed on volumes exceeding that limit, but no limit was placed on the volume Canada could export. Ironically, during the first 4 years of the SLA, softwood imports from Canada rose from 17.3 billion board feet to 18.4 billion board feet, primarily owing to growth in shipments from provinces not subject to the quota (Haynes 2003a).

Although the SLA provided protection for some U.S. domestic producers, U.S. competitiveness in international markets suffered from unintended consequences. Because it limits the amount of lumber Canada can export to the U.S. duty free, the SLA forced Canadian producers to sell excess supply at lower prices to offshore markets. As Canadian domestic lumber prices dropped, Canadian producers exported more lumber and secondary products to the Pacific Rim. Expansion of lumber to the Pacific Rim accelerated the shift from U.S. log exports to lumber exports from Canada and Europe as Japanese buyers saw high U.S. log and lumber prices relative to other supply regions.

Loss of offshore markets also forced PNW lumber producers into U.S. markets traditionally served by the lower cost U.S. South. The PNW had long been at a competitive disadvantage with the U.S. South in serving wood products to Eastern and Southern U.S. markets. In the U.S. South, relatively inexpensive timber supplies were plentiful, and favorable prices triggered milling capacity expansion in lumber as well as pulp and paper industries (fig. 20).

Because the South has never been a major exporter to the Pacific Rim, Southern lumber exports generally have not directly competed with Canadian lumber. Ironically, Southern mills benefited more from the SLA than PNW mills as U.S. South exports have increased compared to the loss in PNW exports (Lippke et al. 1999b). Thus, the SLA may have contributed to loss of PNW export market share to the U.S. South.

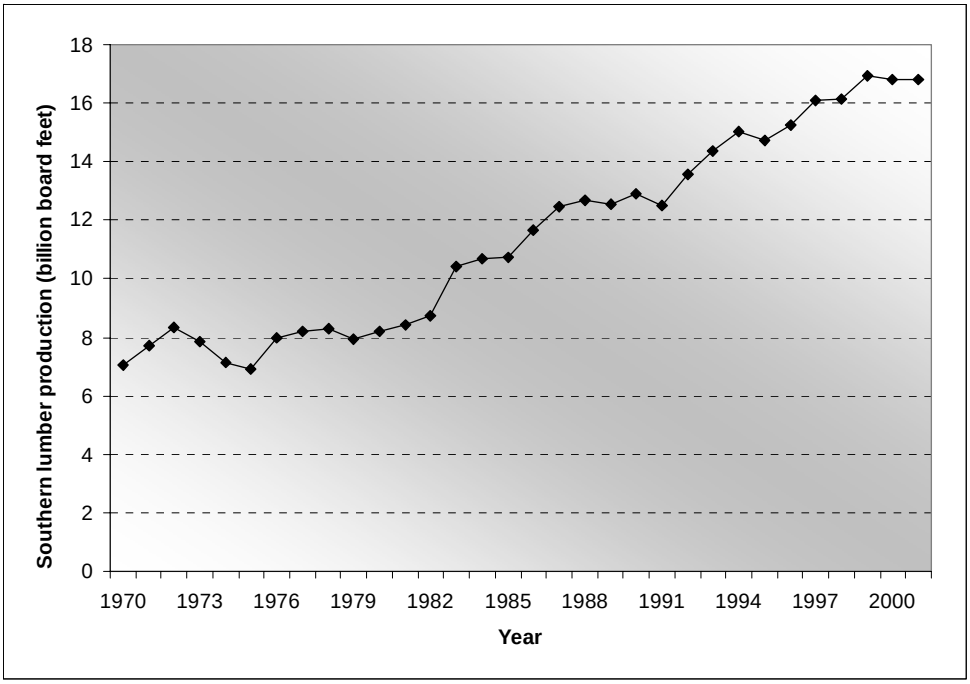

Figure 20—Southern softwood lumber production.

Other possible consequences of the SLA include material substitution in U.S. housing construction. Raising the costs of Canadian producers by imposing fees on imported lumber could increase the use of nonwood substitutes. As lumber becomes more expensive, builders in the United States may find building materials like concrete or steel to be more cost effective. Internationally, producers in other supply regions might capitalize on the decline in Canadian imports to increase their own exports of lumber into the United States, in effect substituting restricted lumber imports from Canada for unrestricted lumber imports from other regions.

Countervailing and antidumping—

The voluntary softwood lumber agreement expired on March 31, 2001. Soon after the expiration, the U.S. Coalition for Fair Lumber Imports filed countervailing and antidumping duty petitions against the Canadians with the United States government, which initiated a U.S. Department of Commerce investigation.

A countervailing duty is a tax applied on imports found to be unfairly subsidized. The countervailing duty petition alleged a subsidy rate of 39.9 percent and named Canadian federal and provincial stumpage and log export constraints, as well as 5 federal government and 22 provincial government programs, as the sources of the subsidies. Consequently, in 2003, Canadians exporting softwood lumber to the United States currently were charged a 19.3 percent countervailing duty imposed by the U.S. government.

Dumping is a term used to describe the sale of goods to another country at less than what they cost to produce. The antidumping petition against Canadian exporters alleged margins of 22.53 percent to 72.91 percent. In 2003, the average antidumping duty charged to Canadian exporters was 12.57 percent.

Resolving the softwood lumber dispute remains a top Canadian trade priority. To this end, the Canadian government has challenged the U.S. determination of subsidy before the World Trade Organization (WTO) and under the North American Free Trade Agreement (NAFTA Secretariat 1994), and has held WTO consultations concerning the U.S. determination of dumping. Market participants on both sides of the border await the final determination.

The gap between U.S. domestic consumption and production of lumber is forecast to exist well into the future. Reducing imports to encourage domestic production for domestic markets requires increased investment in capacity that is limited by capital requirements and environmental constraints. Until U.S. producers invest in additional sawmill capacity, domestic demand for lumber exceeding domestic production will be met with imports (Fukuda 2001). Whether Canada remains the dominant supplier to the U.S. market increasingly depends on the ability of the United States to compete against other global suppliers. One thing is certain, lumber trade with Canada has replaced the log export debate as the most controversial trade policy of the new millennium.

Prices in Domestic and Export Markets

Regional markets are generally guided by the concept of price arbitrage. Arbitrage refers to buying something in one market then immediately selling it in another market for a higher price (Stockman 1996). Arbitrage opportunities lead to trade; when two locations are in different countries, it leads to international trade.[2]

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[2] If a profit opportunity does exist, arbitrage, by buying low and selling high, will quickly eliminate it. For example, suppose that Southern pine lumber sells for $150/thousand board feet in Lufkin, Texas, and $200/thousand board feet in Opp, Alabama. A profit opportunity exists because someone could buy lumber in Lufkin and sell it in Opp. In the absence of any shipping or other costs, this individual would make $50/thousand board feet in risk-free profits. However, as profiteers start buying up lumber in Lufkin and selling it in Opp, they drive the price up in Lufkin and down in Opp. This process continues until the price difference between the two locations narrows to a level that just covers transaction costs, such as transportation. Thus, the act of arbitrage will eliminate profit opportunities by reducing or eliminating price differences between two markets for the same good. In general, consumers in Opp and producers in Lufkin will benefit from arbitrage, whereas consumers in Lufkin and producers in Opp will not.

In a smoothly functioning competitive market, there will be few, if any, opportunities to exploit pricing differences. Log export restrictions introduce arbitrage opportunities because restrictions limit market access, causing diverging price trends in stumpage, logs, and lumber markets (Adams and Haynes 1991).

Stumpage Prices

In Washington, as a result of log export restrictions, stumpage prices paid for the right to harvest from federal or state lands reflect the opportunity to sell exclusively to domestic markets. Conversely, stumpage prices paid to harvest from private timberlands reflect the opportunity to sell in both export and domestic markets as logs harvested from private lands flow into both these markets. Although private timber owners are eligible to purchase timber from state and federal governments, doing so precludes participation in the export market owing to provisions prohibiting substitution.

When standing timber is cut, it will yield a certain percentage of logs with the species, size, and quality characteristics desired by the export market. Total quantity of logs supplied by timber owners is a function of stumpage prices that blend log prices in export and domestic markets adjusted for costs of harvesting and transportation.

During the 1970s, stumpage prices peaked twice, in 1973 and in 1979 (fig. 21). Expanded demand from parallel housing booms in both the United States and Japan caused tightening in PNW softwood log supply. High demand in the face of tight supply forced log, lumber, and other product prices to record highs, causing prices in the stumpage market to rise as well.

Stumpage prices in the PNW dropped precipitously during the severe national recession of 1980 through 1982. By 1983, increased levels of residential and commercial construction signaled the end of the recession for the forest products industry. Increased stumpage prices from 1984 to the late 1980s reflected a period of high economic growth brought on by macroeconomic factors.

Until the end of the 1980s, most price volatility in stumpage markets resulted from demand-side pressures. In 1989, PNW stumpage prices reached a decade peak of $377.73 per thousand board feet in response to severe cutbacks in federal timber sale volume owing to the listing of the northern spotted owl (*Strix occidentalis* Caurina) as an endangered species. Tightened supply raised the price of Western timber species, impacting production levels and thus, exports. The period of declining stumpage prices seen immediately following the run-up occurred during the Gulf War when the United States experienced a short economic downturn. After

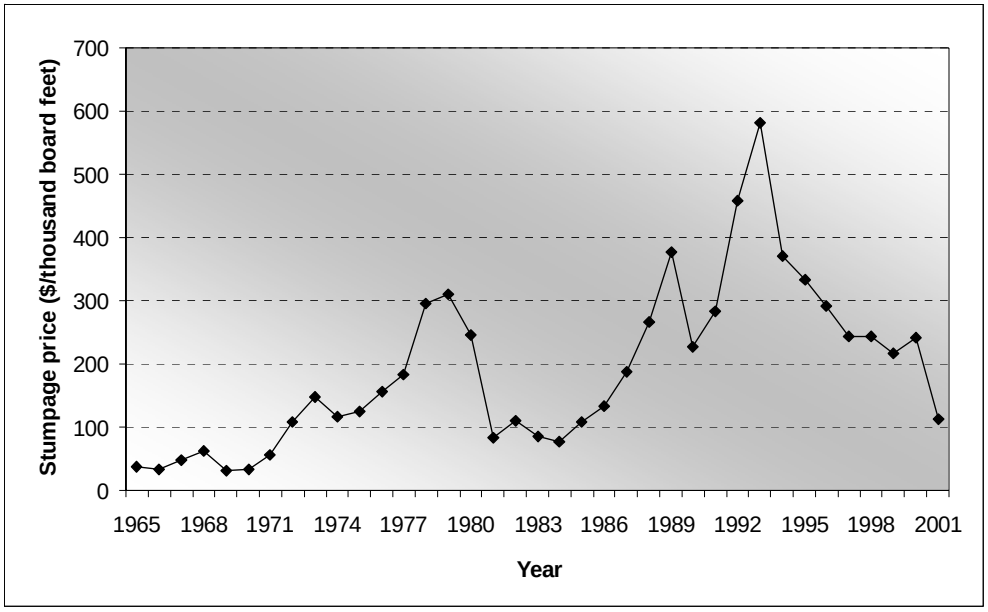

Figure 21—Pacific Northwest stumpage prices, nominal dollars.

1990, stumpage prices rose sharply in response to volatility in lumber prices and peaked at $581 per thousand board feet in 1993. This near doubling of stumpage price stimulated demand for wood from lower cost international suppliers, as well as nonwood substitutes like concrete and steel. As the world responded to large PNW supply changes, stumpage prices retreated to $242 per thousand board feet in 2000 (Warren 2003).

Log Prices

Demand for logs is a derived demand that rests ultimately on lumber demand. In the absence of export bans, it would be possible to model the trade between Washington and Japan by considering only two integrated markets: the log market and the lumber market. For each commodity, there would be a single price, apart from transportation costs, that would prevail in both countries owing to price arbitrage.

The partial export ban on PNW logs prevented the establishment of one uniform price in PNW log markets. Darr (1975b) pointed out that restriction was contributing to the development of two distinct markets for logs in the PNW. There was a definite price difference between logs channeled into domestic markets and those destined for export. The existence of export restrictions has led to a dual market for PNW logs; export and domestic log prices display a real price differential that remains even after adjustment for quality and species differences.

Export markets introduce foreign demand factors affecting forest product values and contributing to quality-sensitive demand differences (Lippke and Perez-Garcia 1998). Japanese preference for high-quality and supply continuity, combined with an advantage in labor-intensive processing and a strong species preference, resulted in a willingness to pay higher log prices. The development of different price levels for logs in the two markets, combined with the inability or unwillingness of the Japanese to substitute in the quality spectrum, resulted in an export price premium.

Flora et al. (1991) found that in 1988, export log prices ranged from $150 to over $3,500 per thousand board feet, with much of the differential attributable to log quality. Figure 22 displays the export price premium for Douglas-fir logs in northwest Washington from 1989 to 2003. The Japan 12 grade includes high-quality export logs destined for Japan; the No. 2 sawmill grade is considered its domestic counterpart. Export premiums are sensitive to relative market conditions; by 1989, international markets began tightening in response to PNW harvest reductions. The premium increased dramatically over the next 4 years, with export prices jumping from $416 per thousand board feet in 1989 to $1,184 per thousand board feet in 1993. Rapid price increases were seen in domestic sorts as well; domestic Douglas-fir log price increased from $318 in 1989 to $1,046 in 1993 (Log Lines 1989 through 2003).

