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*Markets and Market Forces for Lumber**

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Lumber, also called sawnwood, is an important historical antecedent of the wood products industry. The Hierapolis sawmill, a Roman waterpowered stone sawmill at Hierapolis, Asia Minor (modern-day Turkey), dating to the second half of the third century AD, is the earliest known sawmill. It is also the earliest known machine to incorporate a crank and connecting rod mechanism. Waterpowered stone sawmills working with cranks and connecting rods, but without gear train, are archaeologically attested for the sixth century AD at the Eastern Roman cities Gerasa and Ephesus (Ritti et al. 2007).

The earliest literary reference to a working sawmill comes from a Roman poet, Ausonius, who wrote an epic poem about the river Moselle in Germany in the late fourth century AD. At one point in the poem, he describes the shrieking sound of a watermill cutting marble. Marble sawmills also seem to be indicated by the Christian saint Gregory of Nyssa from Anatolia around 370/390 AD, demonstrating a diversified use of waterpower in many parts of the Roman Empire (Wilson 2002). Sawmills became widespread in medieval Europe again, as one was sketched by Villard de Honnecourt in c. 1250 (Singer et al. 1956). They are claimed to have been introduced to Madeira following its discovery in c. 1420 and spread widely in Europe in the sixteenth century (Petersen 1973). By the eleventh century, hydro-powered sawmills were in widespread use in the medieval Islamic world, from Islamic Spain and North Africa in the west to Central Asia in the east (Lucas 2005).

The continued history of sawmilling includes dramatic new applications of technology to increase efficiencies and improve lumber product quality. These events accelerated with the advent of the industrial revolution that included the conversion from circular saws to band saws, the use of the steam engine to power sawmills, and the shift to gasoline and electricity. Today, technology and business practices and globalization have created a truly international marketplace for lumber.

Although lumber is ubiquitous on the international stage, not all lumber is similar or interchangeable in properties, applications, and in the production of potential downstream value-added or secondary wood products. As such, this chapter is divided into the three broadest generally recognized categories of lumber. Section 3.1 focuses on softwood lumber that is mainly used for building construction but also a multitude of other uses. Section 3.2 focuses on temperate hardwood lumber used in products ranging from industrial pallets to the finest custom furniture. Section 3.3 focuses on tropical hardwood lumber. Tropical lumber and other wood products have evolved on a different timeline than softwood or temperate hardwood products. Many tropical wood species are among the most valuable in the world while at the same time are often facing extinction with international efforts to protect them. The three parts of this chapter generally follow a uniform organization with an introduction, a discussion of global production and consumption, an analysis of international trade, and perspectives on influences on the sector and future markets.

3.1 Softwood Lumber Products and Markets

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3.1.1 Introduction

Softwood (coniferous) lumber, also known as sawn softwood, has been an internationally traded commodity for centuries, with production and trade in softwood lumber intensifying in the twenty-first century. Softwood lumber has been used mainly for building

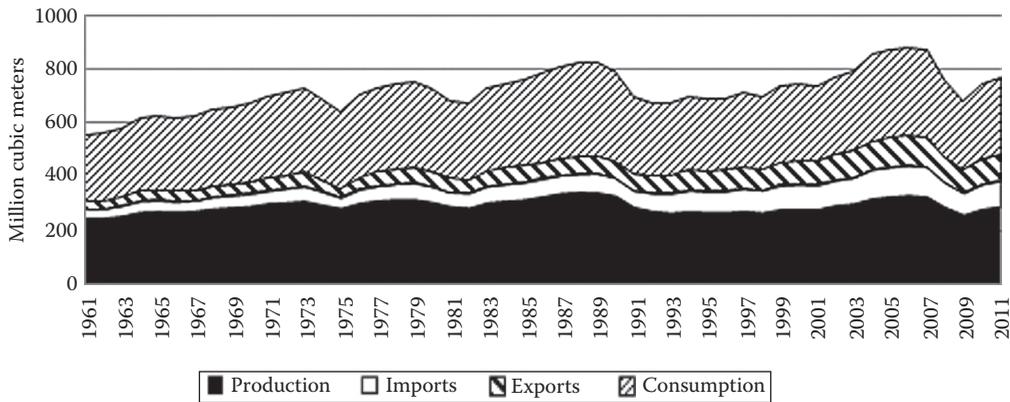


FIGURE 3.1
Softwood lumber consumption, production, and trade evolution.

construction, although it also has a multitude of other valuable uses. New uses continue to be developed that extend its product life cycle beyond that of a simple commodity. Softwood lumber production, consumption, and trade typically follow global economic cycles and, because softwood lumber is most used for home construction, are often strongly impacted by such cycles. In addition to general economic cycles, major global changes such as the fall of the Soviet Union in 1990 and the global economic recession in 2008–2009 have drastically affected the global production, consumption, and trade of softwood lumber (Figure 3.1).

Softwood lumber is the term used in North America, whereas in Europe it is referred to as sawnwood and sawn timber. Regardless of the terminology, lumber is sawn from logs or produced when cants (squared logs or parts of logs) are resawn into planks. Europeans distinguish sawnwood so that it includes cants, beams, and railroad ties (called sleepers in Europe). In this chapter, the term lumber is used to include all squared, sawn timber especially because there is no distinction in the international trade statistics between boards and thicker cants.

3.1.1.1 Where Are the Softwoods?

The geographical range of softwood forests is large and has been extended by the expansion of plantations of fast-growing species (Figure 3.2). The northern boreal forests have many species of softwoods, and often due to less favorable climatic conditions, their slow growth produces high-quality timber. This is due to narrow growth rings that produce dense, strong, and stable timber. This occurs, for example, in Russia, the country with the largest softwood resource. Softwoods extend southward to the tips of Africa and South America and are prevalent in Oceania. The Food and Agriculture Organization (FAO) of the United Nations (UN) shows softwood lumber production in over 100 countries, which is roughly half of the world’s countries. Table 3.1 indicates the global softwood growing stock by region.

Softwood genetic research has taken place for centuries in search of creating fast-growing, straight trees to produce high-quality lumber. Plantations in Europe contain many softwood species from North America, for example, Douglas fir (*Pseudotsuga menziesii*), Sitka spruce (*Picea sitchensis*), loblolly pine (*Pinus taeda*), and lodgepole pine (*Pinus contorta*). Another American species, radiata pine (*Pinus radiata*) dominates the softwood plantations in Australia, Chile, New Zealand, and South Africa. Radiata pine has undergone considerable genetic improvements from its origins in California, and growing conditions in the southern

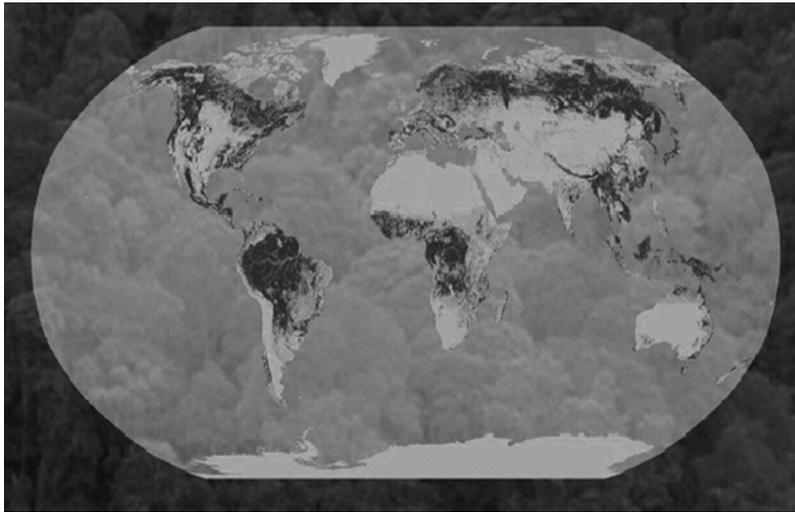


FIGURE 3.2
Global forest resources.

TABLE 3.1

Global Softwood Growing Stock by Region, 2010 (million m³)

CIS ^a	63,754
North America	59,618
Europe	13,672
Asia	11,143
Caribbean and Central America	1,224
South America	1,184
Oceania	968
Africa	217
World	152,000

Sources: Food and Agriculture Organization of the United Nations (FAO), Available at: www.fao.org/forestry/fra/fra2010; Food and Agriculture Organization of the United Nations (FAO), *Southeast Asian Forests and Forestry to 2020*, Subregional report of the second Asia-Pacific Forestry Sector Outlook Study, RAP Publication 2010/20, FAO, Bangkok, Thailand, 199pp, 2011.

Note: Growing stock is the volume of standing timber. In the CIS, the Russian Federation has 61,570 million m³ of softwoods. North America includes Canada and the United States.

^a CIS includes Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.

hemisphere have been more suitable for the species than in the north. Scotch (or Scots) pine (*Pinus sylvestris*) is widely planted in Europe and provides the bulk of pine lumber.

Despite vast areas of softwood forests being converted to other uses, compensation owing to plantations has resulted in total softwood forest area expanding. Where softwood forests have flourished, a culture of using softwood lumber has developed. While softwoods were originally hewn into beams and sawn into lumber where they grew,

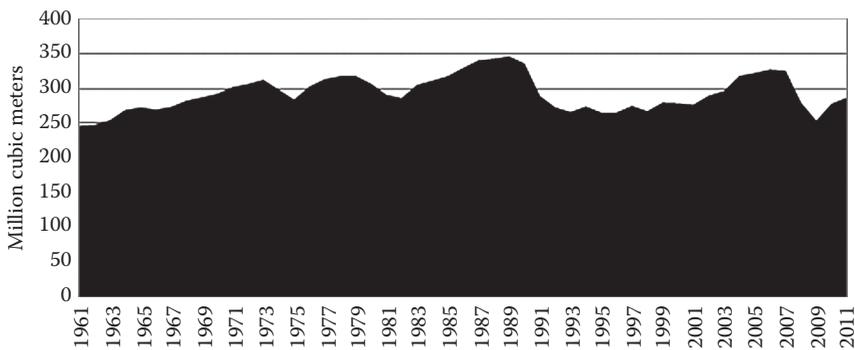


FIGURE 3.3
Global softwood lumber consumption, 1961–2011.

demand for softwoods has also developed in other areas of the world. Softwood timber, both round and sawn, was used originally to build housing and other structures in North America, the Nordic Countries, and Russia. Softwoods have always been used for a multitude of other uses, both interior and exterior. With proper design, protection, and treatments, softwood lumber has been developed to withstand potentially damaging effects of weather (precipitation and sun), insects, and disease (bacteria and fungi).

3.1.1.2 Softwood Lumber Consumption

Softwood lumber consumption is the direct indicator of demand for softwood lumber, and it can be derived from production and trade volumes and values (apparent consumption*). For the remainder of this section, consumption has been calculated as apparent consumption.

Globally, softwood lumber consumption has increased only slightly during the past 50 years, by 16.5% (Figure 3.3), although world population and gross domestic product (GDP) have increased at much greater rates. This disparity can be attributed to global consumption growth having suffered significant periodic setbacks during the oil crises of the mid-1970s, mid-1980s, the fall of the Soviet Union in the early 1990s, and more recently during the economic and financial crisis in the mid- to late 2000s. In 2012, global consumption was again increasing but, at 287 million m³, is far from the historical high of 346 million m³ in 1989.

Most consumption of softwood lumber occurs in regions with wood building culture, for example, in the United States (Figure 3.4 and Table 3.2). Second to the United States in consumption, China uses softwood lumber in construction but usually in conjunction with concrete forming. Substantial volumes in China are consumed for packaging, as China exports significant quantities of goods on pallets and in crates.

3.1.2 Softwood Lumber Uses

Softwoods have been utilized historically in a multitude of uses, including structural and nonstructural components of building, shipbuilding, furniture, energy, pulp, and particle-board manufacturing. This section describes lumber usage in two broad categories, structural and nonstructural.

* Apparent consumption (derived from production plus imports minus exports) excludes inventory as stocks either in the producing sawmill or with the customer and the volume of sawnwood in transportation.

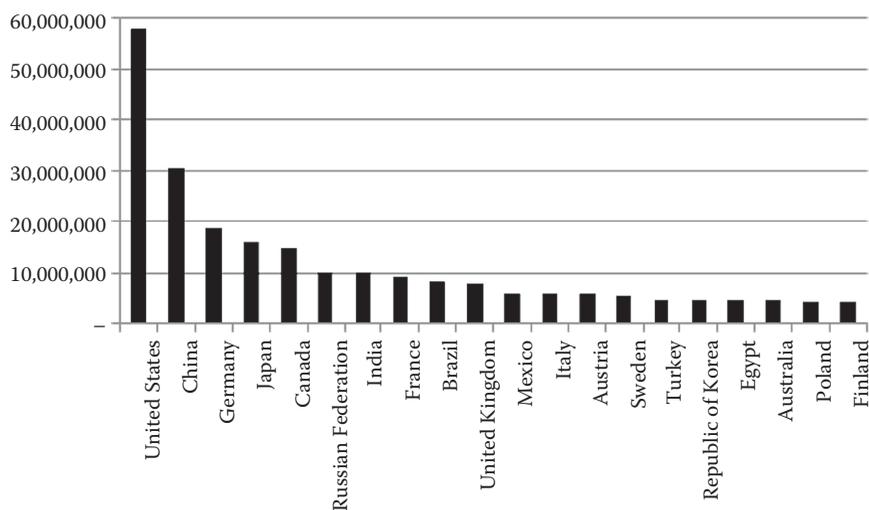


FIGURE 3.4
Top 20 softwood lumber-consuming countries (in m³), 2011.

TABLE 3.2

Top 20 Softwood Lumber-Consuming Countries (m³), 2011

United States	58,058,236
China	30,458,594
Germany	18,805,566
Japan	15,794,751
Canada	14,968,707
Russian Federation	10,223,750
India	10,019,231
France	9,175,142
Brazil	8,229,206
United Kingdom	7,609,345
Mexico	5,650,765
Italy	5,629,000
Austria	5,605,727
Sweden	5,380,589
Turkey	4,741,000
Republic of Korea	4,636,330
Egypt	4,484,553
Australia	4,467,000
Poland	4,358,402
Finland	4,058,384

Sources: FAO, 2013a; Food and Agriculture Organization of the United Nations (FAO), FAOSTAT, 2013a, <http://faostat.fao.org/site/626/DesktopDefault.aspx?PageID=626#ancor>, accessed March 11, 2013.

3.1.3 Structural Uses

The greatest demand for softwood-based housing is in North America. When the first settlers arrived, they found the continent covered with virgin forests, of which softwood species often predominated. The earliest buildings were constructed from softwood logs, and today there is a continued demand for log homes and buildings. Log construction, whether sawn square or left round, has a natural insulating value and also an appearance preferred by many homeowners. As sawing became mechanized with waterpowered mills, softwood lumber became the standard building material. Eventually, 2 × 4 (2 in. thick by 4 in. wide) construction became the norm, and it still is today, although the techniques have evolved considerably to make buildings more energy efficient and comfortable.

In Asia, for example, in Japan, a different construction method for softwood lumber evolved, that is, post and beam. Rather than the lighter framing of 2 × 4 techniques, the post and beam method uses heavier cross sections to construct the exterior and interior walls and roofs. In Japan, 56% of the homes built in 2011 were wood-based construction. The share of wooden homes has been growing during the past decade, in part due to the strong wood culture. North American sawmillers have successfully introduced the 2 × 4 construction technique to Japan, and it accounted for approximately one-fifth of all wooden houses in 2011. Wooden housing got a boost in 2011 in Japan during the reconstruction from the tsunami and earthquakes. Wooden structures withstood the earthquake and its aftershocks better than many concrete buildings. Japan's traditional post and beam construction has also witnessed innovations, with engineered wood products, such as glulam beams and laminated veneer lumber (LVL) substituting for traditional custom-made components.

Consumption of softwood lumber for building is receiving strong promotion with the implementation of green building policies. Governments, corporations, organizations, and trade associations have recognized the environmental, as well as economic, value in using wood in construction. As a renewable resource with good insulating values, wood is increasing its market share in construction of residential, commercial, and industrial buildings. European governments at national and local levels have established green building policies that in turn have boosted softwood lumber consumption. National and regional trade associations have seized the opportunity to promote wooden buildings, and the share of wooden structures is increasing. The market share for wood is increasing in many European countries, but it lags relative to masonry and concrete home and building construction. Restrictive fire codes and expensive insurance are additional obstacles for developing the wooden housing industry in Europe. As these restrictions diminish, which has been taking place in recent years, markets for softwood lumber will expand. Further market development will be promoted by trade associations, designers, and architects.

Research and development (R&D) has produced significant improvements in buildings in terms of strength, cost, and energy efficiency. Softwood lumber in different dimensions from the standard 2 × 4 enabled walls and roofs to have greater insulation capacity, for example, by framing walls in 2 × 6s. Engineered wood products can improve strength while using less wood, for example, wooden I-beams that can use lumber or LVL for their flanges. Glulam beams are built from softwood lumber and have successfully competed against concrete and steel with regard to strength properties and from an environmental perspective on a life cycle basis.

Softwood lumber is a globally traded product. But a most interesting development in the past decade has been the increasing trade of prefabricated softwood-based buildings. Entire houses can be constructed in factories from lumber and softwood-based engineered wood products, such as glulam and LVL. The walls and other structures are sized

to be shipped by container across land and sea and to be erected relatively quickly. The importance of this development is that affordable, energy-efficient buildings are being constructed in countries far from the softwood resources and in some countries where few buildings have been constructed from wood. Another advantage is that costly onsite construction waste is reduced considerably.

3.1.4 Nonstructural Uses

Softwood lumber is used extensively for packaging applications. In Europe, standard pallets are usually constructed from softwoods. In the United States, one-way (one-use) pallets and skids, as well as other crating, are often made from softwood. In contrast to Europe, most US multiple-use pallets are made from hardwoods.

Softwood lumber is also used for millwork, for example, window and door manufacturing. For windows, boards with straight grain and no knots are resawn into rails and sills, impregnated with antifungal preservatives, assembled into window frames, and often factory-painted. The technology for designing energy-efficient, wooden windows has improved dramatically, making wooden windows highly competitive with plastic and metal alternatives.

In another unique application of softwood lumber, the USDA Forest Service Forest Products Laboratory has developed wooden bridge technology and demonstrated its cost advantages, especially for shorter spans. One of the most popular uses of wooden bridges is in municipal settings for pedestrian crossings. While wooden road bridges may not appear as wood construction when an asphalt surface is applied, pedestrian bridges are often aesthetically pleasing structures.

Softwood lumber is also used for furniture manufacturing using both clear and knotty lumber. Tight knots, called red knots in the trade, provide attractive character marking. Softwood furniture can be finished with clear coats, or attractively stained or painted, with most softwoods having excellent staining and finishing characteristics. Most softwoods are easy to work, mill without grain problems, and produce products that given the proper care become heirlooms. In Nordic Countries where pine, spruce, and fir are plentiful, furniture is designed to exhibit the beauty of softwood. Some plantation-grown softwoods, which are becoming more prevalent, have stability, resin pockets, and other wood quality problems that are reducing recoveries of higher grades of sawnwood; these affect consumer perceptions of the quality of softwoods in some applications, particularly those that require a stable product.

3.1.5 Softwood Lumber Consumption

The development of demand for softwood lumber shows periods of growth, followed by sharp drops due to global economic downturns. Consumption was highest in 1989, just before a downward spiral due to the collapse of the Soviet Union. The decline is real, but the extent is not precise, due to a simultaneous collapse in statistical record keeping and reporting.*

* Following the fall of the USSR, the statistics on softwood lumber production by the Russian statistical agency, Rostat, were inaccurately reported. Rostat collected only production records from the largest sawmills, which were the ones exporting most of the lumber. This meant that considerable volumes produced from small- and medium-sized mills, which were the most numerous, were not collected and reported. This problem came to light in the rebound of demand in the CIS, and especially Russia, when rising exports did not keep pace with increases in production—the result was declining apparent consumption, something inconsistent with rising construction-related demand. Hence, prudence is required in looking at the figures for the USSR and the CIS.

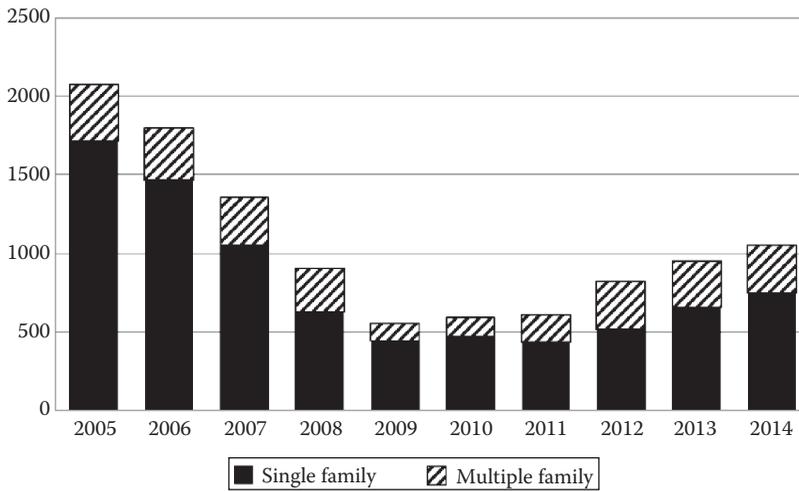


FIGURE 3.5
US housing starts (thousand units), 2005–2014.

Despite statistical concerns for data from the Commonwealth of Independent States (CIS), the global trend is cyclical, indicated by long periods of growth, followed by sharp declines. Consumption has only risen 16.5% in 50 years since 1961. Softwood lumber consumption in 2012 is rebounding from the global economic and financial crisis of 2008–2009. Before the crisis, consumption had risen to 327 million m³ in 2006 but declined in response to the rapid decline in global housing demand, particularly in the United States (Figure 3.5). When the market collapsed, home values fell dramatically, foreclosures ensued, and the demand for housing, and lumber, collapsed. What had been a 16-year growth in softwood lumber consumption came to a halt.

Not only were Canadian and US lumber manufacturers tied to the US housing market but also offshore exporters. European, Asian, South American, and Oceanian suppliers were exporting significant quantities of lumber, and other wood products, to the United States. The downturn in demand not only resulted in sawmill closures and rationalization of capacity in the United States but also for its importers. Full recovery of global market demand for sawnwood is dependent on a recovery of the US housing market.