Record prices and tightened supplies of traditional PNW species and grades encouraged Japanese buyers to experiment with alternative species and products. The PNW advantage in log production was jeopardized as substitutes for PNW logs became available from alternative international log suppliers. For example, the export market for PNW hemlock logs was devastated by market restructuring following high prices in the 1990s. Hemlock had been largely purchased by international users who have since substituted other whitewood species from Russia, Europe, New Zealand, and Chile. Price premiums for PNW hemlock logs are unlikely to ever reach levels experienced in the 1990s again (Lippke et al. 1999b).

As was illustrated in figure 4, Japanese purchasers were willing to pay higher prices for PNW logs for several years. However, even after paying higher prices, it was not possible for Japan's mills to replace lost log import volume. Raw material shortages triggered expanded imports of processed products such as lumber as the only practical alternative to meet the demands of Japan's construction industry. Thus, the PNW lost its advantage in supplying Japan's markets to international suppliers like Canada and Europe that had developed an advantage in producing processed materials.

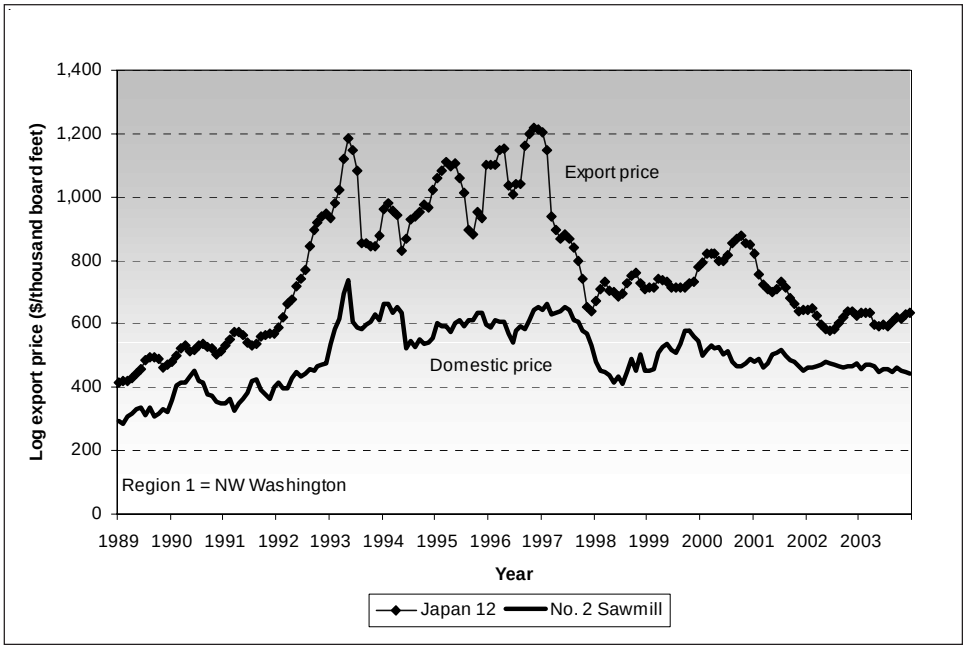

Figure 22—Log export price premium for northwest Washington softwood logs. Source: Log Lines Reporting Service, 1989-2003.

Export log prices remained high until 1997 when Japanese demand collapsed as a result of the Asian financial crisis. Between 1997 and 1998, Douglas-fir prices fell by almost half to $639 per thousand board feet. The Asian financial crisis and other market changes impacting Japan's demand for PNW softwood logs are fully addressed in a later section.

Lumber Prices

Logs may be diverted directly into export markets, or they may be utilized by domestic lumber processing firms. Domestic lumber processors then decide whether to channel lumber into export or domestic markets. Because Japan imports both logs and lumber from the Pacific Northwest, Japan's demands for lumber and logs are interrelated. Imported lumber must compete with lumber produced by Japan from PNW logs. Thus, Japan's demand for logs imported from Washington is determined by availability of logs from Japan and other foreign suppliers, log prices, and lumber prices (Parks and Cox 1985). When export log volumes declined owing to price hikes in the early 1990s, many hoped that higher prices for logs would have a feedback effect of increasing Japan's demand for PNW lumber.

Lumber price spikes can be explained by economic activity in general. Prices increase dramatically during economic boom times, or after significant economic shocks, and fall rapidly during bust times. This is primarily due to the interrelation among economic activity, housing demand, and prices of substitute building materials.

The first noticeable period of price fluctuation was in the late 1960s and early 1970s when three price spikes occurred (fig. 23). Price first peaked in 1967 when inflation and the economy heated up simultaneously in response to rapid expansion for the Vietnam War. After a mild economic downturn, prices increased from $243 per thousand board feet in 1970 to peak at $385 per thousand board feet in 1973, increasing competition for log supply. Log exports were blamed for part of the perceived timber supply problem; the total ban of log exports from federal lands went into effect in 1973. The peak in 1973 was followed by another recession brought about by an energy crisis spurred by the Oil Producing and Exporting Countries. Lumber prices dropped to $257 per thousand board feet by 1975 owing to decreasing real GDP and dramatically decreased domestic and international housing demand; mill curtailments and shutdowns were widespread (Sohngen and Haynes 1994). The last spike of the 1970s occurred when demographic conditions resulting from the post World War II "baby boom" led to an unprecedented demand for housing. Demand pressure from a parallel housing boom in the United States and Japan led to tightened supplies of west coast softwood logs and forced log, lumber, and plywood prices to record highs.

Rising prices for raw and finished wood products during the seventies housing boom led to the expansion of lower cost competing producers. Competitors in Canada and the U.S. South made gains in traditional PNW markets. Despite strong housing demand, the PNW market share in solid wood products declined. Between 1970 and 1980, the PNW share of total U.S. lumber production dropped from 30 percent to 25 percent. The expansion of sawmill capacity in both Canada and U.S. South resulted in a loss of market share for PNW producers.

The strong market conditions experienced with the 1970s housing boom were forecast to continue into the 1980s. Washington and Oregon's timber operators celebrated the new decade with phenomenal profits resulting from rapid inflation. After monetary policies designed to fight persistent inflation were enacted that same year, inflation rates dropped sharply and real interest rates rose dramatically, curtailing housing activity and reducing investment. Real GDP dropped by 2.6 percent, unemployment peaked at 10.8 percent, and the country was spun into the worst economic downturn since the Great Depression. Domestic lumber prices declined to pre-1970s housing boom prices, signaling the end of the high-demand period (Lippke and Perez-Garcia 1998).

The recession of 1981–82 was particularly devastating to the forest products industry. Tight monetary policies, high interest rates, slumping housing starts, declining lumber and plywood prices, domestic production cutbacks, and inflation crippled the industry. Thousands of timber workers lost their jobs. Forest sector

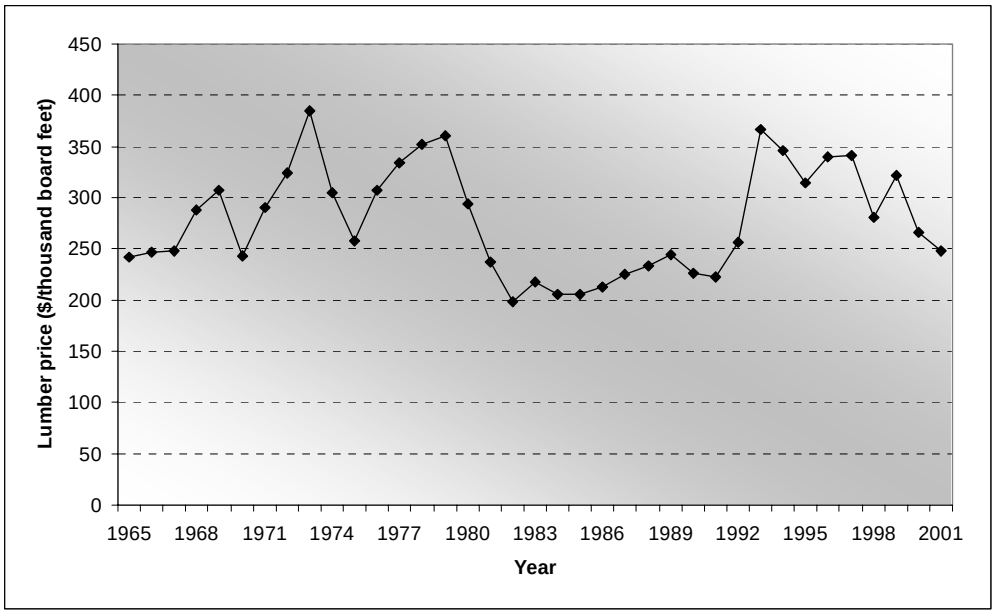

Figure 23—Domestic Douglas-fir lumber prices, 1982 dollars.

employment declined by 39,000 jobs in Oregon and Washington from 1978 to 1982 (Adams 1986). Many companies went bankrupt, merged, or were bought out. Companies that survived restructured their operations by closing older, inefficient mills, improving skills of workers, laying off workers, and increasing capital investment in manufacturing technology (Conway and Wells 1994). Fewer people had timber jobs, but worker productivity increased as mills invested in cost-cutting technologies and efficiency. By 1983 and 1984, increased residential and commercial construction signaled the end of the recession and the start of a new business cycle for the forest products industry.

After the U.S. economy recovered from the 1981-82 recession, lumber prices remained relatively stable for the remainder of the decade. After a short market decline from 1989 to 1991 owing to recessionary pressures, prices peaked in 1993 to levels not experienced since the high housing demand period of the 1970s.

Lumber price escalation in the early 1990s was driven by supply, rather than demand, constraints. In February and March 1991, a lumber price run-up began with roots in the old-growth controversy. Federal District Judge William Dwyer issued a sweeping injunction that drastically reduced PNW national forest timber sale levels from 3,380 million board feet of sales in 1990 to only 297 million board feet in 1991. Speculative behavior by lumber buyers combined with uncertainty to contribute momentum to the runup.

By 1993, reduced harvests from forest land in the PNW led to immediate increases in prices; lumber prices spiked at a high of $366/thousand board feet. Higher prices mitigated some economic loss to forest landowners from reduced harvest volumes, but other stakeholders were not so fortunate. Increased prices decreased lumber production in the PNW region; many PNW mills were forced to close. Approximately 12,600 primary processing jobs and an equal number of indirect rural jobs in the PNW have been lost since 1992 (Lippke et al. 1999a). Price increases also stimulated gains in wood utilization with the development and adoption of engineered wood products resulting in greater use and value from lower quality wood.[3] High prices also motivated investment and increased production rates from lower-cost competing suppliers worldwide.

From 1989 to 1997, trends in softwood lumber exports from the U.S. were driven by changes in PNW exports (fig. 24). Lumber exports from the U.S. South remained constant throughout this period. By 1999, exports from the PNW had fallen below Southern exports; the U.S. South overtook the PNW as the dominant lumber export region. Overall, total volume of U.S. softwood lumber exports declined by 75 percent between 1989 and 2003 (U.S. Department of Commerce, 1989-2003a).

To sum up, the market for logs is influenced by three interrelated markets: the lumber market, the domestic log market, and the export log market. These three markets are fully interdependent in the sense that quantities supplied and demanded in each market depend not only on the price in that market but also on prices in the other markets. Changes affecting PNW log export markets are explored in the next section.

Key Changes Affecting the Log Export Market

Three key changes affecting the log export industry in the PNW were changes in PNW harvest levels, changes in Asian demand, and the globalization of wood markets.

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[3] Engineered wood products (EWPs) are products used as substitutes for conventional softwood dimension lumber in markets where structural applications predominate. Demand for engineered wood products such as glulam, structural wood I-beams, and laminated veneer lumber grew rapidly in the United States during the 1990s. The efficiency and cost advantages of EWPs over conventional wood products guarantee their continued growth in international markets. EWPs have two major advantages in residential and nonresidential construction applications. First, EWPs have uniform strength properties that enhance design values and enable more efficient installation. Second, EWP manufacturing uses more efficient conversion technology; final product yield from raw material inputs is significantly higher than lumber.

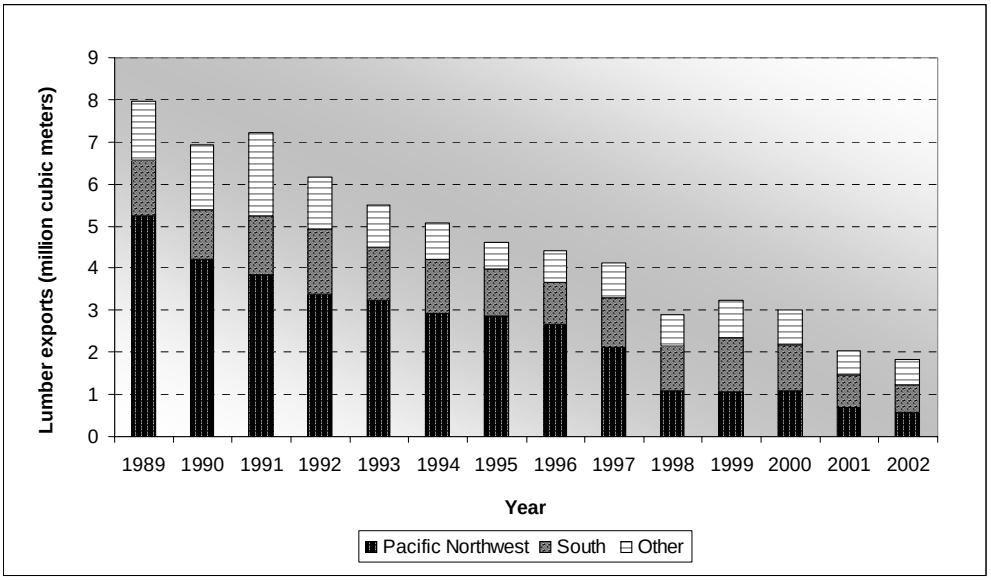

Figure 24—United States softwood lumber exports by region.