In contrast to the important rises in US housing starts, housing starts in Europe are not forecast to increase significantly in the coming years (Figure 3.6). The weak growth forecast led to sawmillers forecasting lower consumption levels, by 5.6% in 2012 and almost no growth in 2013 (International Softwood Conference 2012). This weak market situation has led sawmillers and traders to seek to strengthen positions in other markets, for example, Japan and the Middle East. Europeans are also regaining market share in the US market that was lost with the downturn in US housing and the weaker US dollar (meaning euro-based sawnwood was too expensive).

In 2011, the world consumed nearly 300 million m³ of softwood lumber. This was the same volume as in 1971, 1983, and 2003 (with global statistics initiated in 1961). The peaks in softwood lumber were in 1973 (312 million m³), 1978 (317 million m³), 1989 (346 million m³), and 2007 (325 million m³). Globally, demand has not grown at the same rate as population and GDP, two factors with which lumber consumption is correlated. This can be

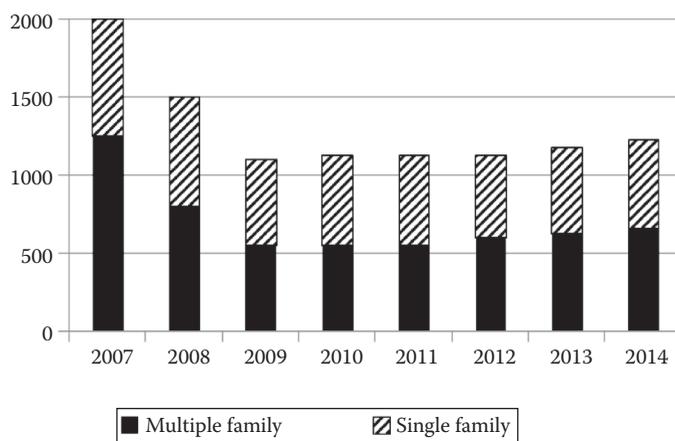


FIGURE 3.6
European housing starts (thousand units), 2007–2014.

attributed in part to substitution by other wood products such as composite panel products and engineered wood products and in part to substitution by non-wood products that compete for market share, such as plastic, steel, aluminum, and concrete.

Softwood lumber consumption is cyclical and despite regular downturns each decade has increased by 16.5% over the last 50 years. New market drivers for wood—such as green building, public procurement policies, and certification of sustainable forest management (SFM)—are expected to boost softwood lumber consumption. Other policies, for example, the European Union (EU) Timber Regulation, could create additional new demand. Chemical and heat treatments, which are expanding softwood end uses, as well as improved building systems, could boost consumption back to its historical high and drive growth in the future.

3.1.6 Softwood Lumber Production

As softwoods grow in temperate climates, in the past most softwood lumber was produced where it grew. Although it still is produced in mainly temperate regions, Asia has become the third largest softwood lumber-producing region, in part using imported logs from Russia, North America, and Oceania (Figure 3.7). China is the world's largest importer of softwood logs. The FAO of the UN indicates that softwood lumber is produced in over 100 countries. The 20 largest producers are shown in Figure 3.8 and Table 3.3.

Depending on conversion factors used, China may be the largest producer of softwood lumber (Wood Markets 2012). However, the phenomenal growth of China's consumption of all wood products has slowed in 2012 as housing started and related wood consumption slowed. Most Chinese housing is multifamily and concrete-based, but wood is used in concrete forming and in millwork and joinery. Chinese softwood lumber consumption nearly doubled from 2009 to 2011, increasing from 24.4 to 39.7 million m³ (Wood Markets 2012).

It must be noted that the volumes produced in 2011 are in some cases far from the peak volumes produced. For example, the United States produced over 69 million m³ in 2005, at the height of its housing boom. Russia, combined with the other countries of the former USSR, produced over 103 million m³ in 1972. Long-term series are sometimes difficult to

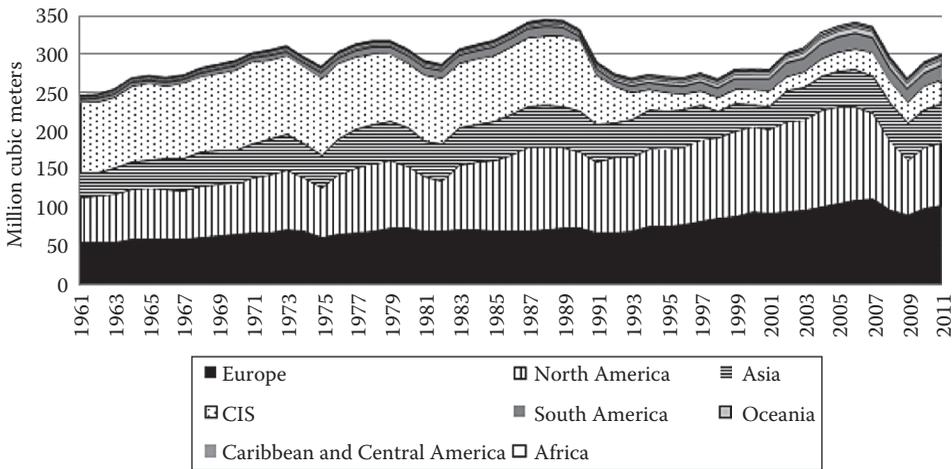


FIGURE 3.7
Softwood lumber production by region, 1961–2011.

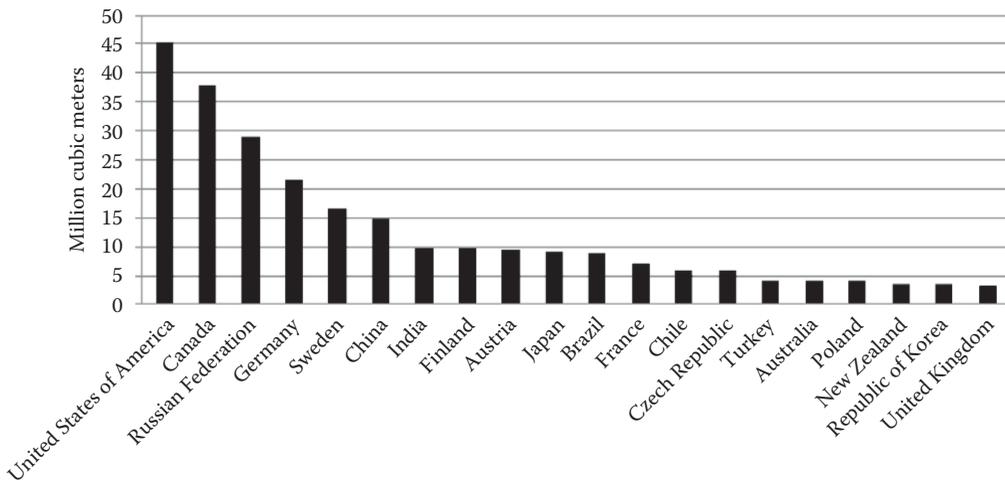


FIGURE 3.8
Top 20 softwood lumber producers (in m³), 2011.

accurately analyze due to changes of country groupings such as the formation of the CIS. Specifically, the current 11-country CIS (which replaced the 15-country USSR) does not contain the 3 Baltic countries, which are important softwood producers. Nevertheless, the global trends are evident in [Figure 3.9](#).

The long-term production trend shows rising growth through the late 1980s, when the USSR collapsed. Although production had dropped in response to reduced demand from the oil crisis–induced economic shocks in the mid-1970s and mid-1980s, there was no precedence for the catastrophic fall in the early 1990s. Economic activity ground to a halt in Russia, the main lumber producer in the former USSR, and sawmills closed. When the economies of the new CIS started to improve in the mid-1990s, the systems for collecting and disseminating statistics were also reestablished. However, to date, Russian official

TABLE 3.3
Top 20 Softwood Lumber Producers, 2011

Country	Volume in m ³
United States	45,410,400
Canada	37,991,503
Russian Federation	29,055,000
Germany	21,593,373
Sweden	16,700,000
China	14,920,000
India	9,900,000
Finland	9,700,000
Austria	9,485,000
Japan	9,277,000
Brazil	8,970,000
France	6,965,000
Chile	6,050,000
Czech Republic	5,783,665
Turkey	4,192,000
Australia	4,167,000
Poland	4,150,000
New Zealand	3,658,000
Republic of Korea	3,654,000
United Kingdom	3,227,334

Sources: FAO, 2013a; Food and Agriculture Organization of the United Nations (FAO), FAOSTAT, 2013a, <http://faostat.fao.org/site/626/DesktopDefault.aspx?PageID=626#ancor>, accessed March 11, 2013.

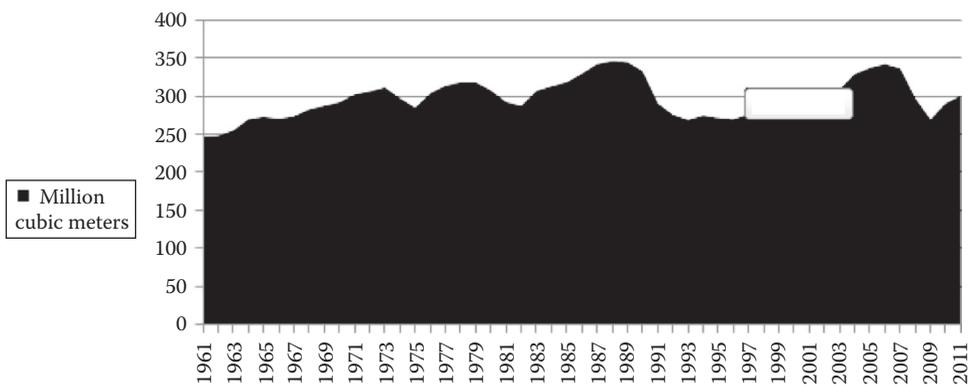


FIGURE 3.9
Long-term production volumes of softwood lumber, 1961–2011.

statistics underestimate lumber production because Rostat only records production from the large, export-oriented sawmills. Therefore, in the statistics in recent years, FAO has adjusted Russia's production upward to better account for the small- and medium-sized sawmills.

In 2012, global softwood lumber production has not regained the 1988 peak of 345 million m³. In 2011, the most recent annual figure available, global production was 300 million m³, 15% lower than the level of 1988. Since 1961, global production has grown 22%. However, the economic and financial crisis of the mid-2000s brought global production down to the low level of the early 1960s, which was also the production level in the mid-1990s.

Sawing logs into lumber has greatly improved in efficiency as sawmillers attempt to improve yields and production rates and hence profits. Circular saws have long been the favorite for log breakdown, and by reducing the kerf of saw teeth, more lumber is produced and less sawdust. Band saws typically have narrower kerfs, but the compromise is a slower throughput. In Europe, sash gang saws, which have kerfs equivalent to band saws, are common; however, production rates are less. In the past decades, chip-and-saw systems have improved production rates, especially where sawdust and chip demand enables sawmillers to achieve up to 40% of their revenue from residues. In a chip-and-saw system, logs are debarked, sorted by diameter, scanned for size and shape (and to avoid any metal), and then profiled into a rectangular cant that is sawn into boards. Chip-and-saw sawmills are sometimes owned by pulp producers, since the clean (debarked) chips are needed for pulp production and the sawdust can be used for energy production to heat the kilns and to generate electricity. After sawing, boards must be trimmed to standard lengths to remove unacceptable amounts of wane. Normally, edging is not necessary in softwood lumber since the widths produced at the headrig correspond to required dimensions. Visual and/or machine grading occurs after the next steps when lumber is further processed.