Changes in Pacific Northwest Harvest Levels

In June 1990, the U.S. Fish and Wildlife Service listed the northern spotted owl as threatened throughout its range. Domestic timber harvest levels declined after large tracts of PNW federal timberlands were withheld for northern spotted owl habitat under the Endangered Species Act (1973). Between 1988 and 1996, timber harvests fell 87 percent on national forests and 38 percent overall (Warren 1992, 1999).

Production levels, and thus, exports were impacted by declining sales of federal timber and state forest practice regulations developed to conserve northern spotted owl habitat. Subsequent listing of the marbled murrelet (*Brachyramphus marmoratus*) and requirements to protect salmon in riparian areas on state and private lands reduced allowable harvest levels further. Since timber harvest restrictions were first implemented in 1990 to protect endangered species, harvest volumes have declined 30 percent in Washington and over 40 percent in Oregon (Warren 1999).

Figure 25 displays combined timber harvest by landowner for Washington and Oregon from 1985 to 2001. Clearly, the bulk of timber harvesting in the PNW occurs on private forest lands. However, harvest reductions have occurred across timber owners as federal, state, and private forest lands in Washington and Oregon implement policies that constrain timber management strategies. These policies, along with log export market response, are highlighted in the following section.

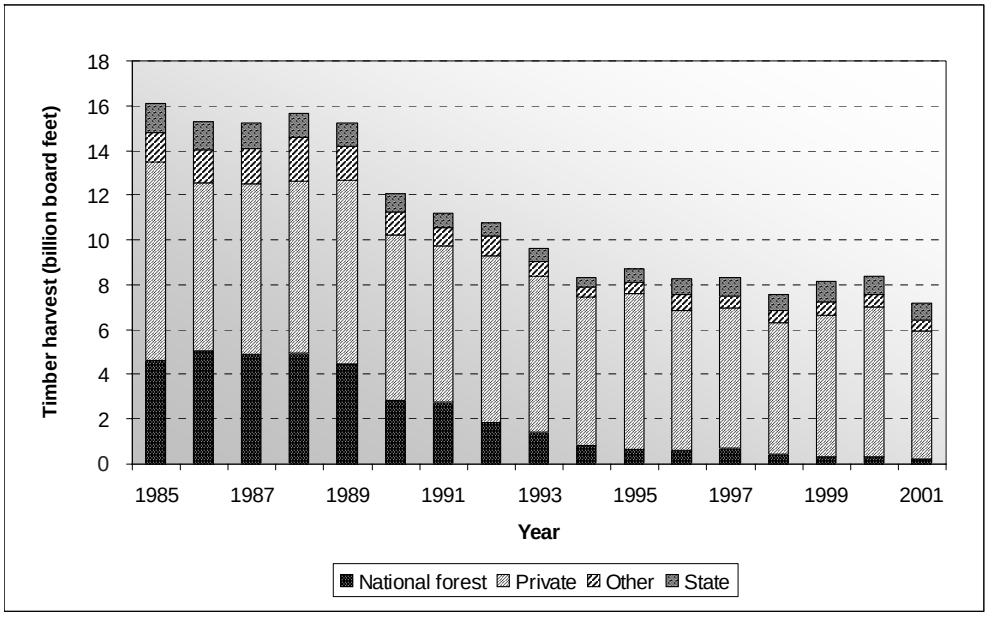

Figure 25—Washington and Oregon timber harvest by owner.

Federal lands—

The timber industry in the PNW was dealt a serious blow on May 29, 1991, when Judge Dwyer, ruling on a lawsuit filed by environmental groups seeking to prevent the extinction of the northern spotted owl, banned new timber sales on about 10 million acres in 17 national forests in Washington, Oregon, and northern California. Federal logging in the three states came to a standstill when he ruled the federal government had no plan to protect the threatened northern spotted owl. He found the Forest Service was violating laws by not maintaining a "viable population" of all species found within a particular national forest. The 1991 decision ordered the USDA Forest Service to adopt a conservation plan in compliance with the Endangered Species Act (1973) and the National Forest Management Act (1976) to ensure the survival of the spotted owl before selling additional rights to log owl habitat areas in national forests.

Dwyer's injunction remained in place for 2 years. In 1993, the injunction was lifted when Judge Dwyer accepted the Clinton Administration's Northwest Forest Plan record of decision (ROD) (USDA and USDI 1994) as the management plan for the region. This new plan replaced a timber-driven management focus with an ecosystem management focus aimed at preserving and increasing old-growth habitat.

Figure 26 shows the volume of timber sold from Pacific Northwest national forests from 1965 to 2000. Although sale volume dipped to 3.2 billion board feet in 1976 and 3.5 billion board feet in 1985, timber sale volume consistently fluctuated between 4 and 5 billion board feet from 1965 to 1988. Volatility introduced in anticipation of Judge Dwyer's decision caused timber sale levels to plummet by 2.2 billion board feet between 1988 and 1989. After sale volume peaked again in 1990, supply constraints became the dominant factor influencing timber price and availability. The following year saw national forest timber sales drop to less than 1 billion board feet per year, a level maintained throughout the 1990s. Former purchasers of federal timber were forced to rely on the private sector for a larger share of timber volume.

State lands—

Harvest levels have declined on state forest lands in Washington and Oregon as well. Regulatory changes in management regimes enacted to preserve critical habitat and protect endangered species characterize the tradeoffs made between increased environmental protection and economic impacts on the PNW forest sector.

The Washington DNR was established in 1957 to serve as a land manager for a variety of state-owned lands, including forested, aquatic, urban, and agricultural lands. In its role as a land manager, DNR manages approximately 0.8 million hectares of state forest land. Approximately 0.6 million hectares of this forest land is in western Washington (west side).

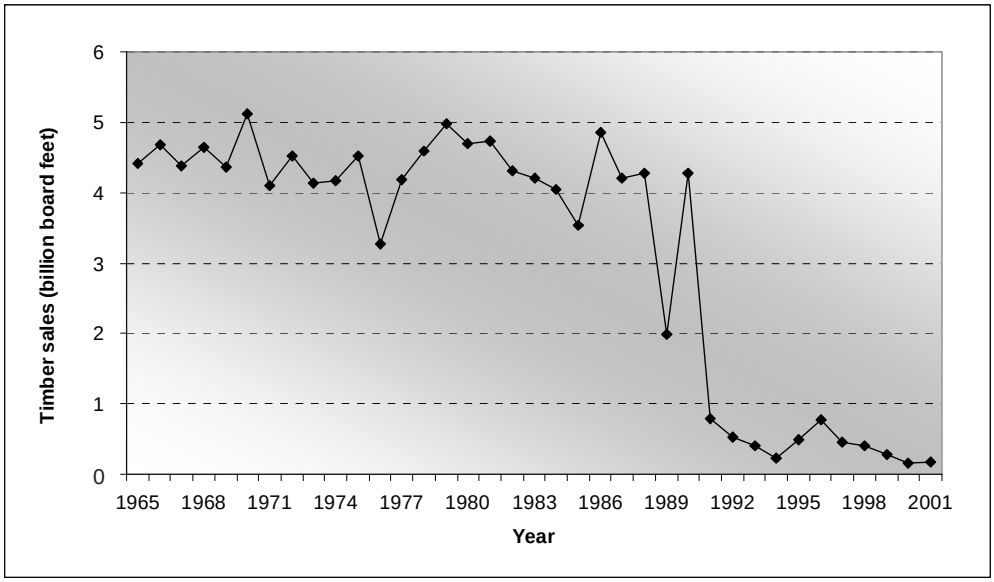

Figure 26—National forest harvest volumes.

As the land manager of 0.6 million hectares of Washington west-side trust forest lands, the DNR has two main purposes. The DNR has a fiduciary responsibility to create trust revenue as manager for public trusts, such as schools. Secondly, DNR is responsible for maintaining habitat and sensitive resources on lands under its management. To achieve these two potentially conflicting mandates, the DNR has developed policies, procedures, and strategies governing their management of trust forest lands.

State trust forest land management is conducted within the framework of state and federal laws, the DNR's 1992 Forest Resource Plan (FRP), 1997 Habitat Conservation Plan (HCP), the 2001 Forest Practices Rules (in instances where they are more protective than the HCP), and with oversight provided by the Board of Natural Resources. The FRP and the HCP have the greatest impact on harvesting from Washington state lands.

The FRP was developed to guide the management of state forest land for a 10-year period (1992-2002). The FRP describes DNR's guiding policies and priorities for management of trust forest lands (WADNR 1992). The FRP was extended until June 2005 to allow for the completion of the sustainable harvest calculations for western and eastern Washington. The sustainable harvest level is the volume of timber scheduled for sale from state-owned lands during a planning decade as calculated by the DNR and approved by the Board of Natural Resources. The sustainable harvest level is part of DNR's strategic plan for managing state forests to ensure future benefits to trust beneficiaries while maintaining a viable forest resource.

The DNR also manages west-side trust forest lands according to a multispecies habitat conservation plan (HCP) agreement with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. The plan covers the approximately 0.6 million hectares of DNR state trust lands located within the range of the northern spotted owl. The HCP ensures that the DNR can manage forests located in endangered species habitat without fear of prosecution under the federal Endangered Species Act. In exchange, the DNR is required to implement forest management practices that conserve threatened and endangered species and habitat outside of actively managed areas. Thus, the HCP provides DNR assurance that timber harvesting and other management activities will continue while providing for threatened and endangered species conservation (WADNR 1997).

Improvements in DNR forest inventory data, recalculation of the 10-year sustainable timber harvest level required for the new FRP, and several years of land management under the 1997 HCP collectively have resulted in a suite of management regimes on Washington west-side state forest trust lands. The challenge of

meeting mandated obligations to trust beneficiaries while providing endangered species protection presents a significant challenge to establishing cohesive forest management policies on Washington state forest lands.

As an interesting side note, trade policy regarding log exports from Washington state lands has also impacted revenues to trust beneficiaries. The spotted owl controversy rekindled the debate over log export restrictions as the domestic timber industry scrambled to gain access to more raw materials to substitute for lost federal timber. In 1990, federal lawmakers passed the Forest Resources Conservation and Shortage Relief Act, which banned the export of logs from Washington state forests.

Prohibiting state logs from entering export markets was intended to offset a portion of lost federal log supply to Washington mills, ensuring availability for local processing. However, declining federal harvest levels resulted in higher domestic log prices as mills competed for the reduced supply. Although private timber suppliers were not constrained by the ban, higher prices in domestic markets diverted logs from private sources previously destined for export back into domestic markets. Most of the diversion in log exports was market response to tight U.S. markets and high domestic prices, not a result of the state ban.

Lippke et al. (1999b) describe one unintended consequence of legislation prohibiting export of state logs. Because federal supply reductions were greater in Oregon than in Washington, almost half of the log sales from Washington state lands were purchased by processors in Oregon, rather than intended processors in Washington. Ironically, the ban on state log exports caused much of the loss in revenue to Washington's trust beneficiaries to be gained by mills in Oregon rather than Washington.

In Oregon, the Oregon Department of Forestry (ODF) manages approximately 315 655 hectares of forest lands. State forest lands represent about 3 percent of Oregon's forests and are jointly owned by the Oregon Board of Forestry and the Oregon State Land Board. Over 200 million board feet of timber valued at approximately $100 million was harvested from state forest lands in 2000, producing revenues for schools, counties, and local taxing districts.

State forest lands in Oregon are managed under broad forest management plans. Board of Forestry lands are similar to Washington DNR state forest trust lands in that the Board of Forestry is mandated to secure the greatest permanent value from its forests. In a recent administrative rule, the board defined this to mean healthy, productive, and sustainable forest ecosystems that over time and across the landscape provide a full range of social, economic, and environmental benefits to the people of Oregon.

The ODF also manages 50 181 hectares of Common School forest lands owned by the State Land Board. These lands were granted to the state by the federal government at the time of statehood to support Oregon's public schools. Under the Constitution, the State Land Board must manage and protect these lands for the maximum, long-term benefit of Oregon public schools.

Western Oregon state forests operate within their own current and proposed HCPs. The Elliott State Forest Management Plan and HCP are under revision. The current Elliott HCP for northern spotted owls and marbled murrelets was approved by the U.S. Fish and Wildlife Service in 1995. During the next 2 years, the ODF will be completing a proposed HCP for threatened and endangered species in western Oregon state forests. Extensive public and scientific input since 1998 helped shape the draft strategies; the U.S. Fish and Wildlife Service and National Marine Fisheries Service have authority to adopt the plan and an associated environmental impact statement.

During the 1997 legislative session, the Oregon Legislature passed the Oregon Plan for Salmon and Watersheds (ODF 2003). The initiative outlined a conservation plan for protecting and improving salmon and salmon habitat. The plan is aimed at protecting watersheds and contributing to the conservation and recovery of native fish stocks in cooperation with other government agencies and landowners. Although the plan was initially tailored to address coho salmon (*Oncorhynchus kisutch* Walbaum) concerns, it has evolved to address other species throughout Oregon. The goal is to restore populations and fisheries to productive and sustainable levels that will provide environmental, cultural, and economic benefits.

Changing societal goals for state forest lands undoubtedly has reduced timber harvesting on state lands in Washington and Oregon. The loss of timber revenue to trust beneficiaries, schools, and other entities in both states highlights the impacts that can result from species protection on public forests.

Private lands—

Eventually environmental restrictions imposed on public forests spread into the private sector. Forest practice regulations and salmon recovery plans targeting private forest landowners have impacted timber harvest in both Oregon and Washington.

The Oregon Forest Practices Act (FPA), voted into law by the legislature in 1971, was the first of its kind in the Nation. The act encouraged economically efficient forest management in Oregon and the continuous growing and harvesting of trees and maintenance on nearly 5 million hectares of nonfederal forest land that

is consistent with the protection of forest resources through the sound management of soil, air, water, fish, and wildlife resources (ODF 2003).

The FPA rules apply to harvesting, reforestation, road construction and repair, slash disposal, chemical use, and stream, lake, and wetland protection. Sensitive resource sites, such as bird nesting and roosting locations, and threatened and endangered species sites are also protected under the rules.

The 1994 Oregon Department of Forestry Forest Practice Water Protection Rules require the establishment of riparian management areas (RMAs) on most streams that are within or adjacent to a harvest unit (ODF 2003). The RMA width requirements differ depending on stream classification. A landowner has multiple options for managing RMAs. For example, one option is to harvest conifer trees within riparian management areas that are in excess of standard basal area targets, while maintaining a 6-meter no-cut buffer zone as measured from the average annual high-water mark.

In 1974, the Washington state legislature wrote the Washington FPA following more than a year of discussion among large and small timber processors, environmental groups, state agencies, and counties. The goal of the FPA was to protect forest resources while assuring that Washington continued to be a productive timber-growing state. The act regulated activities related to growing, harvesting, or processing timber on all local government, state, and private forest lands. The act was designed to protect timber supply, soil, water, fish, wildlife, and amenity resources by regulating timber removals, road construction and maintenance, reforestation, and the use of forest chemicals.

The FPA requires the DNR to administer and enforce all adopted rules. Forest landowners in Washington must get permission from the state to conduct logging, road building, and most other forest management practices by filing a forest practice application. Each forest practice application is reviewed by the state to ensure compliance with forest practice rules.

Forest practice rules have been amended and strengthened 13 times since they were established in 1975. The most recent changes were the result of the Forests and Fish Law (WADNR 1999), adopted by the legislature in 1999 in response to federal listings of endangered salmon and impaired water quality on nonfederal forest lands.

The Forests and Fish Law mandated changes to forest practices rules to protect fish habitat and water quality on 3.24 million hectares of private forest land in Washington state. The new law required private forest land owners to manage riparian vegetation and sediment to provide stream habitat and clean water for salmon. Activities such as improving road culverts for easier upstream migration,

improving road construction to reduce stream sedimentation, and enlarging and maintaining buffer zones along streambanks to provide shade and keep water cool have been mandated for long-term recovery of salmon on more than 96 500 kilometers of streams (Washington Forest Protection Association 2002).

Harvest reductions resulting from the protection of aquatic resources occur in riparian buffer zones along streams. Lippke et al. (1999a) estimated the economic impacts on private landowners in Washington from mandated riparian management changes alone to equal net present worth losses of $3.2 to $5.6 billion, depending on the selected management alternative. They also point out that high regulatory costs may provide incentive for small, nonindustrial forest land owners to liquidate timber assets and convert to alternative land uses. Thus, higher management costs from aquatic resource protection may ultimately reduce the economic viability of commercial forest management in the PNW.

Log export market response—

Harvest constraints in the PNW triggered long-term industry structural adjustment in both export and domestic markets. Prior to the 1991 injunction, the industry exported more than 3 billion board feet of logs annually, or about one-fourth of all logs cut in the region. By 1996, log exports had dropped by half (Niemi et al. 2000). Logs formerly destined for domestic markets consisted of old-growth and lower grade second-growth while export log markets were stratified by quality differences in second growth. Competition between exporters and domestic processors for PNW softwood logs caused domestic prices to rise enough to compete with export prices. The log export market suffered after overseas prices jumped in response to reduce availability of export logs.

Export volume declines were largely experienced in hemlock and lower grade sorts to Korea and China. Substitution for lower cost whitewoods from other supply regions permanently reduced the price for PNW hemlock while the premium for Douglas-fir climbed to new highs. Chinese softwood log imports peaked in 1988 with 1.05 billion board feet and rapidly declined to 11.9 million board feet in 1996. Korean imports peaked at 658 million board feet in 1989 then gradually declined to 74 million in 1996 (Warren 1992, 1999). Because these nations were more sensitive to price than Japan, high PNW log prices drove both nations to other suppliers.

Japanese markets were forced to adapt to reduced availability and increased prices when the high-quality logs sought by Japanese purchasers began ending up in domestic markets (Flora and McGinnis 1989). Overall, Douglas-fir log export volume to Japan declined by 30 percent between 1989 and 1991. In spite of

declining export volume, Japanese willingness to pay record high premiums for Douglas-fir logs meant total PNW export log revenues actually increased in 1991 and remained high until 1997, when demand collapsed in response to the Asian financial crisis (U.S. Department of Commerce 1989-2003a).

Even with higher prices, it was not possible for Japan to replace lost log import volume; reduced exports created a shortfall in Japanese processing facilities. Eventually Japanese importers secured substitutes for PNW high-quality logs; supply shortages forced the acceptance of lower quality materials. Technologies in Japanese wood utilization, processing capacity, and construction techniques began to change (Flora and McGinnis 1989). Demand for engineered wood products (EWPs) in Japan increased after the residential construction sector successfully experimented with products like glulam beams in traditional post and beam housing. These developments, along with the Asian financial crisis and other factors that have diminished Japan's demand for PNW logs, are described later in the text.

After constraints on public harvest, domestic markets changed as well. By 1992, 75 percent of the softwood harvest in the PNW originated from private lands. The majority of private timberlands were stocked with second- and third-growth, compared to old-growth timber on public lands. Old-growth timber, once a major component of timber harvests, was virtually nonexistent on private timberlands. Declining availability of old-growth drove technology changes as mills were refitted to process smaller diameter timber. Lumber produced from smaller diameter second- and third-growth trees has more juvenile wood, more knots, diminished strength properties, and reduced performance (UN ECE 2000). Supply and quality problems in the lumber industry opened the door for wood and nonwood substitutes. Engineered wood products were also penetrating domestic markets as alternatives to old-growth timber products.

In Washington, export volumes and harvest levels declined simultaneously, which sustained flow of logs to local mills for processing. However, because there was a greater decline in harvest volume and a lower volume of log exports in Oregon, there was substantial reduction in local processing in Oregon. Pacific Northwest logging and processing costs increased by almost 20 percent relative to those of the U.S. South (Lippke et al. 1999b). Production of primary products such as lumber and pulp declined as margins fell below cashflow levels necessary to sustain capacity. In addition, higher prices raised the cost of wood inputs for secondary processors, raising the cost of secondary wood products. Losses to primary and secondary processors reduced PNW competitiveness in international markets.

Poor markets and reduced timber harvest led to widespread mill shutdowns and unemployment in the forest industries in the PNW. By far, the majority of closures occurred in small mills. Figure 27 illustrates the change in the number of Washington sawmills by mill size from 1970 to 2000. Mill size is classified according to mill capacity in board feet (lumber tally) per 8-hour shift (WADNR 1970 to 2000). Figure 27 illustrates that the number of mills in the B, C, and D mill size classes declined overall since the 1960s. The decline in the number of size D mills from 127 in 1968 to 14 in 1998 was especially dramatic. On the other hand, the number of size A mills increased to dominate the industry. Big mills were increasing while small mills were shutting down, indicating that large firms able to capture the benefits of economies of scale were increasingly dominating the lumber industry. This trend continues today.

Despite dramatic declines in the number of mills, overall mill capacity has changed little (fig. 28). Total installed 8-hour capacity fluctuated over time but remained relatively constant between 1970 and 2000 (WADNR 1970 to 2000). Size A mills doubled their share of total capacity while size D mills share declined by a factor of 8 since 1970, again reflecting the dominance of large sawmills. Thus, the same amount of lumber was manufactured by fewer and larger firms, reflecting improvements in technology and efficiency in Washington sawmills. Trends in sawmilling indicate that changes in timber supply, technology, and product demand mean fewer mills, more diversification, and more efficient use of labor and raw material inputs.

Supply constraints provided opportunities for other supply regions to meet the difference between U.S. domestic consumption and production and to meet raw material requirements in the Pacific Rim. In addition, higher overseas prices and fewer offerings helped competing suppliers gain market share as importers tried to offset shrinking volumes available for export from PNW. The influence of imported wood products from Canada continued to be strongly felt, especially for dimension lumber. Low-cost wood from Chile, New Zealand, and Russia appeared on the global market.

The impact of harvest constraints is not temporary; it has forced long-term industry structural adjustment. This should be viewed largely as a permanent policy shift, if not a barometer for increasing environmental constraints on harvest. The long-term effect on PNW regional competitiveness in wood product markets remains a point of debate among stakeholders.

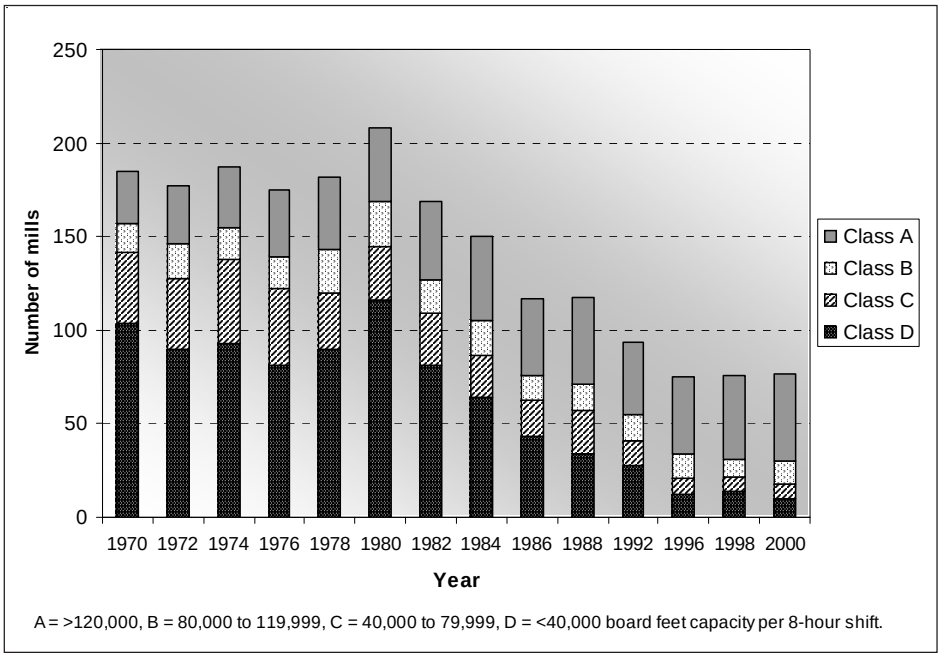

Figure 27—Number of sawmills by mill size, Washington.

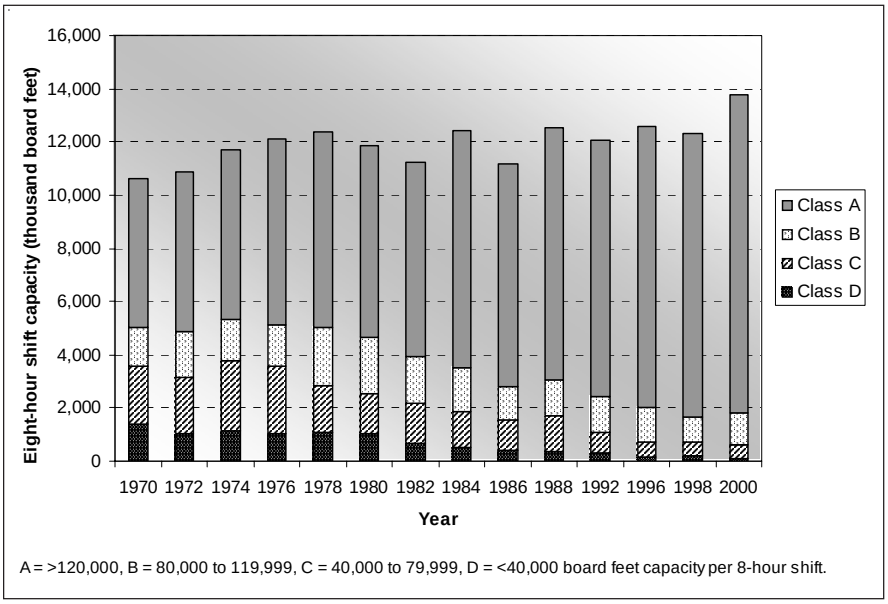

Figure 28—Installed 8-hour capacity of Washington sawmills.