After sawing into lumber, mills can add value to the commodity product by drying in air or kilns, planing, and molding. Drying is critical for most applications as the lumber becomes stronger and more dimensionally stable. Planers give a smoother surface to the lumber and molding can ease the corners or give profiles for different applications. Planer and molding shavings are dry and valuable as a raw material for particleboard, fuel pellets, animal bedding, etc.

Many, but not all, softwoods are not naturally durable. However, species such as Cyprus cedar have good natural durability. For other species, treatment by chemical or heat can improve their durability and useful life in service. Chemical treatments have been changing to reduce their toxicity. Since the 1940s, copper–chrome–arsenate (CCA) was a favored pressure treating method which improved lumbers resistance to attack by insects and microbial agents (fungi and bacteria). The US Environmental Protection Agency banned CCA for most uses in residential settings, and further restrictions are to be imposed in 2013 (EPA 2012). Alternatives exist including alkaline copper quaternary (ACQ, a water-based preservative), borates, copper azole, cyproconazole, and propiconazole. Creosote is used for commercial, not residential, purposes such as railroad ties.

Pentachlorophenol (PCP or penta) was similarly banned by the EPA for residential uses due to its toxicity but is allowed for commercial uses such as walkways, docks, fences, and exterior glulam. Proper disposal of treated wood is critical as the preservatives can leach into the soil and water if buried or be volatilized into the air if burned in an uncontrolled environment.

Heat treatments avoid the problem of chemical toxicity. New regulations for wooden packaging and pallets for international trade are the driver for most heat treating to reduce

the possibility of transmission of insects and diseases. For packaging the heat treating temperatures are required to reach 56°C for a period of 30 min (IPPC 2012).

Higher temperature heat treatment, up to 230°C depending on the species, and for a 24–96 hour period, can render lumber more durable to attack by biological agents. It also changes the properties of wood by increasing its hardness. However, a drawback is that the modulus of rupture is diminished (Esteves and Pereira 2009). High-heat-treated lumber is resistant to water and can be used for outdoor residential requirements such as decking and siding. It also darkens the color of the wood, which enables it to have the appearance of some hardwoods, including some tropical species.

3.1.7 Softwood Lumber Trade

Trade of softwood lumber developed originally between regions where softwood resources were plentiful and those countries that had little or no softwood resources. However, over the past centuries, plantations of softwood species have enabled many countries to source their softwood needs domestically. Limited availability of resource has resulted in a major shift in the United States from being a net exporter of softwood lumber to becoming a net importer. Another remarkable development in the softwood trade is China's rise to become the world's largest softwood lumber importer, as well as producer, in a relatively short time period. While the previous sections showed slow developments in softwood lumber consumption and production, its trade has been dynamic, both positive and negative, in the past decade.

Global softwood lumber exports followed demand as shown in the consumption section mentioned earlier, with dips in the mid-1970s and mid-1980s due to economic weakness brought on by oil crises (Figure 3.10). Since the breakup of the USSR in the early 1990s, exports accelerated until the recent US housing collapse in the mid-2000s. Exports peaked in 2006 at 115.2 million m³, in large part driven by US and Chinese imports for housing and nonresidential construction. The latest global export volume, 98.2 million m³ in 2011, is tripling since 1961s 33.0 million m³. Export growth has outstripped production and consumption growth at 22.0% and 16.5%, respectively.

Canada is by far the largest exporter of softwood lumber, mainly to the United States (Figure 3.11 and Table 3.4). During the housing slump in the United States, Canada also

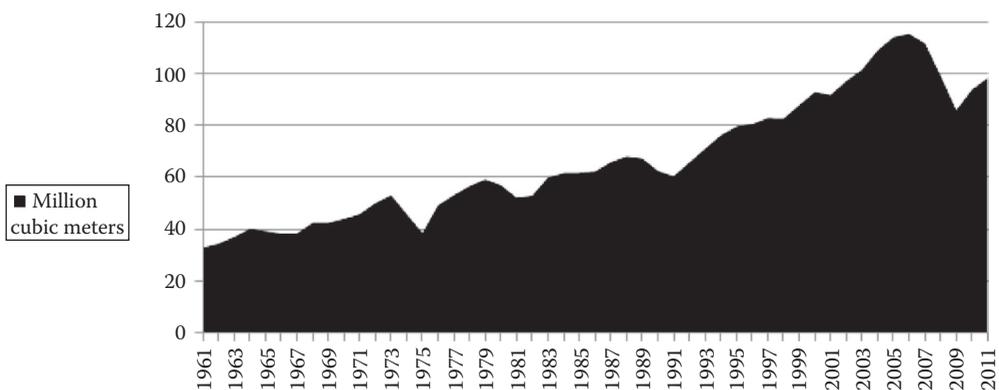


FIGURE 3.10
Global softwood lumber exports, 1961–2011.

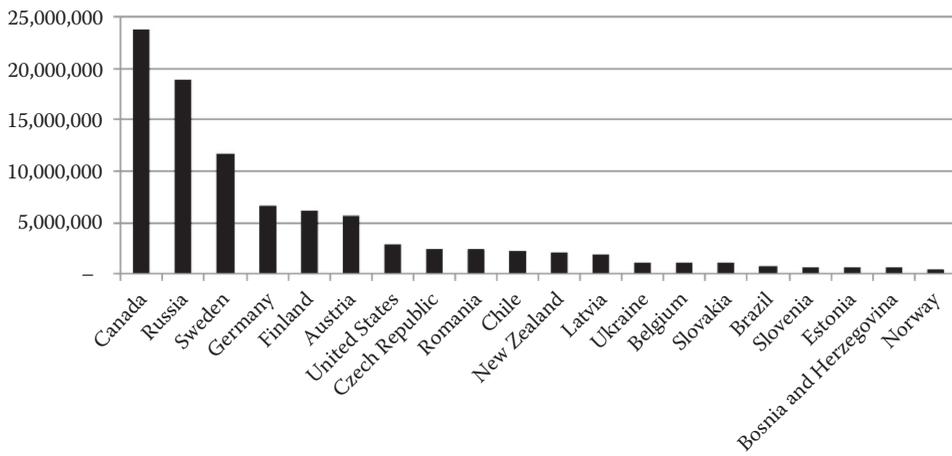


FIGURE 3.11
Top 20 softwood lumber exporters (in m³), 2011.

TABLE 3.4
Top 20 Softwood Lumber Exporters (m³), 2011

Canada	23,798,712
Russia	18,846,000
Sweden	11,656,400
Germany	6,712,198
Finland	6,102,293
Austria	5,591,703
United States	2,955,814
Czech Republic	2,401,809
Romania	2,324,297
Chile	2,289,000
New Zealand	2,023,217
Latvia	1,906,106
Ukraine	1,171,382
Belgium	1,097,474
Slovakia	1,012,797
Brazil	781,000
Slovenia	680,147
Estonia	631,230
Bosnia and Herzegovina	531,000
Norway	466,714

Sources: FAO, 2012; Food and Agriculture Organization of the United Nations (FAO), FAOSTAT, 2013a, <http://faostat.fao.org/site/626/DesktopDefault.aspx?PageID=626#ancor>, accessed March 11, 2013.

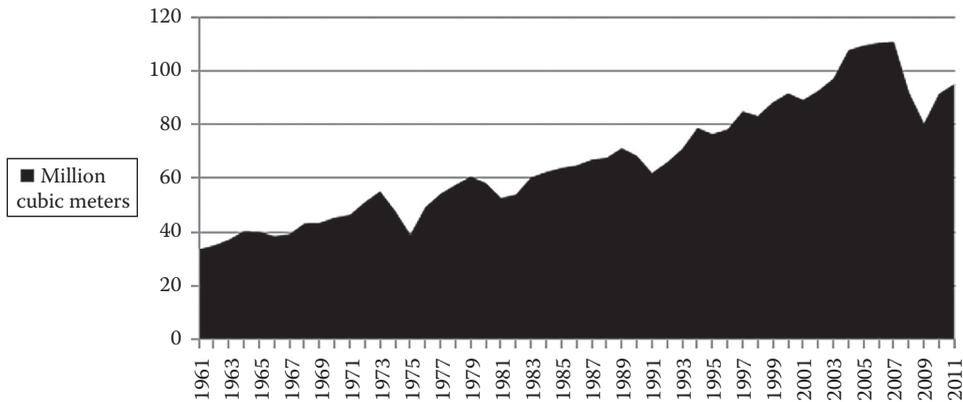


FIGURE 3.12
Global softwood lumber imports, 1961–2011.

developed markets in Asia. In the 1990s, an infestation of the pinewood nematode caused North American exports of softwood lumber to cease, unless it was kiln dried.

Globally, softwood lumber imports naturally follow exports and should be equal on a global level (Figure 3.12). However, there are always discrepancies in the statistics, which can be for valid reasons, or errors, or from other sources, for example, illegal trade. Discrepancies exist when trade data are collected at different periods, from different sources and by different methods. Some countries report lumber trade in volume, for example, in cubic meters or in board feet. Conversion between cubic meters and board feet rely on conversion factors, which are not standard. Conversion is also dependent upon whether the board feet were measured as actual or nominal. For example, a 2×4 cross section is a size in name only (nominal) because it is not 2 in. by 4 in. but rather, after drying and planing, 1.75 in. by 3.5 in. Discrepancies between importers' and exporters' records require validation, and it is not always clear which is correct. When countries report trade in units other than volume, for example, by value or weight, conversion to volume to enable comparison is challenging.

Sometimes, these discrepancies can indicate or suggest illegal trade. The elimination of illegal logging through prohibiting illegal imports is the aim of relatively new legislation in the United States, that is, the Lacey Act Amendment and the EU, via its EU Timber Regulation, as well as a growing number of other countries. Illegal logging deprives countries of revenues from their forest resources and is unsustainable. Illegal trade deprives the legal forest products industry of its rightful revenues as it competes unfairly with legal production and trade.

In the top 20 softwood lumber-producing countries, many countries have limited forest resources. Others, such as Japan, have rich forest resources, but the economics of harvesting the resource is prohibitive. Other countries are rich in forest resources, for example, the United States, Germany, France, and Austria, but their domestic production either does not meet their needs or, in the case of Germany, they import and export different species and qualities for particular end uses.