Changes in Japan's Demand

As previously noted, Japan has always been the dominant purchaser of PNW logs, and the PNW log export market has been maintained over time owing to Japan's preference for high-quality wood. Changes in Japan's economy and housing industry have resulted in drastic changes in Japan's demand for forest products.

Specifically, the Asian economic collapse caused a dramatic decrease in Japan's log demand and increased price sensitivity in Japanese consumers. Changing preferences in Japan's housing and housing reforms undertaken by the Japanese government have altered import product mix and rerouted trade flows.

Asian economic crisis—

The Asian Economic Collapse began on July 2, 1997, when Thailand floated its currency, the baht. The devaluation of the Thai baht started a domino effect of devaluations across Southeast Asia. Speculation spread across east Asia to Malaysia, Indonesia, and the Philippines, then to Singapore and Taiwan. What was first viewed as a regional crisis became a global problem when currency speculators attacked Hong Kong's link with the U.S. dollar. After six major currencies in the region were devalued by an average 40 percent, the Korean won could not maintain its value and fell later that year. China was the only Asian economy to be relatively unaffected by the crisis.

Currency devaluations led to bank failures and bankruptcies across Asia. Banks borrowed abroad in foreign currency; bad loans were commonly made to finance an asset price bubble in stock markets, land, and real estate. Because of expectations of a government bailout, banks borrowed too much from abroad and lent too much for high-risk investment projects that were marginal if not outright unprofitable. When the asset bubble burst in 1997, the firms, banks, and investors that borrowed these funds found themselves with a huge amount of foreign debt, mostly in foreign currencies, that could not be repaid. As the economy slumped and currencies tumbled, more and more governments sought relief through the International Monetary Fund.

Recession in Japan, the leading regional economic power, exacerbated poor economic performance in the region. Japan's economy stagnated throughout the nineties; GDP growth averaged only 1 percent per year. In 1996, it appeared that an economic recovery was returning in Japan; however, an increase in the consumption tax, bankruptcies, banking troubles, and a drop in consumer confidence spun Japan into another recession. Economic weakness in Japan kept interest rates low, resulting in a continued depreciation of the yen relative to the U.S. dollar from 1995 onward, impacting Japanese foreign trade. Japanese exports were hit especially hard because Japan exports more than one-third of its products to other Asian nations.

In addition, Japanese banks had heavily lent to other troubled Asian economies. Serious domestic weakness in the economy, including the collapse of land and property prices, left Japanese banks burdened with an estimated outstanding

liability of 76 trillion yen ($530 billion) in bad debts (Roubini 2002). As banks attempted to collect on these loans, borrowing firms began to fail. Between 1997 and 2001, the Asian financial crisis resulted in an estimated 20,050 bankruptcies in banks and other large firms across Japan. By 2002, Japanese banks had yet to clear the bad debt accrued during this period.

Declines in PNW log supply and Japan's demand have triggered changes in trade flows. Figure 29 again displays PNW log export volume and prices for all species to Japan but focuses on only the period between 1990 and 2001. Note that volume exported to Japan declined rapidly from 2,114 million board feet in 1990 to 642 million in 2001. Effects of PNW supply constraints are evident by rapidly increasing prices and plunging exported log volume in 1991. Prices for export logs peaked at a record $1,026 per thousand board feet in 1995; despite high prices, Japanese importers were able to maintain a steady supply of PNW logs between 1993 and 1996. With the onset of the Asian Financial Crisis, Japan's imports of PNW logs plummeted, causing a related drop in log prices. Japanese importers were unable to benefit from declining prices since demand collapsed in 1997.

The PNW mill and timber owners were severely impacted by the collapse. Log exports that had already declined by 45 percent from 1989 to 1994, continued to fall owing to reduced Japanese demand after economic collapse in Asia (Lippke and Perez-Garcia 1998). Log and lumber shipments to Asia were drastically reduced, and volumes were rerouted into the North American market. Domestic mills struggled to adjust to an oversupply of wood; stumpage prices fell both for export- and domestic-grade timber. Reduced Japanese demand also meant that most U.S. timber producers no longer enjoyed an export price premium, which may ultimately have repercussions for forest management.

Heightened price sensitivity—

The Asian downturn also impacted the buying behavior of Japanese consumers. The Japanese became less likely to pay price premiums for building materials and more likely to use price to evaluate products. Value-oriented behavior favors high-quality, reasonably priced value-added products over commodities (Cunningham and Eastin 2002).

Two other factors have influenced heightened price sensitivity in Japanese consumers, a strong U.S. dollar and an increase in the Japanese consumption tax rate. During the recession, the Japanese yen weakened against the U.S. and Canadian dollar, effectively raising the price of U.S. wood products in Japan.

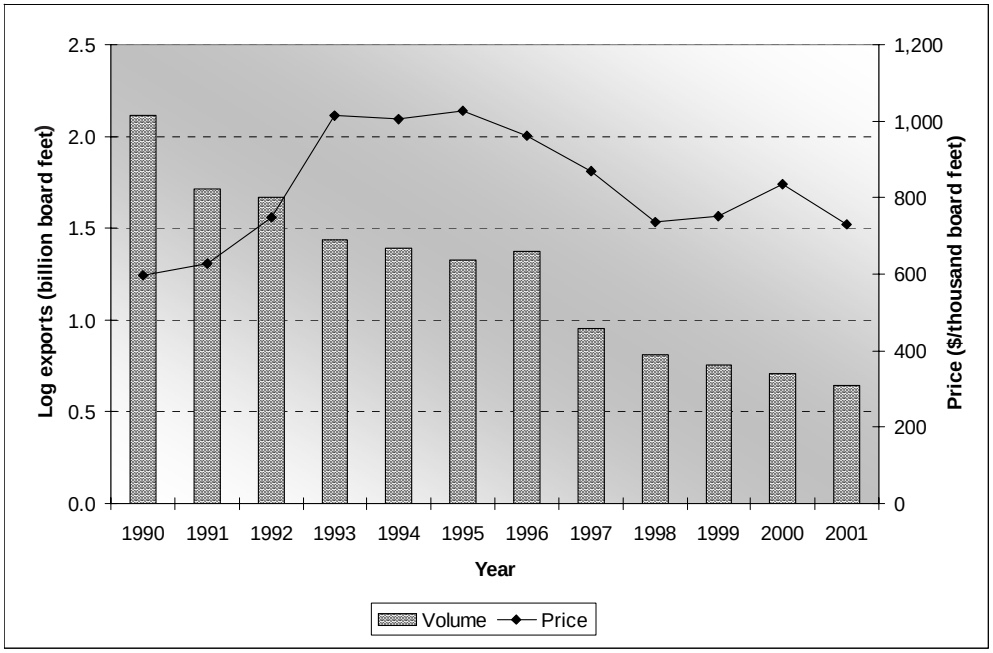

Figure 29—Volume and nominal prices of PNW softwood log exports to Japan, 1990 to 2000.

In addition to the increased cost of imported materials, taxes on these items were also increased, making imported building materials more expensive. It is no coincidence that Japanese housing starts peaked in 1996; the Japanese enacted a consumption tax rate increase in 1997. Consumers were motivated to build before the tax increase became effective. Certainly this tax has impacted housing demand in Japan and contributed to a new price consciousness on the part of consumers. Thus, the legendary Japanese demand for quality at any price has been replaced with price consciousness and value orientation, resulting in both substitution of building materials and supply sources.

Changes in Japan's housing industry—

Since 1997, Japan's economic difficulties have devastated the country's housing industry. Thousands of contractors have gone out of business, and the number of new housing starts, after peaking at 1.66 million units in 1996, declined to 1.17 million units in 2001. The decline in the number of housing starts was accompanied by a decline in Japan's demand for imported wooden building materials, which has adversely affected U.S. wood product exports. Exports of primary wood products declined 53 percent and secondary wood products declined 46 percent from 1996 to 1999 (Eastin et al. 2002).

Japan's domestic wood processing industry has suffered along with its housing industry. One long-term serious side effect of Japan's current deflationary business climate is relocation of domestic industry overseas. Manufacturing capacity for both wood products and substitutes for wood products are moving, particularly to China, signaling long-term changes to trade flows for both raw material and finished products (Glass 2002). A decline in wood processing capacity implies that Japan will substitute imports of lumber and other products for unprocessed logs.

Although demand for new housing is constrained by macroeconomic factors in any economy, declines in Japan's housing demand will be maintained owing to shifting demographics in Japanese society. A high proportion of Japan's population is beyond the highest years for forming households. Projections indicate Japan's population will begin to decline after 2010, resulting in declining demand for new housing. Thus, Japanese housing starts are expected to remain flat and then begin declining after 2010, leaving little hope for long-run recovery in their new housing industry, although repairs and renovations are expected to remain strong.

In addition, the number of qualified Japanese carpenters is declining as fewer young people enter the trade to replace retiring workers. Skills required for traditional labor-intensive customized construction techniques are becoming rare. Traditionally, skilled carpenters cut all the joints and notches for the traditional post and beam house at the job site. In response to this declining number of carpenters, Japanese builders are shifting to using precut post and beam housing kits. These precut systems are cut to very exact dimensions; defects arising from green lumber during the air drying process, such as warping and twisting, are unacceptable. Virtually all precut housing manufacturers use kiln-dried lumber to manufacture housing components.

Regulatory reform—

Traditionally, Japanese housing emphasized aesthetics over any other characteristic, including performance. Homes were not expected to last long with rebuilds occurring every 20 to 30 years. Attitudes of Japanese homebuyers changed dramatically after the 1995 Kobe earthquake. Serious concerns about housing safety and quality, including construction styles and materials, have had far-reaching effects on Japan's housing industry (UN ECE 2000).

Overwhelming consumer dissatisfaction with housing quality led the Japanese government to enact two regulatory reform measures, the Building Standard Law (BSL) and the Housing Quality Assurance Act (HQAC) (Eastin et al. 2002). The BSL was revised in 1998 for the first time since 1950. The first revision requires

that all residential housing units receive an interim and final building inspection. The second revision transformed the BSL from a specification-based building code to a performance-based building code. Only building materials that meet the performance standards are eligible for use in residential construction.

The HQAA was enacted to provide homebuyers with safeguards in resolving disputes with building contractors. The HQAA has four objectives: to improve the quality and performance of residential homes, provide homebuyers with a mechanism for resolving disputes with building contractors, establish a system of Housing Performance Indication Standards against which specific houses can be compared, and establish a housing completion guarantee system. One component of the HQAA is the requirement that homebuilders in Japan provide a 10-year warranty on all structural components of a newly constructed house. This focus on housing quality and performance favors higher quality building materials utilizing kiln-dried lumber, durable species, and precut construction systems, resulting in greater demand for engineered wood products (EWPs).

In addition, changes in Japan's building codes allow foreign construction methods and products to be used in Japanese construction. The new codes allow the use of building materials that meet foreign standards, provided that products have sufficient structural strength, are produced under strict quality control, and are similar to existing Japanese products. Japan's builders now have the freedom to use a variety of imported building materials for construction applications. Consequently, the relaxation of regulations has boosted imports of processed wooden building materials. Housing systems using these new building technologies and materials incorporate EWPs like laminated beams (glulam) and laminated veneer lumber (LVL). In 1989, there were 15 new construction systems recognized in Japan and only one incorporated LVL or glulam. By 1998, 114 new systems were recognized with 57 incorporating LVL and/or glulam (UN ECE 2000). Thus, deregulation of Japan's housing industry has increased the attractiveness and reduced the cost of Western style construction techniques and materials and dramatically increased Japan's demand for EWPs.

Regulatory reforms in Japan's housing industry have opened the door for more extensive use of Western style construction materials and techniques. Use of Western style precut systems and 2 by 4 construction is growing because of lower cost, superior seismic performance, and higher durability. In addition, Japanese builders have successfully incorporated EWPs into traditional post and beam construction. By 2000, the post and beam construction sector employed the most EWPs of the Japanese residential sector. As much as 86 percent of the glulam imported into

Japan entered this housing subsector; Japanese builders use glulam posts and long-span beams in place of solid wood posts and beams to achieve greater dimensional stability. Thus, the growth of EWPs in Japan results from direct substitution for green lumber products as Japanese builders upgrade housing quality.

Changing product mix and rerouting trade flows—
Conventional wood products are losing appeal for many reasons, including decreasing quality and performance as younger and smaller trees are utilized, increasing costs, more demanding consumers, and tougher environmental regulations. Japanese builder preference is clearly shifting from green lumber to dimensionally stable kiln-dried lumber and from solid wood to EWPs for home construction. Although Japan has invested in dry-kiln capacity, shortages in Japanese domestic production will be met by imports.

Use of EWPs in Japan is forecast to grow as the residential construction industry continues to adopt new products for traditional post and beam housing and introduces Western style panelized and platform frame construction technologies. Japanese glulam imports from the world have increased (fig. 30). Although the United States does export glulam into this market, building materials to meet rising demand for EWPs in Japan are rapidly increasing from European sources. In 1999, Austria became the dominant supplier of glulam to Japan, followed by

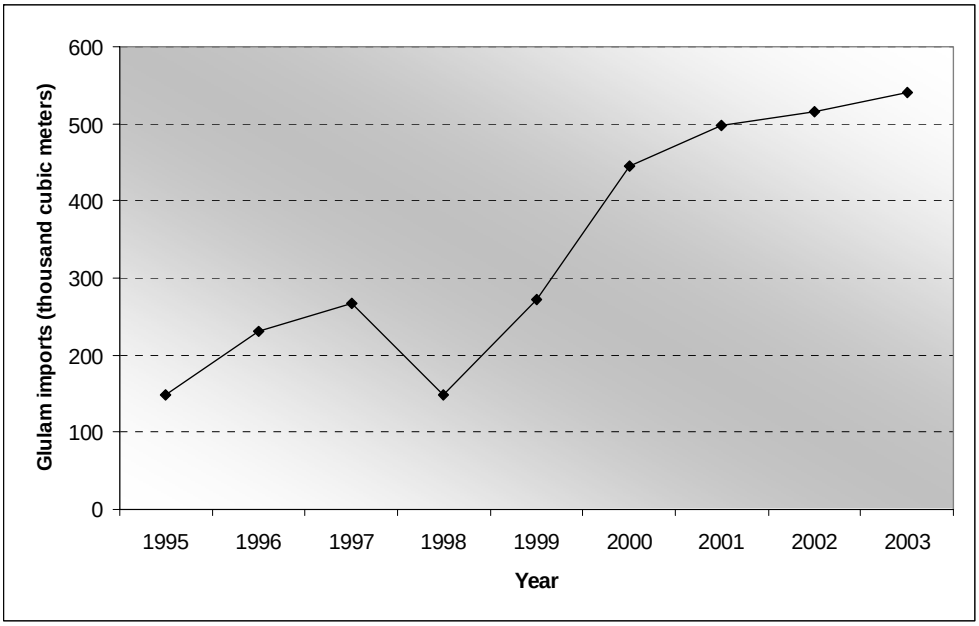

Figure 30—Japanese glulam imports.

the United States and Sweden. Exports of European kiln-dried lamstock are forecast to dominate new market opportunities for EWPs in Japan.

In addition to having a comparative advantage in glulam production, the Europeans gained market share owing to the relative value of U.S., Canadian, Japanese, and European currencies. The strength of the U.S. dollar compared to the weaker yen, Canadian dollar, and Euro reduced the competitiveness of U.S. wood products in Japan. Since 1990, the strength of the U.S. dollar grew steadily, reaching a high of 83.49 yen/U.S. dollar in 1995. By 1998, the yen had declined by 42 percent to 144.68/ U.S. dollar. Exchange rates between the Canadian dollar and the yen went from a high of 60.80 yen/Canadian dollar in 1995 to 95.7 yen/Canadian dollar in 1998, a decline of 36 percent. From 1989 to 2000, the U.S. share of Japan's softwood lumber market declined from 48.2 percent to 5.6 percent and the Canadian share decreased from 50.9 percent to 43.9 percent. During this period, the European market share in Japan increased from 0 to 25.1 percent.

After its adoption as the official currency of the European Union (E.U.) in 1999, the Euro continued to depreciate relative to other major currencies, including the dollar, the yen, and the pound sterling. This increased the attractiveness of European exports. In February 2002, the Euro had lost about 25 percent of its value against the U.S. dollar since its launch. The Euro weakened considerably against the yen during the first 2 years since its launch, by almost 30 percent, before recovering some of the lost value in 2001. However, since January 2003, the Euro has strengthened by about 16 percent against the U.S. dollar and reached a record level of 1.16 Euro/U.S. dollar in May 2003. The rising strength of the Euro may signal future trouble for European firms that export wood products.

Unlike other suppliers, the Europeans have demonstrated a willingness to provide custom cutting in specific dimensions requested by Japanese customers. In addition, there is a widespread perception in Japan that quality of European whitewood lamstock is superior to North American lumber. Thus, European exports of softwood lumber and glulam to Japan have increased dramatically, largely at the expense of U.S. and Canadian producers. American and Canadian suppliers have been slow to recognize the shift in product demand in Japan; it will be difficult to recapture market share lost to the Europeans.

The lumber market is a good example of changes in the Japanese market. Increased international competition has resulted in a loss of U.S. market share to Canada, European countries, and radiata-pine-producing countries like New Zealand and Chile. Scandinavian precision-cut kiln-dried glulam lumber has

steadily increased market share, making Scandinavia the second largest supplier of lumber at the expense of green lumber and U.S. lumber. Russian whitewood is entering the market as currency-strapped Russia is looking for sources of revenue. Radiata pine lacks the performance characteristics of Douglas-fir and the aesthetic qualities of hemlock, yet it has gained an increased share of the Japanese lumber market (Cunningham and Eastin 2002).

Although the majority of PNW firms engaged in exporting processed wood products to Japan were adversely affected by the Japanese recession, some firms were able to increase exports to Japan. Cunningham and Eastin (2002) investigated why some firms successfully increased exports during the Japanese economic downturn by using an analysis of marketing variables and demographic characteristics to determine factors influencing export performance. Factors associated with export success include shortened distribution channels by direct shipping to Japanese homebuilders, overseas sales representation in Japan, and product mixes focusing on secondary wood products, particularly prefabricated housing components and value-added products like cabinets, flooring, stairs, molding, and millwork. They conclude that if U.S. firms want to improve their export competitiveness, a strong commitment to the export process and gaining experience in Japanese markets are beneficial.

The Asian financial crisis, as well as new construction methods and materials, changing consumer behavior, and new housing regulations in Japan have combined to reduce the competitiveness of U.S. wood products in Japanese markets. In only 6 years, Japanese demand has evolved from PNW old-growth softwood logs to European kiln-dried lumber.

Globalization of Wood Markets

In addition to economic and regulatory changes in Japan and supply constraints in the PNW, changes in softwood log trade patterns between Japan and the PNW have resulted from increased globalization of wood markets. Regions including Chile, New Zealand, Russia, and Scandinavia represent new and potential areas of wood supply to meet growing international demand for wood products. Extensive forest plantations in Chile and New Zealand, combined with vast regions of natural stands of softwood timber in Scandinavia and Russia, have resulted in excess supply of wood in world markets. On the demand side, China is considered an emerging market with enormous potential for forest product exports. Data for this analysis are taken from statistics gathered from the United Nations Food and Agricultural Organization Yearbook of Forest Products (FAO 1990 and 2000a).

Figure 31 displays the shift in major industrial roundwood suppliers to the world. First, note only the U.S., Russia, and New Zealand exported significant volumes of industrial roundwood in the 1990s. U.S. exports dominated this market then declined rapidly after 1992. The expansion of Russian resources since the dissolution of the U.S.S.R. in 1990 is remarkable. Russian exports, formerly combined with other Soviet Union nations, began with 0 in 1990 to overtake the United States as dominant producer by 1997. New Zealand's exports doubled after 1990 and have remained relatively constant through the remainder of the decade. Chile's industrial roundwood exports remained flat from 1990 to 1997 but declined to almost 0 in 1998 owing to capacity expansion for sawn wood production. Canadian industrial roundwood exports have increased since 1998. Traditional regulations restricting log exports from crown lands were eased under a relief program for forest workers as a result of depressed economic conditions for lumber products in Canada (USDA FAS 2001).

To contrast, figure 32 displays major softwood sawn wood exporters to the world. Clearly, Canada dominates the sawn wood export market. Canadian lumber exporters control over half of the total market share. Although Canada controls the majority of the market, Scandinavian suppliers have made substantial inroads in the global sawn wood market. Scandinavian market share has expanded every year during the 1990s. Notable also is the expansion of Russian sawn wood exports

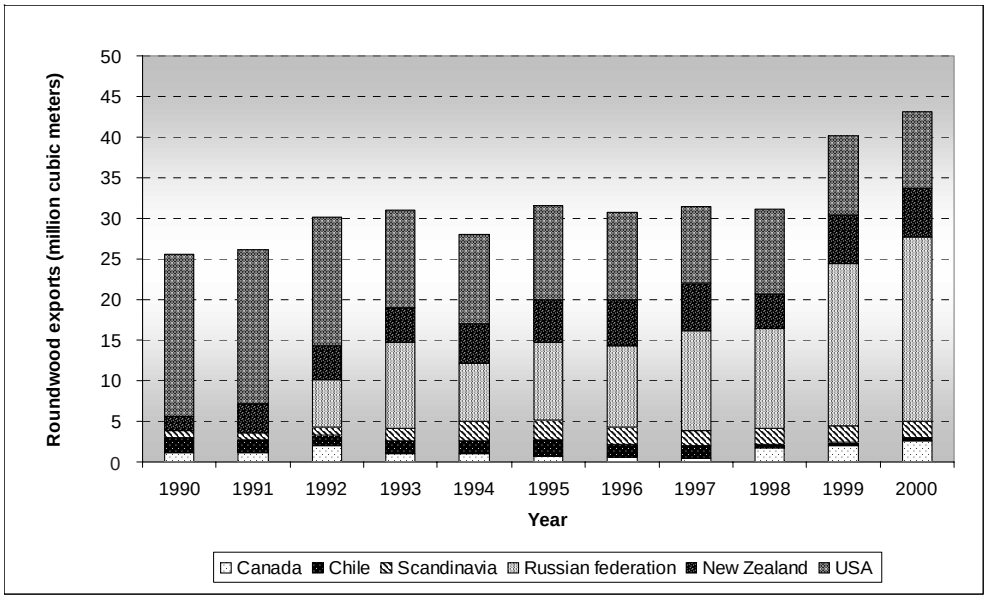

Figure 31—Leading industrial roundwood exporters to the world.

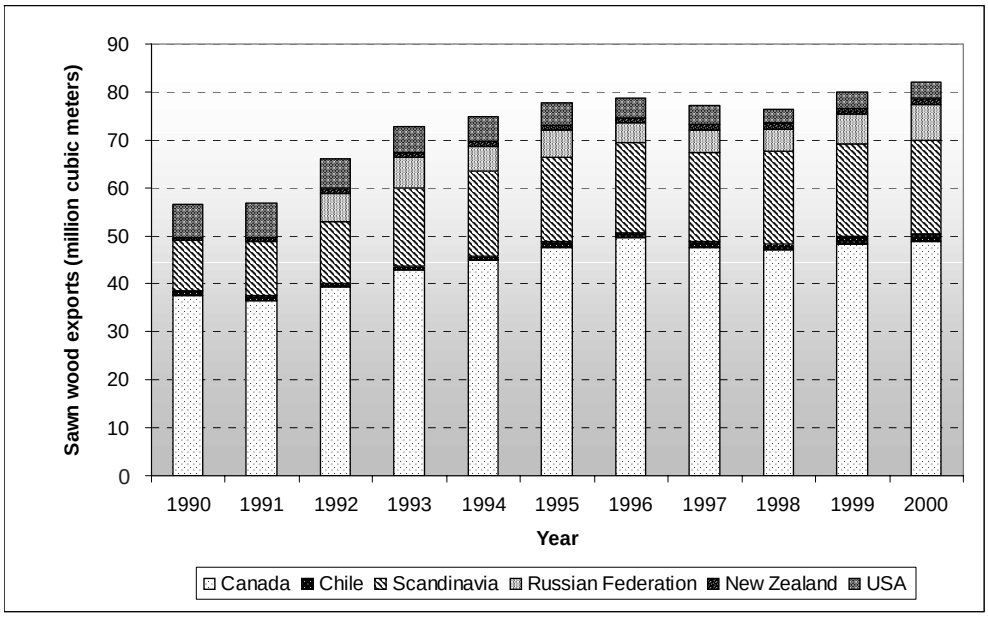

Figure 32—Leading softwood sawn wood exporters to the world.

from 0 in 1990 to about one-tenth of global supply in 2000. Sawn wood exports from Chile and New Zealand have remained relatively low over the decade, but the Chileans were able to expand exports of sawn wood after 1998. Only the United States has lost market share in the global sawn wood arena. The U.S. share of this market has declined from about 12 percent of total global supply in 1990 to 4 percent in 2000, providing evidence against the argument that reducing log exports stimulates increased lumber exports. A closer examination of the leading suppliers in these two markets follows.

Chile and New Zealand—

Chile and New Zealand have many similarities. Unlike other countries supplying timber to foreign markets, New Zealand and Chile export wood that largely originates from forest plantations. Both countries possess large areas of short-rotation radiata pine plantations that are approaching maturity, and both have strong export orientation. Unlike the situation in the tropics, North America, and Russia, there are relatively few ecological constraints on harvesting. Industrial forests have been planted specifically for sustained high management intensity.

Traditionally, the knotty nature and perceived lack of strength of radiata pine meant it was designated for low-grade end uses. Radiata pine has traditionally been used for structural applications and for the pulp and paper industries. Radiata pine exports will provide low-cost alternative wood fiber to produce pulp, composite

product substitutes, and structural lumber applications. With demand growing for EWPs, radiata pine could overtake higher cost/higher quality timber in some markets (Blandon 1999).

Chile has 15.6 million hectares of forest cover (about 20 percent of the county's total area), with native forests representing 85.9 percent (13.4 million hectares) and plantation forests accounting for 13.5 percent (2.1 million hectares) of the total. The majority of plantation resources in Chile are privately owned. Since the Chileans began establishing large commercial plantations in the 1950s, dependency on native forests has decreased dramatically.

Radiata pine has been the preferred plantation species in Chile primarily owing to its fast growth rate and straight form. This species currently represents over 75 percent of plantation area with inventories displaying a relatively balanced age-class distribution and an average rotation age of 25 years. Based on established plantation inventories, age classes, and annual increments, radiata pine timber production is forecast to increase substantially from an annual harvest of 18.8 million cubic meters in 2002 to an estimated harvest of 36.9 million cubic meters in 2018. In 2001, 41 percent of harvest was processed into sawn wood, 31 percent into pulp, and the balance exported in log form or used for structural and nonstructural panels (UN ECE 2002).