The two major softwood lumber importers, China and the United States, have had the greatest impact on global markets (Figure 3.13 and Table 3.5). Until 2010, the United States was the global leader in lumber imports. But with the downturn in demand, US imports fell and in 2011, while Chinese imports continued to rise they surpassed the United States for the first time. Most of the US imports come from Canada, while China sources its lumber needs from many countries. The maximum production for the United States,

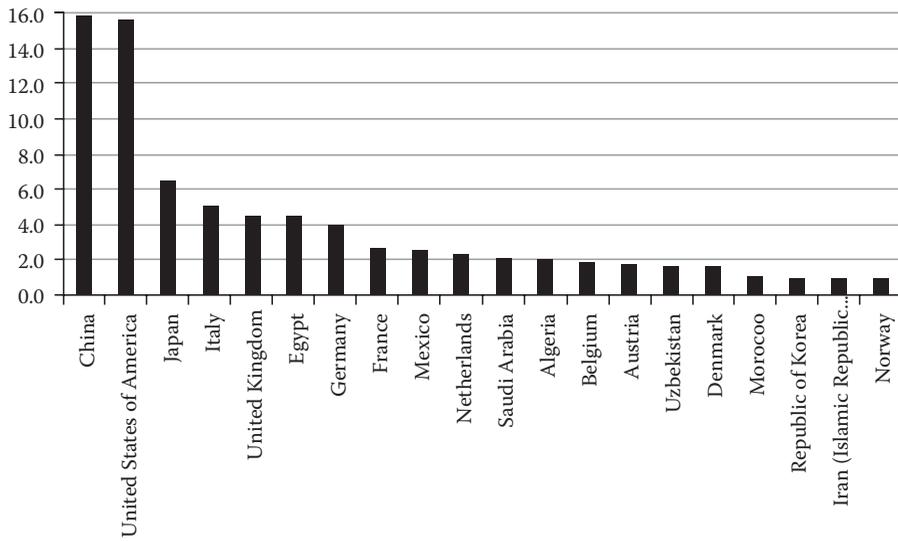


FIGURE 3.13
Top 20 sawn softwood importers (in million m³), 2011.

TABLE 3.5

Top 20 Sawn Softwood Importers (million m³), 2011

China	15.8
United States	15.6
Japan	6.6
Italy	5.0
United Kingdom	4.5
Egypt	4.5
Germany	3.9
France	2.7
Mexico	2.6
Netherlands	2.4
Saudi Arabia	2.1
Algeria	1.9
Belgium	1.8
Austria	1.7
Uzbekistan	1.7
Denmark	1.7
Morocco	1.0
Republic of Korea	1.0
Iran (Islamic Republic of)	0.9
Norway	0.9

Sources: FAO, 2012; Food and Agriculture Organization of the United Nations (FAO), FAOSTAT, 2013a, <http://faostat.fao.org/site/626/DesktopDefault.aspx?PageID=626#ancor>, accessed March 11, 2013.

69.2 million m³ could have made the United States self-sufficient for earlier years, but when timber availability decreased substantially from federal lands in the 1980s, the United States became dependent on imports.

Countries that are members of the World Trade Organization (WTO) are committed to lowering and eliminating tariffs and resolving trade disputes. Canada and the United States are members of the WTO but have a long running battle over tariffs and taxes for softwood lumber. US lumber manufacturers and their associations claim that their Canadian counterparts are unfairly subsidized by the provincial and federal timberland owners. In Canada, stumpage prices are set by the government and not by market forces as in the United States. However, the Canadian governments, lumber manufacturers, and their trade associations dispute the assertion of subsidies. Since 1982, there have been a number of iterations of this trade dispute that resulted in 1996 in the Softwood Lumber Agreement (SLA). The Agreement has been renewed several times, despite being contested. It has measures to impose higher tariffs by the United States when lumber prices are low; conversely, when lumber prices are high, there is a lower tariff or quota, and when prices reach \$355 per 1000 board feet (MBF), there is no quota or tariff (US Lumber Coalition 2012). The current SLA, established in 2006 for a period of 7–9 years, has resulted in stability and an end of trade litigation.

The drivers for lumber imports are those mentioned earlier, and trends are correlated with gross national product (GNP). Lumber imports are climbing back from the global economic and financial crisis in the mid-2000s and are expected to continue to climb when housing demand improves.

3.1.8 Future Softwood Lumber Market Trends

Softwood lumber continues to renew itself with improvements in its uses, preventing it from peaking in the product life cycle. Processing efficiency increases have enabled structural lumber to be produced from increasingly smaller diameter logs, which is especially important with plantation-grown timber being grown on shorter rotations.

Softwood structural lumber competes with alternative building materials, for example, concrete and steel. For windows and doors, softwoods compete with aluminum and plastic. On a life cycle basis, wood is a superior material, which is why some green building systems promote the use of lumber and associated wood-based engineered wood products. In countries such as Sweden, multistory wooden buildings are well established (Figure 3.14).

Production of softwood lumber is forecast to continue to grow slowly. The primary drivers of construction, residential and nonresidential, are trending upward in North America in 2012 and forecasts are positive for the coming years. Conversely, in Europe and Asia, housing construction has slowed in 2012 and is forecast to remain relatively flat in the coming years. When new housing demand slows, production will be oriented toward the repair and renovation markets that are massive due to the huge existing and aging housing stock. New products and treatments will also enable softwood lumber production to continue to increase.

Softwood lumber is currently used for a multitude of purposes, and demand will continue to grow as new uses are developed. But in order to compete with, both wood and non-wood competitors, softwood lumber will need to be produced in a cost-effective manner and to be able to be shipped to distant markets economically. Chemical (impregnation and coating) and heat treatments can improve lumber's properties for different uses. R&D will always be necessary to improve lumber production and processing efficiency and to improve wood longevity in use.



FIGURE 3.14
Eight-story wooden apartment house in Växjö, Sweden, 2012.

3.2 Temperate Hardwood Lumber Products and Markets

William Luppold and Matt Bumgardner

3.2.1 Introduction

Hardwood (non-coniferous) tree species are found on all continents other than Antarctica. The uses for the fibrous material derived from this resource range from wood pulp to architectural plywood, but hardwood lumber is the most common solid wood product. Hardwood lumber is used in appearance, industrial, and building framing applications. The major appearance applications include furniture, cabinets, flooring, and millwork. The most important industrial applications are pallets, cross ties or sleepers, scaffolding, and dunnage. While softwood (coniferous) tree species are preferred for building framing in developed countries, hardwood lumber can be used for this application in countries that do not have a large inventory of softwood timber.

This section focuses on hardwood lumber production, exports, imports, and apparent consumption for major producing and consuming regions and countries in temperate zones. The temperate zones are defined as north of the Tropic of Cancer and south of the Tropic of Capricorn.

3.2.2 Temperate Hardwood Lumber Production

Over 50% of worldwide hardwood lumber production is produced in the temperate regions. Temperate hardwood lumber production trended downward between 1990 and 2003, increased between 2003 and 2007, decreased in 2008 and 2009, and rebounded in 2010 and 2011 ([Figure 3.15](#)).

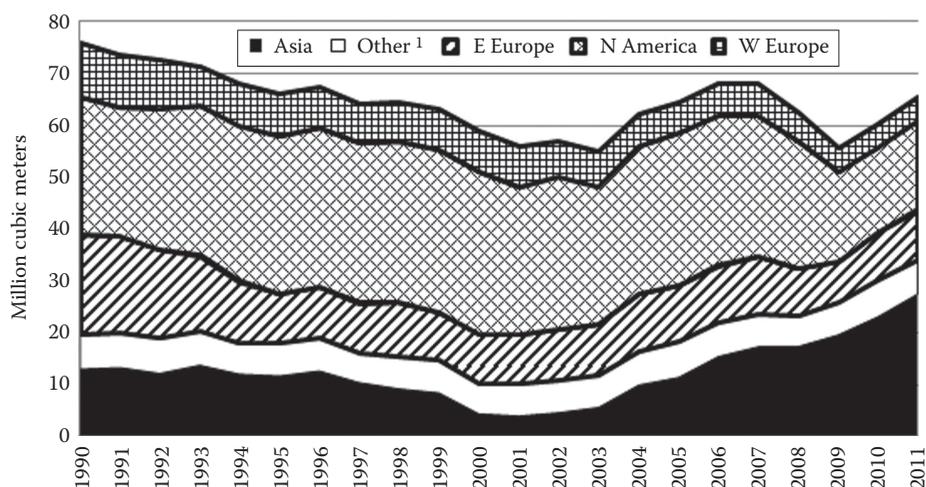


FIGURE 3.15

Hardwood lumber production by temperate region, 1990–2011. *Note:* ¹Other is primarily India, Turkey, and Australia. (From Food and Agriculture Organization of the United Nations (FAO), FAOSTAT, 2013a, <http://faostat.fao.org/site/626/DesktopDefault.aspx?PageID=626#anchor>, accessed March 11, 2013.)

TABLE 3.6

Top Five Hardwood Lumber–Producing Countries in the Temperate Region in 1990, 2000, 2005, and 2011

1990		2000		2005		2011	
Country	Market Share (%)	Country	Market Share (%)	Country	Market Share (%)	Country	Market Share (%)
United States	33.2	United States	50.8	United States	43.0	China	41.5
USSR	17.1	China	5.4	China	16.7	United States	24.9
China	11.1	France	5.0	Turkey	4.1	Russia	4.0
France	5.1	Russia	4.3	Russia	4.1	Turkey	3.5
Japan	4.4	Turkey	4.1	France	3.0	Romania	2.4
Top five ^a	71.1	Top five	69.6	Top five	63.4	Top five	76.3

Source: Food and Agriculture Organization of the United Nations (FAO), FAOSTAT, 2013a, <http://faostat.fao.org/site/626/DesktopDefault.aspx?PageID=626#anchor>, accessed March 11, 2013.

^a May not add up due to rounding error.

In 1990, the United States, the former USSR, and China were the largest producers of temperate hardwood lumber accounting for 33.2%, 17.1%, and 11.1% of worldwide production, respectively (Table 3.6). Regionally, North America* was the largest producer of temperate hardwood accounting for over 25% of worldwide production (Figure 3.15). Temperate hardwood lumber production declined by over 50% in East Europe[†] between

* North American temperate lumber producers are located in the United States and Canada.

[†] East Europe includes Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Czechoslovakia, Estonia, Hungary, Latvia, Lithuania, Montenegro, Poland, Republic of Moldova, Romania, Russian Federation, Serbia, Serbia and Montenegro, Slovakia, Slovenia, the former Yugoslav Republic of Macedonia, Ukraine, USSR, and Yugoslav SFR.

1990 and 2000, with the greatest declines occurring in countries that were formerly the USSR* (FAO 2013a). In 1990, the USSR was reported to produce 13 million m³ of hardwood lumber. In 2000, the combined production of the 15 countries that made up the former USSR was 5.1 million m³, or a 61% decrease. Most of this decline occurred between 1992 and 1995. West Europe[†] had a 37% decline in hardwood lumber production between 1990 and 2003 (Figure 3.15). The decline in West Europe hardwood lumber production was relatively constant over time, with the greatest declines occurring in Germany and France.

Between 2003 and 2007, temperate hardwood lumber production increased by 24% but there were major shifts in the amount of lumber produced in specific countries, regions, and zones (Figure 3.15). Production in North America remained nearly constant during this period. West European production continued to decline between 2003 and 2007 with the greatest declines occurring in France. By contrast, production in East Europe increased by 14% and production in East Asia[‡] increased by 209%. China's production accounted for most of the increase in East Asia, soaring by 240%, coinciding with a 100% increase in imports of temperate hardwood roundwood on a volume basis (UN FAO 2013a). The major source of temperate roundwood imports was Russia (FAO 2013b).

Between 2007 and 2009, temperate hardwood lumber production declined by 18% (Figure 3.15) as a result of the global recession. The most affected regions were North America, East Europe, and West Europe where hardwood lumber production declined by 36%, 29%, and 26%, respectively. The countries with the greatest absolute declines were the United States, Russia, and France. By contrast, hardwood lumber production in China increased by 14% and by 2009, China had become the largest hardwood lumber producer in the world (UN FAO 2013a).

3.2.3 Temperate Hardwood Lumber Trade

3.2.3.1 Exports

In 1990, the United States accounted for 34% of international shipments of temperate hardwood lumber (Table 3.7). Other important exporters of temperate hardwood lumber in 1990 included France, the former Yugoslavia, Canada, and Germany. The United States remained the largest exporter of temperate hardwood lumber in 2000. China, Canada, France, and Romania were also major exporters of temperate hardwood.

The United States continued to be the largest exporter of temperate hardwood lumber in 2005. Thirty-three percent of US exports in 2005 went to Canada while another 17% went to China (USDA FAS 2012)[§]. Other major temperate hardwood lumber-exporting countries

* Countries that were formerly the USSR include Russia, Ukraine, Belarus, Uzbekistan, Kazakhstan, Georgia, Azerbaijan, Lithuania, Moldova, Latvia, Kyrgyzstan, Tajikistan, Armenia, Turkmenistan, and Estonia.

† West Europe includes Austria, Belgium, Belgium-Luxembourg, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

‡ Temperate East Asia includes China, Democratic People's Republic of Korea, Japan, and Republic of Korea.

§ US sources (USDA FAS) consider China, Hong Kong SAR, and Taiwan POC as separate export destinations, whereas UN sources (FAO) only provide trade data for China. When US exports to Taiwan, Hong Kong, and China (USDA FAS 2012) are combined, they equal UN FAO estimates of Chinese imports from the United States in 1997 and 1998. These two series were poorly correlated between 1999 and 2004 but were in a similar range between 2005 and 2009. In 1997 and 1998, combined exports to Hong Kong and Taiwan from the United States exceeded exports to China by over 85%. Direct exports to China started to increase in 1999 and exceeded combined exports to Taiwan and Hong Kong in 2003. It is interesting to note that FAO (2013b) indicated that imports to China from the United States declined sharply in 2003, while USDA FAS (2012) indicated a steady increase.

were Canada, China, Germany, and Romania. Exports of temperate hardwood lumber declined by 34% between 2007 and 2009 (FAO 2013a) as a result of the global recession. Hardwood lumber exports from the United States declined by 46% mainly as a result of a 56% decline in shipments to Canada (USDA FAS 2012).

The United States remained the largest exporter of temperate hardwood lumber in 2011 with a 23% market share (Table 3.7). Belgium was a major exporter of hardwood lumber in 2011, but the lumber shipped from Belgium could have been produced in other countries since it imported nearly as much lumber as it exported that year. Russia became one of the five top exporters in 2011, displacing China.

The relative size of hardwood lumber exports as a percentage of regional production is shown in Table 3.8. East Europe exported only modest amounts of hardwood lumber in 1990, but by 2000, over 41% of the lumber produced in this region was exported. This increase was the result of a 252% increase in lumber exports and a 50% decrease in lumber production. In 1990, West Europe exported 17% of the lumber it produced,

TABLE 3.7

Top Five Hardwood Lumber-Exporting Countries in the Temperate Regions in 1990, 2000, 2005, and 2011

1990		2000		2005		2011	
Country	Market Share (%)	Country	Market Share (%)	Country	Market Share (%)	Country	Market Share (%)
United States	34.3	United States	23.6	United States	25.6	United States	22.8
France	12.1	China	13.0	Canada	11.5	Belgium	8.9
Yugoslavia	11.8	Canada	11.5	China	6.8	Russia	7.2
Canada	7.8	France	5.3	Germany	6.5	Romania	7.1
Germany	5.8	Romania	5.2	Romania	5.9	Germany	5.9
Top five ^a	71.8	Top five	58.5	Top five	56.3	Top five	51.9

Source: Food and Agriculture Organization of the United Nations (FAO), FAOSTAT, 2013a, <http://faostat.fao.org/site/626/DesktopDefault.aspx?PageID=626#ancor>, accessed March 11, 2013.

^a May not add up due to rounding error.

TABLE 3.8

Exports as a Percentage of Hardwood Lumber Production by Temperate Region in 1990, 2000, 2005, and 2009

Region	1990 (%)	2000 (%)	2005 (%)	2011 (%)
East Asia	2.4	5.8	7.2	2.0
East Europe	5.8	41.4	37.6	43.9
West Europe	17.4	29.6	37.4	59.4
North America	9.6	14.2	14.7	15.9
Other	3.4	3.4	4.6	2.5
All temperate	7.9	21.2	18.2	15.8

Source: Food and Agriculture Organization of the United Nations (FAO), FAOSTAT, 2013a, <http://faostat.fao.org/site/626/DesktopDefault.aspx?PageID=626#ancor>, accessed March 11, 2013.

Note: Other is primarily India, Turkey, and Australia.

but by 2011 this proportion had increased to 59% as hardwood lumber production decreased and exports increased.

3.2.3.2 Imports

In 1990, Japan, Italy, and China accounted for nearly 34% of total hardwood lumber imports by countries in the temperate zone (Table 3.9). Between 1990 and 2000, worldwide imports of hardwood lumber (temperate and tropical) increased and a high proportion of this increase was the result of a 376% increase in imports by China (FAO 2013a). By contrast, imports by Japan declined by 34% during this period. In 2000, the major sources of hardwood lumber imported by China were Indonesia and Malaysia (tropical hardwoods), and the United States (temperate hardwoods) (FAO 2013b).

Imports of hardwood lumber by countries in the temperate region remained constant between 2000 and 2007, but imports into the United States, Italy, and Japan declined sharply (FAO 2013a). US hardwood lumber imports declined by 27% between 2000 and 2007, and nearly all of this decrease resulted from reduced imports from Canada (USDA FAS 2012). This decline occurred at the same time hardwood lumber consumption by the furniture industry in the United States declined by 60% (HMR 2009). Italian imports declined by 23% during this period with the greatest decline being shipments from East Europe and West Africa (FAO 2013a, b).

The recession of 2008 and 2009 caused worldwide imports of hardwood lumber to decline with the largest absolute declines in China, Italy, the United States, and Spain (FAO 2013a). China reduced its hardwood lumber imports from the United States, Thailand, and Brazil while increasing its imports from Russia (FAO 2013b). The overall reduction in Chinese imports was the apparent result of increased hardwood lumber production in China and the shift in furniture manufacturing from China to Vietnam (Luppold and Bumgardner 2011). Imports of hardwood lumber by temperate regions rebounded to near 2007 levels by 2011, with the greatest increases occurring in the United States and China. In 2011, 43% of the hardwood lumber imported by temperate region countries went to China.

TABLE 3.9

Top Five Hardwood Lumber–Importing Countries in the Temperate Regions in 1990, 2000, 2005, and 2011

1990		2000		2005		2011	
Country	Market Share (%)	Country	Market Share (%)	Country	Market Share (%)	Country	Market Share (%)
Japan	13.2	China	24.2	China	24.9	China	43.1
Italy	12.5	Italy	10.3	United States	9.3	Italy	5.8
China	8.1	United States	8.3	Canada	7.8	Belgium	4.7
Netherlands	7.2	Canada	5.9	Italy	7.6	United States	4.1
Spain	6.7	Japan	5.7	Spain	4.9	Egypt	3.6
Top five ^a	47.6	Top five	54.4	Top five	54.5	Top five	61.4

Source: Food and Agriculture Organization of the United Nations (FAO), FAOSTAT, 2013a, <http://faostat.fao.org/site/626/DesktopDefault.aspx?PageID=626#ancor>, accessed March 11, 2013.

^a May not add up due to rounding error.

3.2.4 Temperate Hardwood Lumber Consumption*

Hardwood lumber consumption is affected by numerous factors including lumber availability and price, population size and age, wealth, and the existence of industries that use hardwood lumber as a major input. Population size is important because the greater the number of people the greater the demand for furniture, cabinets, flooring, millwork, and industrial products. The age of the population is also important because people in their 60s and older consume fewer durable products than younger people. Normally, countries with median population in the mid-40s have a considerably greater proportion of older people than countries with median population in the mid-20s. In addition, the greater levels of wealth, as defined by GDP, the more goods consumers will purchase. Countries that have established wood-consuming industries as a part of their overall economic development plan or have historically had a secondary hardwood processing industry will consume more lumber than countries that have few such manufacturers. Similarly, countries that have lost their secondary manufacturing industries due to international competition will reduce hardwood lumber consumption.

In 1990, 62% of the hardwood lumber consumed in the temperate region was by four countries, the United States, the former USSR, China, and Japan (Table 3.10). These four countries were also highly populated, collectively accounting for 34% of world population in 1990 (Table 3.11). The United States was by far the largest worldwide consumer of hardwood lumber in 1990 even though it was the fourth most populated country in the world.[†] The number one ranking of the United States in 1990 was primarily the result of the size of its economy, which accounted for 25% of the world GDP in that year (Table 3.12), as well as the presence of numerous secondary processing industries. The United States was also the largest producer of hardwood lumber (FAO 2013a). The large consumption by the former

TABLE 3.10

Top Five Hardwood Lumber–Consuming Countries in the Temperate Regions in 1990, 2000, 2005, and 2011

1990		2000		2005		2011	
Country	Market Share (%)	Country	Market Share (%)	Country	Market Share (%)	Country	Market Share (%)
United States	28.8	United States	43.0	United States	36.5	China	47.1
USSR	15.8	China	9.7	China	20.6	United States	20.4
China	11.2	France	4.5	Turkey	3.7	Turkey	3.2
Japan	6.1	Italy	4.2	Italy	3.1	Russia	2.7
France	4.5	Turkey	3.7	Russia	3.0	France	2.0
Top five ^a	66.4	Top five	65.1	Top five	66.8	Top five	75.4

Source: Food and Agriculture Organization of the United Nations (FAO), FAOSTAT, 2013a, <http://faostat.fao.org/site/626/DesktopDefault.aspx?PageID=626#ancor>, accessed March 11, 2013.

^a May not add up due to rounding error.

* Consumption figures used in this section are approximate estimates of consumption (apparent consumption) and have been derived from production plus imports minus exports. Hardwood lumber inventories have not been considered.

[†] While the USSR state that is now the nation of Russia was the sixth most populous country in 2003, the combined population of the 15 countries in the former USSR was the third largest country in 1990.