The growth of Chile's forest industry over the past three decades has depended on the development of international markets. Since 1990, the value of forest product exports has more than doubled, reaching $2,200 million in 2001, representing 13 percent of the country's total exports. Approximately 75 percent of the production of primary (pulp, paper, panels, and sawn wood) and secondary products (EWPs, doors, windows, interior finish items and furniture and furniture components) is exported.

The United States remains the principal destination for Chile's wood exports, accounting in 2001 for 23 percent of the value of total wood product exports, Japan and China with 12 percent and 11 percent, respectively. However, the types of forest products imported by these three countries are dramatically different. The United States imports primarily value-added radiata pine wood products, such as moldings, planed wood, and doors and doorframes. The principal product exported to Japan is eucalyptus wood chips, whereas China imports primarily softwood pulp. Over the last decade, the value of Chilean wood products exports has more than doubled, mainly resulting from a dramatic increase in the value of further-processed wood products exports.

Three important trends have emerged in the Chilean forest products industry. First, the degree of vertical integration is high, with supply chains managed from

resource to international markets, including nursery operations, harvesting, log merchandizing, sawmilling, value-added manufacturing, marketing, and sales. Second, there has been a large investment in technology in all aspects of their operations, substituting capital for increasing labor costs. The third trend is the investment that Chilean forest companies have made in other Latin American countries, opening more direct markets for their products.

New Zealand is moderately forested with more than 29 percent forest cover. By 1995, New Zealand had about 1.5 million hectares of plantations established, with radiata pine representing 91 percent of plantation area. New Zealand has a relatively balanced age-class distribution, with a predominance of areas under 35 years old and an average rotation age of 25 years (FAO 2000b). Short-term volume available for harvests, defined as volume above rotation age, is estimated at 88 000 to 140 000 cubic meters. Industrial roundwood production was estimated at 16 400 cubic meters in 1997 of which 20 percent was pulpwood (FAO 2000a). New Zealand became a competitor in the "construction grade" log export market when its extensive plantations of radiata pine entered trade channels in 1995 (Vlosky 1985).

With these trends expected to continue, Chile and New Zealand will continue to gain in importance as world wood products suppliers, contributing to the global trend of an increased reliance on Southern Hemisphere plantations (FAO 2000b).

Russia—

The Russian Republic includes some 771 million hectares of forest spread across the entire national landscape. This is more than one-fifth of the world's total area of forest and other wooded land. Two-thirds of the forest is available for wood supply, the remainder being unavailable because of economic and accessibility constraints. Although Russia's forests contain an estimated 82 billion cubic meters of growing stock, only about 55 billion cubic meters are considered accessible (67 percent). More than nine-tenths of Russian forest land is classified as undisturbed by man and therefore mature or overmature, with some additional areas of semi-natural forest and a smaller area of plantations. Forest land remains predominantly in public ownership, but efforts to privatize some forests are underway (Gataulina and Waggener 1997).

The forestry sector in Russia, particularly the East Siberia and Far East Regions, has substantial potential for development. The eastern Russian regions contain some 438 million hectares of forests and account for approximately 67 percent of Russian federation forest land. The combined two-region inventory for conifer species is 42.5 billion cubic meters, or almost 71 percent of the Russian

total. Although approximately 43 percent of Far East inventory and 41 percent of East Siberian inventory are presently inaccessible, this sparsely developed forest region has the greatest potential to affect global timber supply (Backman and Waggener 1996).

The Russian federation is one of the largest producers and exporters of industrial roundwood in the world (fig. 31). Softwood logs have dominated this trade. Almost all of Russia's exports of unprocessed logs originate in Far East Russia and East Siberia and end up in Pacific Rim markets including Japan, South Korea, and China. In addition to the official trade, there is undocumented barter trade, particularly in the border region between the Russian Far East and northeast China. Trade relations between Russia and its partners have in part been determined by political relationships and partly by economic realities including the need to earn foreign exchange. Although traditional trade was conducted with former planned economies, the dynamics of political and economic change have opened relations with Western Europe and the Pacific Rim, and exports have strengthened overall Russian federation trade balances.

Expansion of eastern Russian exports into processed product markets is constrained by several factors. Utilization of existing supplies of timber from Russia is currently limited by poor accessibility and forest quality. Major portions of mature forests are inaccessible owing to limited railroad and highway infrastructure into remote areas of the Russian Far East. Overall investments in infrastructure will be required to make the harvesting and processing of timber viable. In addition, the Russian Far East has the highest proportion of low-quality sites and one of the lowest proportions of fully stocked stands of any region of the former Soviet Union. High-grading of timber stands for saw logs has deteriorated forest stocks, resulting in relatively poor-quality forests. Also, many Russians appear to believe that preventing further forest degradation is essential; increasing environmental concerns are likely to limit timber output from the region and reduce overall harvest potential (Cardellichio et al. 1989).

In addition to harvesting limitations, capacity limitations are a barrier to Russian entry into processed markets. The overwhelming share of the Russian forest products industry is located in the European-west Siberian region, with substantially less industry in the timber-rich eastern Russian regions. Substantial domestic and international capital investment will be required to transform the existing deteriorating industry capacity to standards of technology and product quality to become truly competitive in international markets. Joint ventures have traditionally been linked to the export of raw materials. Investment in direct forest sector operations and processing are much more limited and await more favorable

economic investment conditions. Present political and economic conditions are not yet conducive to large-scale foreign participation in processing sector development. Investment in Russia is still associated with high risk to firms; as conditions stabilize, investment should gradually increase. Until the existing sawmill sector in East Siberia and the Far East is upgraded, the ability to compete in lumber markets will be hindered, and Russia will continue to export primarily unprocessed logs (Blandon 1999).

With Russian economic improvement, domestic demand for forest products will grow within Russia. Rising domestic consumption interacting with physical limitations of the Russian forest resource may limit the contribution that Russia can make to global consumption in regions outside Russia, including the Pacific Rim, Western Europe, and possibly the United States. However, while eastern Russian forests should find growing domestic demand, exports of timber and wood products in the near term will remain attractive as domestic prices adjust to international levels. Retention of foreign earnings will be required to provide the base capital investments to modernize and upgrade capacity. Exports are projected to remain strong because the Russian need for foreign exchange will outweigh domestic consumption.

Russian economic stabilization has facilitated growth of industrial output in the forest and forest products sector. Between 1999 and 2000, exports of roundwood increased by 111.6 percent to 30.8 million cubic meters. Of this total, 29 percent of exports were composed of softwood logs. The main countries importing Russian roundwood are Finland and Japan, whose combined share of total Russian roundwood exports is over 50 percent. The major share of roundwood export to Finland is pulpwood and saw logs to Japan.

Scandinavia—

The flow of lumber from Scandinavia to Western Europe has historically been the third main trade flow of wood products in the world. Finland and Sweden are the main timber producing countries in Scandinavia. Sweden and Finland's relatively small population has limited domestic consumption of wood products with excess production channeled into export markets. Approximately two-thirds of the volume of sawn wood produced in Sweden and Finland is exported. Changes in market demand and restructuring resulted in expansion of Scandinavian exports to areas traditionally served by the United States and Canada.

Finland and Sweden are in the boreal coniferous forest zone, one of the richest regions of coniferous timber in the world. About 80 percent of Swedish forests and 94 percent of Finnish forests are included in this 900 million hectare region that

stretches from the Russian Far East to Norway. Scandinavian forests are primarily dominated by Scots pine (*Pinus sylvestris* L.) and Norwegian spruce (*Picea abies* (L.) Karst.).

Together, Sweden and Finland contain approximately 49.2 million hectares of forest land, or 62 percent of the two countries' land area. Approximately 41.9 million hectares are considered forest available for wood supply. Although this is considered only a small portion of the world's forest area (2 percent), the region's plentiful supply of slow-growing, high-quality timber has made Finland and Sweden 2 of the 10 leading sources of sawn softwood products internationally (UN ECE and FAO 2000).

Lumber producers in Scandinavia have enjoyed a competitive environment allowing them to steadily increase volume of lumber production. Domestic timber resources are plentiful and far more abundant than the forest resources of neighboring regions. This comparatively abundant supply is located in proximity to lucrative European markets. In addition, government programs to ensure sustainable resources and recent corporate mergers have made the two countries home to some of the largest forest products manufacturing firms in Western Europe. From 1991 to 1999, this combination of factors has allowed Finland's sawn wood production to increase 92 percent to almost 13 million cubic meters with production projected to increase through 2005 (Bomersheim 1999, METLA 2000). Sweden's production increased 30 percent in the same period, peaking in 1997 and then declining to 14.6 million cubic meters by 1999 (National Board of Forestry 2000).

As one of the leading wood-consuming regions in the world, Western Europe has traditionally been the most important end market for Scandinavian suppliers. In the past, Scandinavian suppliers have experienced little competition in the European market for sawn wood. Suppliers from the United States and Canada focused primarily on the growing U.S. housing market; Russian suppliers lacked the infrastructure to harvest and export substantial volumes of forest products. The leading end markets for Scandinavian sawn wood exports within Europe have been Germany, Denmark, and the United Kingdom. The abundance of high-quality clearwood in Sweden and Finland and proximity to major European markets led to the region's rise as a leading global timber supplier.

Despite the domination of Scandinavian forest products firms in the European market, the economy in Western Europe has been uneven, and prices for sawn wood are substantially lower than in previous years (USDA FAS 2001). Declining overall demand, coupled with increasing competition from lower cost Eastern European suppliers, has made it increasingly tenuous for Scandinavian forest products firms depending on the European market for their survival. In addition,

oversupply of roundwood entering the European market as a result of nearly 200 million cubic meters of windthrow from 1999 storms led to accelerated roundwood production and trade and lowered prices throughout Europe in 2000. More recently, wooden building materials have encountered increasing competition from nonwood substitutes, such as steel-frame housing, concrete, and plastics. Scandinavian industry has seen several firms file for bankruptcy and the related production capacity decline. These factors have made it more important for Scandinavian suppliers to diversify into new non-European markets and differentiate their products.

Recent years have shown a dramatic increase of Japanese sawn wood imports from Scandinavia. Beneficial exchange rates, rising North American lumber prices coupled with declining production, willingness to tailor products to meet customer requirements, and commitment to quality control and price advantage are a few of the factors that have contributed to Scandinavian supplier success in Japan. When U.S. export lumber prices spiked from 1992 through 1993, spurred partly by domestic harvest restrictions, Japanese consumers sought lower priced substitutes, which they found from Scandinavian suppliers. The weak Euro combined with the Japanese desire for high-quality kiln-dried lumber and EWPs allowed Sweden and Finland to increase lumber exports to Japan by 235 and 267 percent, respectively, between 1994 and 2000.

In 1990, imports from Sweden and Finland to Japan were almost nonexistent, yet by 2000, the two Scandinavian producers together supplied 14 percent of Japan's imported softwood lumber. In the same period, U.S. share of the Japanese market declined by 24 percent after U.S. export volume to Japan declined 73 percent, down to 1.7 million cubic meters. Following a slump in 1998 attributed to the Asian financial crisis, Finland and Sweden exported almost 1.5 million cubic meters of softwood lumber to Japan in 2000 (UN ECE 2000). Gains that Scandinavian suppliers have won in Japanese markets highlight a growing ability to compete in traditional U.S. markets.

Rising demand for wood products within the United States has also attracted Scandinavian suppliers. Swedish and Finnish firms are reportedly keenly interested in gaining access into the strong domestic U.S. softwood lumber market. In 1999, Sweden exported 120 000 cubic meters to the United States, second only to Austria (220 000 cubic meters) as dominant European supplier in this market. By 2002, there were 15 European mills, 8 of which are Swedish, certified to grade dimensional lumber to meet U.S. standards (UN ECE 2000). Certification of offshore mills means that European suppliers can directly compete in U.S. commodity markets for lumber.

Sweden and Finland remain the two highest volume exporters of sawn softwood in Europe, with 2001 export levels of 10.8 and 8.1 million cubic meters, respectively. Although the major export destinations of Scandinavian softwood lumber continue to be within Europe, exports to Central Europe and the United Kingdom have stagnated as competition from other European and Russian producers continues to gain momentum. The emerging expansion of Scandinavian softwood market share into offshore markets like Japan and the United States continues to make great strides. In 2001, Scandinavian countries exported 420 000 and 1.6 million cubic meters to the United States and Japan, respectively (UN ECE 2002).

China—

With economic reforms and rising domestic consumption, China has received considerable attention as an emerging market for forest products. Value of solid wood product imports, including logs, lumber, panel products, and secondary processed products, from sources worldwide has increased dramatically (fig. 33). Redirection of trade flows to service the growing Chinese economy is underway, with suppliers fiercely competing to acquire a market advantage.

Several demand factors are driving Chinese imports. To get a hint at the potential magnitude of this market, consider that China's population is one of the largest in the world with 1.3 billion people. By slowly opening markets, China has experienced GDP increases averaging 9 percent per year over the past decade. The Affordable Housing project, a series of housing reforms initiated by the Chinese government in 1993, generated an increase in construction activity, stimulating demand for wood products. In addition, the Chinese government is slowly removing barriers to trade by lowering tariffs on many imports, including forest products. Thus, economic reform programs are slowly increasing the Chinese standard of living and opening markets.