TABLE 3.11

Population of Countries That Were Top Five Consumers in Temperate Regions One or More Times during 1990, 2000, and 2011 and the Median Age of Population in 2011

Country	Population 1990 (Million)	Population 2000 (Million)	Population 2011 (Million)	Median Age 2011 (Years)
United States	249.6	282.2	311.7	36.9
USSR	289.1	NA	NA	NA
China	1135.2	1262.6	1336.7	35.5
Japan	123.5	126.9	126.5	44.8
France	56.7	58.9	65.1	39.9
Turkey	56.2	67.4	78.8	28.5
Italy	56.7	56.9	61.0	43.5
Russia	NA	146.3	138.7	38.7
World	5222.8	5991.3	6882.9	28.4

Sources: US Central Intelligence Agency (US CIA), The World Factbook, December 18, 2003–March 28, 2011, NationMaster.com 2013Population (1990) by country, 2013, http://www.nationmaster.com/graph/peo_pop-people-population&date=1990, accessed on March 11, 2013; U.S. Central Intelligence Agency (US CIA), The World Factbook, Median age, 2012, <https://www.cia.gov/library/publications/the-world-factbook/fields/2177.html# 133>, accessed March 11, 2013.

TABLE 3.12

GDP in Terms of Purchasing Power Parity^a of Countries in Temperate Regions That Were Top 10 Consumers One or More Times during 1990, 2000, 2005, and 2011

Country	1990 Billions of US Dollars	2000 Billions of US Dollars	2005 Billions of US Dollars	2011 Billions of US Dollars
United States	5,800	9,951	12,623	15,076
USSR	NA	NA	NA	NA
China	910	3,015	5,364	11,300
Japan	2,370	3,256	3,890	4,444
France	1,027	1,532	1,862	2,214
Turkey	292	513	747	1,076
Italy	976	1,404	1,642	1,847
Russia	NA	1,205	1,894	2,512
World	23,490	42,310	61,705	78,970

Source: Knoema, GDP statistics by country, 2013, <http://knoema.com/gdp-by-country?gclid=CMOu4ImPha8CFcMbQgod62dn4w#United%20States>, accessed March 13, 2013.

^a Purchasing power parity is the rate at which the currency of one country would have to be converted into that of another country to buy the same amount of goods and services in each country (Callen 2012).

USSR in 1990 appears to be the result of high populations and high volumes of hardwood lumber production.

The combined populations of Japan, Germany, and France were similar to that of the United States in 1990 (Table 3.11), and the combined GDP was 83% of the United States (Table 3.12), yet lumber consumption was half that of the United States (Table 3.10).

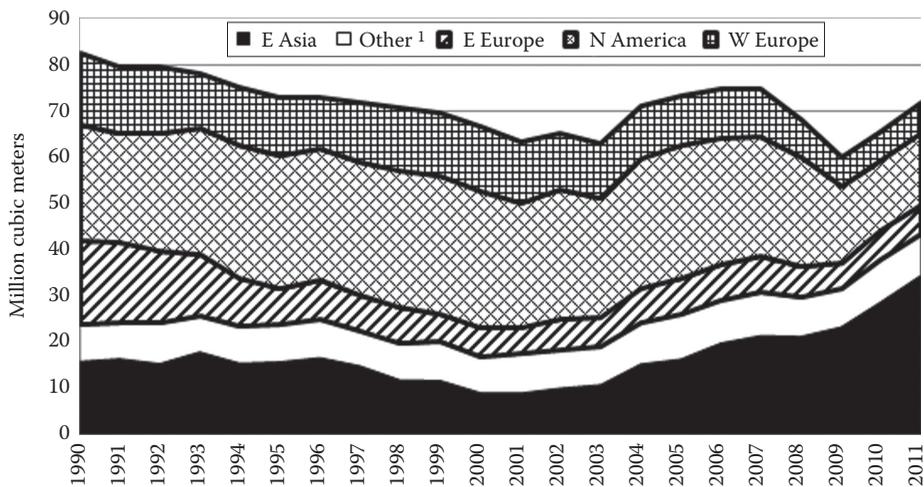


FIGURE 3.16

Apparent hardwood lumber consumption by temperate region, 1990–2011. *Note:* 'Other 1 is primarily India, Turkey, and Australia. (From Food and Agriculture Organization of the United Nations (FAO), FAOSTAT, 2013a <http://faostat.fao.org/site/626/DesktopDefault.aspx?PageID=626#anchor>, accessed March 11, 2013.)

Two potential reasons for combined lower lumber consumption in these countries are lower levels of hardwood lumber production (Table 3.6) and older populations (Table 3.11).

Hardwood lumber consumption in the temperate regions declined between 1990 and 2000 (Figure 3.16). The greatest declines occurred in East Europe and East Asia. The decline in East Europe has been affected by a slowly growing and aging population (US CIA 2013). The decline in East Asia was primarily caused by reduced consumption by Japan. Japan had slow GDP growth between 1990 and 2000 (Table 3.12) and an aging population (Table 3.11). The decline (though relatively small) in West Europe consumption is attributed to aging populations and relatively low GDP growth in larger countries in this region.

Chinese consumption of hardwood lumber declined 30% between 1990 and 2000. As noted earlier, hardwood lumber production in this country decreased, as a result of redirecting logs to plywood production. North American consumption increased as a result of increased demand for hardwood lumber in the United States (Luppold and Bumgardner 2008). The secondary hardwood processing industries that increased their consumption in the United States during this period were kitchen cabinet, millwork, and flooring, as greater volumes of hardwood products were used in home construction.

For the 2000–2005 period, hardwood lumber consumption increased in the temperate zone countries primarily as a result of increased demand by China. The worldwide recession caused a reduction in hardwood lumber consumption between 2007 and 2009. Consumption in North America fell by 53% as the housing market and overall economic activity declined. East European consumption also declined 25%, while West European consumption declined by 40%. By contrast, consumption by China increased (FAO 2013a).

3.2.5 Future Temperate Hardwood Market Trends

The worldwide economic downturn that began in 2008 has caused continued uncertainty, making it difficult to project the future of international hardwood lumber markets. However,

there are a number of trends that have continued during the pre- and post recession periods. These include increased production and consumption of hardwood lumber in China, the continued decline in West European and Japanese production and consumption, and the stagnation of the US market for higher grade lumber.

China became the largest market for hardwood lumber in 2009, while US production and consumption declined by over 36% between 2007 and 2009. China sources lumber imports from nearly every part of the world and was the top export market in 2009 for hardwood lumber from the United States, Indonesia, Malaysia, Cameroon, and Germany. While a portion of the hardwood lumber consumed in China is remanufactured for export products such as furniture, the majority of lumber consumed in China is for domestic markets. Given China's rapidly growing GDP, large population, and rising incomes, this country will probably remain a major consumer if not the largest consumer of hardwood lumber for years to come. However, there are some potential issues that could curtail future increases in hardwood lumber production and consumption in China. The expansion of Chinese hardwood lumber consumption since 2003 has been predicated on imports of logs primarily from the Pacific Rim nations and Russia and lumber from nearly every corner of the world.

Hardwood lumber consumption in West Europe has been declining since 1990. West European hardwood lumber production has also been declining since 1990 but at a lower rate than consumption. The apparent causes of the declines in hardwood lumber consumption are economic and demographic. The major West European hardwood lumber-consuming countries listed in [Table 3.12](#) had lower GDP growth than any country other than Japan. The population growth of these countries between 1990 and 2011 was below or near 10% and the median ages were among the highest in the world (US CIA 2013 and [Table 3.11](#)).

In 1990, Japan was the world's largest importer of hardwood lumber and the seventh largest consumer. It also was the seventh most populous country and the second largest economy in the world (US CIA 2013 and [Table 3.12](#)). Between 1990 and 2000, the Japanese economy and population rate grew at extremely slow rates relative to other industrial countries as it went through a series of economic structural shocks. The median age of the population reached 44 years in 2011, comparable to Germany but with a lower immigration rate of guest workers. This series of events led to a continued reduction in hardwood lumber production, consumption, and imports of 93%, 88%, and 76%, respectively, between 1990 and 2007. Japan also increased its imports of secondary processed hardwood products such as furniture during this period. The recession years of 2008 and 2009 brought even greater declines in hardwood lumber production, consumption, and imports of 29%, 40%, and 46%, respectively. Japanese consumption probably will increase in the near future because of the size of their economy and the rebuilding efforts after the 2011 earthquake and tsunami, but long-term increases appear to be improbable.

For most of the time period examined in this chapter, the United States was the dominant producer and consumer of temperate hardwood lumber and continued to be the most important exporter. Since 2000, US hardwood lumber production and consumption have been trending downward, before declining by over 35% between 2007 and 2009. The decline in the US hardwood lumber market began as domestic furniture manufacturers could no longer compete with East Asian imports (Luppold and Bumgardner 2011). Initially, the decline in consumption by the furniture industry was offset by increased consumption by industries associated with home construction. The crash in the US housing market in 2009 caused hardwood lumber consumption and production to decline to its lowest levels since the early 1960s. The probability that US hardwood lumber consumption will reach 2000 levels in the near future is low. In contrast, the outlook for hardwood lumber production is

better because the United States has a large and sustainable hardwood resource base and the infrastructure to access this base allowing it to remain the world’s largest exporter of hardwood lumber.

Since 2000, East European hardwood lumber production and consumption has been relatively stable. While some countries in East Europe have experienced slow population growth, Russia (the largest) has experienced negative population growth. Similar to West Europe, the median age of the East Europe population is relatively high but with a lower rate of immigration. Similar to North America, there is little change expected in production and consumption in East Europe in the short term.

3.3 Tropical Lumber Products and Markets

Frances Maplesden and Steven Johnson

3.3.1 Introduction

Tropical timber products, including lumber, are derived from timber that is grown or produced in the countries situated between the Tropic of Cancer and the Tropic of Capricorn. Tropical industrial roundwood production, used in the production of sawnwood and veneer for plywood, has been more or less stable in the 16 years from 1995 to 2010 in each of the three tropical regions (Figure 3.17).^{*} However, production in natural forests has become increasingly supply constrained, affected by log export restrictions to encourage downstream processing, reductions in logging quotas to achieve national SFM targets, and crackdowns on illegal logging in the major supplying countries. Illegal logging and trade in illegally sourced products is widely perceived to be more a more serious issue in tropical supplying countries, where forest governance is often poor. Hence, data on forest

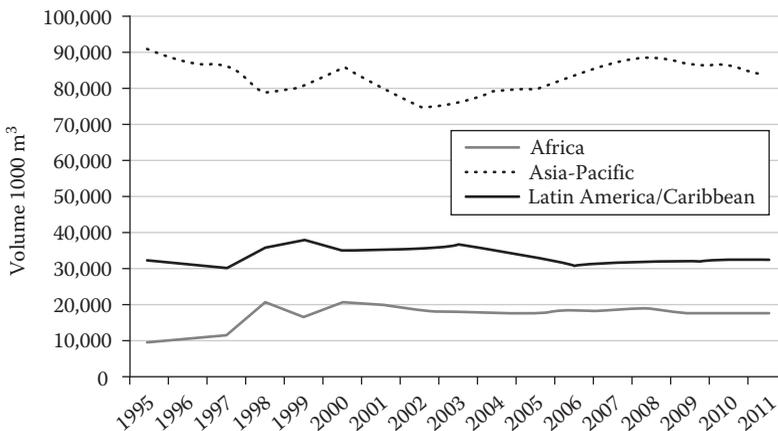


FIGURE 3.17
Tropical log production by region, 1995–2011.