China's domestic timber production is constrained by limited available forest areas and increased forest protection concerns. Although limited information makes it difficult to evaluate the success of Chinese plantations, Perez-Garcia and Marshall (2002) projected wood fiber production from Chinese plantations assuming two growth rates (1 and 10 cubic meters per hectare per year) and rotation ages (30 and 55 years) to determine the potential range of inventory distribution. Under these two assumptions, the plantation inventory resource in China ranges from 75 million to over 400 million cubic meters per hectare. Regardless of the expected future yields of these plantations, they are too young to provide a significant source

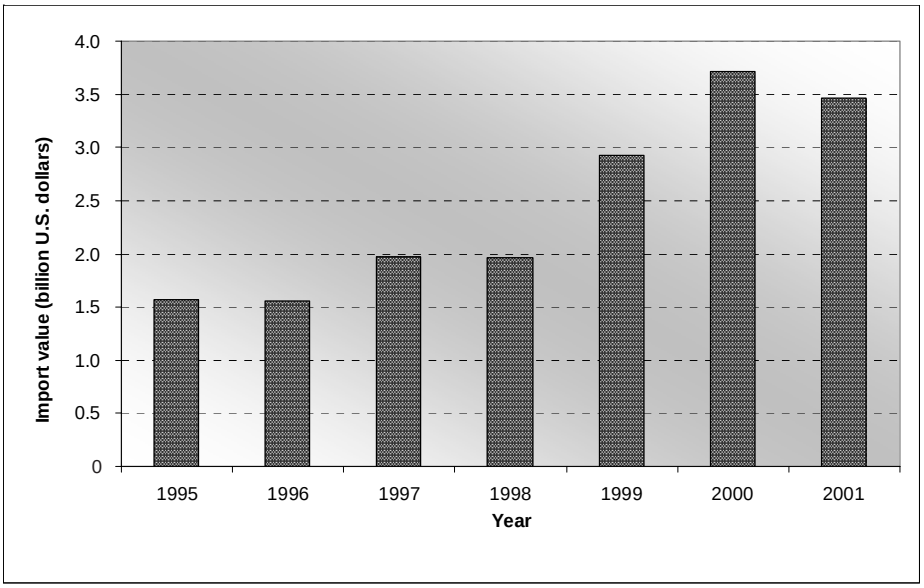

Figure 33—Value of Chinese solid wood product imports from the world.

of timber volume to meet growing Chinese demand in the near term (Perez-Garcia and Marshall 2002).

Domestic harvest is also limited by a logging ban in remaining natural forests instituted in 1998. Increased forest protection became a major concern when serious flooding from summer storms was linked to deforestation. Reduced harvesting in existing natural stands, combined with an immature domestic plantation resource, ensures that China will remain a net importer of forest products. Over the longer term, plantation and non-plantation wood from international suppliers ultimately must compete with plantations in China as they mature.

Although rising consumption and limited Chinese domestic timber production heralds greater demand for imports, emphasis has changed from unprocessed to processed wood products. Softwood logs used in domestic processing were the leading wood product import until they peaked in 1988. Since then, China's wood product import mix has changed; inadequate investment in domestic mill capacity and infrastructure limit the ability of Chinese producers to meet expanded need for processed wood products to serve China's growing economy. Softwood log imports have drastically declined; Chinese importers have switched focus from raw logs to primary and secondary processed products. Although the total value of Chinese forest product imports from the world more than doubled between 1995 and 2000, imports of unprocessed forest products remained constant at about $1 billion. The remaining increases in import value evident in figure 33 reflect increases in imports of lumber, panel products, and secondary manufactured products.

The net export value of solid wood products between the United States and China is presented in figure 34. Net exports, defined as value of exports minus value of imports, is a measure of trade balance between two countries. For softwood logs, softwood lumber, and panel products, the U.S. has maintained a trade surplus with China, meaning that U.S. exports of these products to China are greater than imports from China. While softwood logs dominated this trade between 1995 and 1998, the increasing softwood lumber trade surplus with China beginning in 2001 is noteworthy. Net export value of panel products, consisting of softwood plywood, particleboard, fiberboard, and hardboard, remains relatively flat.

On the other hand, the U.S. has a striking trade deficit in secondary processed products with China; U.S. exports of these materials to China are dwarfed by U.S. imports from China. Between 1998 and 2003, this trade deficit skyrocketed from 6.6 million to 67.5 million nominal U.S. dollars (U.S. Department of Commerce 1989-2003a and 1989-2003b). Although the U.S. has made strides in accessing Chinese markets for softwood lumber, these achievements are overshadowed by gains that secondary processed products from China have made into U.S. markets. Thus, although China's imports of primary and secondary wood products from the world has increased, these trade statistics highlight the profound impact that China has made in U.S. markets in only 5 years.

Pacific Northwest Trade Outlook and Implications for Market Participants

Reduction in federal harvests and environmental regulation on state and private forest lands decreased the volume of PNW logs available to the export market raised costs of forest management throughout the region. Changes in Japan indicate that Asian economic recovery is unlikely to resurrect Japanese demand for PNW logs. Globalization of wood markets has introduced a myriad of international producers in direct competition with PNW producers in both emerging and traditional markets.

Although the intent of this publication is to chronicle the rise and fall of the PNW softwood log export market, rather than to forecast trends in the PNW wood products industry, factors contributing to the loss of log export markets have enduring implications for U.S. trade and PNW market participants. These implications, while somewhat speculative, are worth noting to emphasize the current climate of uncertainty surrounding PNW forest management.

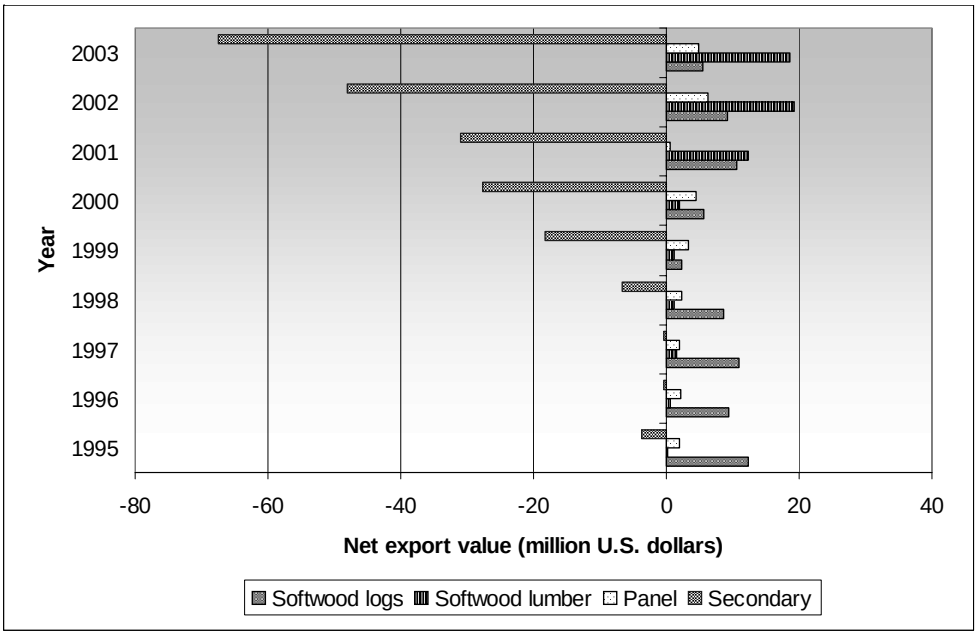

Figure 34—Value of solid wood product trade balance between China and the United States.

Trade Outlook

The United States is no longer a low-cost supplier of logs to the world; globalization of wood markets has resulted in low-cost competition from other supply regions. Focus of timber supply is shifting from traditional suppliers from the temperate region (United States, Canada, and Scandinavia) to Southern Hemisphere plantations. Secondary processed wood products trade is growing faster than trade in primary products as major producers seek to maximize value-added processing and minimize exports of primary products. Trade policies prohibiting green lumber imports are increasing as trading nations attempt to prevent the introduction of destructive foreign insects and diseases.

Poor economic conditions in much of the world, currency exchange rates, and the expiration of the Canadian Softwood Lumber Agreement made the U.S. a major target market for worldwide softwood lumber producers by the mid-nineties. By 2003, 91 percent of total U.S. softwood lumber imports originated in Canada. Increased lumber imports from other countries, particularly from Canada, have driven down domestic lumber prices. Consequent low lumber prices triggered a decline in production and investment in capacity throughout the United States.

The U.S. consumption of wood products is projected to increase. Despite projections that price growth will improve the profitability of wood products and

provide the impetus to expand U.S. domestic capacity over the next five decades, U.S. producers will remain unable to meet domestic demand for softwood lumber consumption (Haynes 2003a). This shortfall is expected to continue to be met by Canadian producers in the near term. However, imports from non-Canadian sources are projected to account for the bulk of import growth after 2010.

The outlook for wood products trade in the United States is thus influenced by a variety of factors including (Eastin et al. 2002, Haynes 2003a):

- Increased U.S. domestic consumption of forest products.
- Increased constraints on wood supply to meet environmental objectives.
- Increased softwood lumber imports to make up for the shortfall in domestic supply.
- Increased price competition from softwood suppliers in Canada, Scandinavia, New Zealand, and Chile in export markets traditionally served by the United States.
- Expanded production and use of EWPs.
- Value of the U.S. dollar relative to trading partners' currencies.
- Weakened demand from traditional U.S. export markets in Japan.
- Continued economy stagnation and demographic changes in Japan.
- Depressed domestic production of lumber and other processed wood products in Japan in favor of imports.
- Unprecedented economic expansion in China.
- Weak domestic demand in Europe.
- Increased globalization as companies seek timber resources abroad and merge to compete internationally.
- Use of trade policies to reduce the flow of softwood lumber imports from Canada.
- Declining Canadian exports to Japan and Europe.
- Increased restriction on imports of green softwood lumber worldwide due to forest health concerns.
- Increased investment in kiln drying capacity to compete in traditional markets.
- Increased willingness to accommodate products to customer specifications, e.g., kiln-drying, use of metric measurements, and product packaging.

Of course, all this should be evaluated in a global context—there are many suppliers vying to service emerging global economies. Economic growth and reforms may open new markets for U.S. wood products, but only if the United States can develop a cost advantage over competing suppliers.

PNW Industry Participants

Private timber owners have been negatively affected by the collapse of the log export market. Timber management strategies that emphasize producing large high-quality logs will no longer capture a price premium at the time of harvest. Timber owners currently holding these high-quality stands of mature timber are faced with disappointing prices in domestic markets where quality is not valued. However, price premiums do exist if a landowner is willing to commit to providing materials for niche markets (Eastin et al. 2003). These market changes are considered permanent; there are no indications that forestry in the PNW will ever return to conditions before the northern spotted owl controversy. Other implications for private timber owners include:

- Loss of log export markets and log export premiums.
- Reduced stumpage prices.
- Disincentive for intensive forest management, such as thinning operations.
- Reduced forest land prices.
- Shorter rotations.
- Pressure to reduce costs to compete in commodity markets.
- Conversion to alternative land uses as forest management becomes less profitable.
- Plantation sources dominating supply.

Mill owners must compete in a commodity product market; individual firms have little market power and little influence on market prices. With the decline in domestic lumber prices, mill owners must concentrate on boosting production and reducing costs to remain competitive with other supply regions. Potential exists for increased efficiency of existing domestic processing capacity to reduce imports and increase exports of secondary processed materials. Firms wanting to remain competitive in the long term must make investments in capacity to expand the domestic industry and fend off lower priced imports, but depressed prices create uncertainty as to whether the cash returns necessary to make capital investments will materialize. Other considerations for mill owners are:

- Strong domestic markets led by continued growth in repair and remodel and nonresidential construction.
- U.S. production absorbed by domestic markets.
- Investment in capacity near major transportation networks.
- Potential profits from investment in kiln drying capacity.

- Expanded markets for EWPs.
- Continued industrial consolidation in the U.S. forest products processing sector.
- Increased demand for secondary processed products at the expense of primary processed products.
- Emphasis on providing custom sizes to meet the needs of customers.
- More emphasis on price in commodity markets.
- Increasing percentage of total U.S. lumber production from the U.S. South.
- Persistent competition from Canada and other global supply sources.

Consumers may benefit because lower prices for log inputs for domestic lumber production may translate to lower product prices. However, logs are but one input in the lumber production process. Prices of other inputs, such as energy and labor, may have a confounding effect on lumber output price. Thus, effects on consumers are uncertain, as changes in housing and wood product prices resulting from reduced stumpage and log prices may be negligible.

Communities in timber-dependent areas also face an uncertain future. Undeniably, forest products sector employment in the Pacific Northwest has declined. However, with more logs remaining in-country for processing, employment in wood product manufacturing could increase after industry structural adjustments are complete. On the other hand, pressure from globalization and increasing transportation costs may direct capacity expansion away from remote, rural locations with forest-dependent communities. Policies to encourage tourism, recreation, and attract retirees, as well as efforts to diversify employment opportunities are likely to benefit such areas in the long run (Daniels 2004).

Metric Equivalents

When you know:	Multiply by:	To get:
Kilometers	.6215	Miles
Meters	3.28	Feet
Hectares	2.47	Acres
Cubic meters	35.3	Cubic feet

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