^{*} Unless otherwise stated, the data on tropical production, consumption, and trade presented in this section are for ITTO member countries only. ITTO’s 60 member countries together constitute 95% of all tropical timber trade and over 80% of tropical forest area.

resources and roundwood production in the tropical zone are often uncertain with the problem exacerbated by poor monitoring and reporting capacities in many tropical countries. Although declines in production in natural forests in some countries have been offset by increases in production from planted forests, plantation development in the tropics has not kept pace with development in the temperate zone, with only 15.6 million hectares (14%) of the world's plantations in countries located in the tropical zone and concentrated in relatively few countries (ITTO 2011).

3.3.2 Production of Tropical Sawnwood

Production of tropical sawnwood in International Tropical Timber Organization (ITTO) producing countries totaled about 41.0 million m³ in 2010, with the Asia-Pacific and Latin America/Caribbean regions each accounting for approximately 44% of production while Africa accounted for the remainder (ITTO 2012). There have been longstanding regional disparities in the proportion of log production utilized domestically, with Latin America converting almost all of its domestically produced logs to at least primary products over the last 5 years, while Asia-Pacific producers domestically consumed about 95% of their log production. Both regions have had rising domestic demand for wood-based products resulting from population and economic growth, as well as emphasis on producing and exporting value-added products.

In the African region, the proportion of all logs produced that were converted domestically to further processed products is relatively small compared with the other regions, although it has increased to an estimated 84% in 2011, reflecting increasing government restrictions on log exports in many ITTO African member countries (ITTO 2012). Africa's tropical log production is more dependent on exports, and EU markets, than the other regions, with over 16% of log production exported as logs in 2010. Compared to Asia and Latin America, the African region was more sensitive to the depressed wood products demand in traditional markets caused by the global economic downturn in 2008 and 2009. Many of the major producing countries relaxed log export restrictions during the economic crisis, to assist their forestry sectors to improve profitability (particularly Gabon, Cameroon, and the Republic of Congo), but in 2010, many countries reimposed these restrictions to assist the recovery of their sawmilling and other wood processing industries (ITTO 2012, ITTO MIS).

Brazil's tropical sawnwood production, totaling 15.5 million m³ in 2010, constitutes over 85% of production in the Latin American region and it remains the largest global producer and consumer of tropical sawnwood, with high economic growth and an increase in construction activity fuelling an increase in domestic sawnwood demand over the last few years (Figure 3.18). India (4.9 million m³), Malaysia (4.3 million m³), Indonesia (4.2 million m³), and Thailand (2.9 million m³) were other major producers of tropical sawnwood in 2010, although the accuracy of aggregate data for the Asian region may be impaired by the lack of official data on sawnwood production available for three of the major producing countries, India, Indonesia, and Thailand. In 2010, sawnwood production in the Asia-Pacific region recovered from a low in 2009, increasing 3% to reach 18.2 million m³.

The top five tropical sawnwood producing countries produced over 77% of tropical sawnwood in 2010, although there were eight other countries (Nigeria, China, Lao PDR, Myanmar, Cameroon, Peru, Côte d'Ivoire, and Ghana) that produced over 500,000 m³ of tropical sawnwood in 2010. China imports more tropical sawnwood than it produces from its considerable tropical log imports. China's domestic sawmills supplied only 33% of

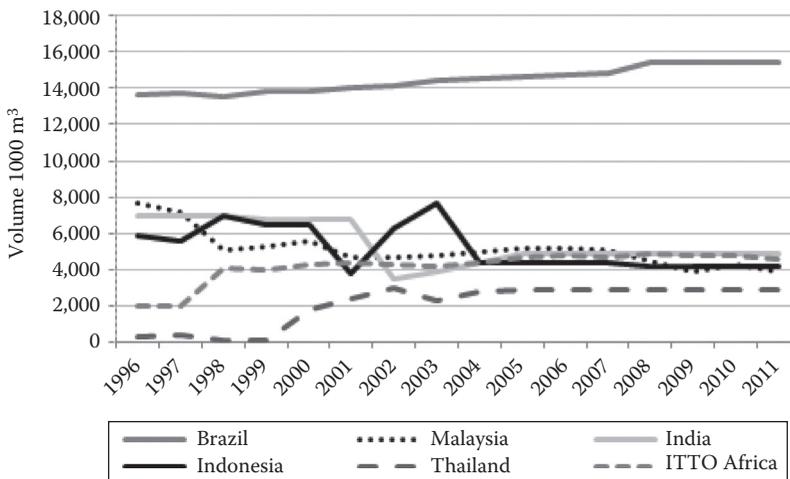


FIGURE 3.18
Major tropical sawnwood producers, 1996–2011.

tropical sawnwood demand in 2011, compared with 67% of coniferous sawnwood demand. This reflects the introduction of log export restrictions in tropical supplying countries (e.g., Gabon) and increases in China's labor costs, reducing competitive advantage in primary processing compared with moving up the value chain. China's sawmilling industry is dominated by small- and medium-sized enterprises and production figures from such numerous, small-scale operations is likely to be underestimated (ITTO 2012).

3.3.3 Consumption of Tropical Sawnwood

Brazil remains the largest ITTO tropical sawnwood consumer at over 14.8 million m³ in 2010. Domestic consumption has been relatively stable since 2009, supported by strong sawn timber demand in the growing construction sector. India, China, and Indonesia were the next most important consumers in 2010, with tropical sawnwood consumption of 4.9, 4.9, and 3.6 million m³, respectively (ITTO 2012). There has been a developing trend toward domestic consumption within tropical producer countries. This has been driven by relatively high population growth and rising GDP/capita in tropical producer (developing) countries, with economic growth generally being higher in developing economies than in developed economies.

China's consumption increased 33% in 2010 as domestic demand grew strongly and as China's wooden furniture and flooring exports recovered from the effects of the global economic downturn on its major markets—the United States and EU countries. EU consumption of tropical sawnwood picked up in 2010 to reach 1.5 million m³, although this was significantly less than precrisis levels. Consumption dropped again in 2011 to 1.4 million m³ with the outlook for a further decline in consumption in 2012. There have been a number of other factors contributing to declining EU consumption, including a loss of secondary processed manufacturing capacity as a result of strong competition from Asian manufacturers (particularly China and Vietnam), substitution by nontropical sawnwood in furniture and joinery manufacture, and more recently a lack of availability of certified tropical sawnwood that will become more critical when the new EU Timber Regulation is enforced in March 2013.

3.3.4 Tropical Sawwood Trade

Although the share of tropical wood products in the global wood products trade has been declining, tropical sawwood has maintained its share of global sawwood imports at 10% between 1994 and 2010. By contrast, tropical logs as a share of global log imports declined from 30% to 13% over the same period. The downturn in the tropical plywood trade has been more pronounced, from 68% share of global plywood imports in 1994 to 37% in 2010. The tropical sawwood trade is dominated by trade within the Asia-Pacific region, with over 75% of global imports and 65% of global exports of tropical sawwood being between countries in the region (ITTO 2012). Intra-regional trade within the African region has also developed in response to growing demand within the region (ITTO 2010a).

3.3.4.1 Imports

Total imports of tropical sawwood rebounded from a low in 2009 to reach 8.1 million m³ in 2010, a year-on-year increase of 23%, as construction demand and consumer spending began to pick up in consumer countries. In 2011, imports moved downward again to 7.2 million m³ as the economic situation in the euro zone deteriorated and the US economic outlook remained uncertain. The largest country importers are in Asia (China and Thailand) with other Asian (Malaysia, Taiwan Province of China (POC), and Japan) and EU importers (the Netherlands, France, Italy, and Belgium) also being important to the trade (Figure 3.19).

China's imports soared in 2010, reaching 3.3 million m³, 50% more than the previous year. The reasons for this growth include rising demand for sawwood in China's furniture and flooring industries; increases in log export restrictions from supplying countries (Gabon and Russia) creating a substantial log supply gap; and increasing labor costs, rising domestic sawwood prices, and appreciation of the Chinese currency that has eroded the competitiveness of tropical sawwood manufactured in China. During the period of the global financial and economic crisis (2008–2009), China's economy was assisted by aggressive fiscal stimulus packages and the subsequent growth in domestic consumption, including demand for tropical sawwood, more than compensated for depressed demand

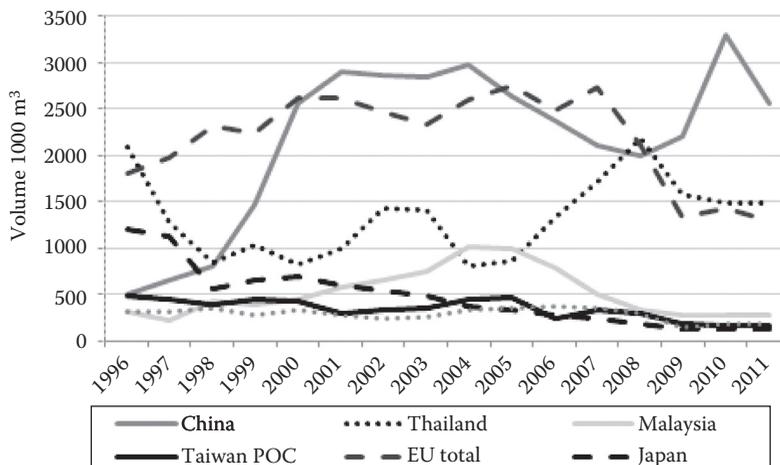


FIGURE 3.19
Major tropical sawwood importers, 1996–2011.

in China's export-oriented wood remanufacturing industries. China's tropical sawnwood imports are mainly used in furniture, interior decoration, and home improvement and are more sensitive to export market conditions than is the case for softwoods, which are used predominantly in domestic construction. In contrast to Thailand (the second largest importer and also a major exporter), China has a larger range of tropical sawnwood suppliers, the main suppliers in 2010 being Thailand (43%), the Philippines (16%), Indonesia (12%), Malaysia (7%), Myanmar (3%), and Brazil (3%). China's imports from Thailand are predominantly of lower priced rubberwood that has become popular in the production of low-cost furniture products. Imports from African countries (Gabon, Cameroon, the Republic of Congo, Côte d'Ivoire, and Ghana) were less than 3% of China's tropical sawnwood imports in 2010 but have the potential to rise given China's investment in many infrastructure projects such as roads and ports to facilitate transport and trade of basic commodities such as logs and sawnwood in the African region. In 2011, China's tropical sawnwood imports declined but remained substantial at 2.6 million m³.

Thailand's tropical sawnwood imports are mainly structural grade material, with 92% of imports from Malaysia and Lao People's Democratic Republic (PDR). However, Thailand's reported imports from Lao PDR of over 672,000 m³ in 2010 were not corroborated by Lao PDR export statistics. Although the Government of Lao PDR has committed to SFM, high demand levels from neighboring countries such as Thailand and Vietnam and a suspected high incidence of illegal logging and poor governance mean that its export figures may be underestimated (Forest Trends 2011).

Taiwan POC's imports rebounded in 2010, increasing nearly 90% to 333,000 m³, with most of the supply (nearly 80%) from Malaysia. Malaysia's imports recovered slightly to 282,000 m³ in 2010 but were still nearly half the 2007 level. Malaysia's suppliers were mostly from the Asian region, with 37% of imports in 2010 from Thailand and most of the remainder from Indonesia, the Philippines, and Myanmar. In Japan, imports and consumption of tropical sawnwood have declined in recent years because the use of solid wood for shop renovations and housing renovations is declining, and the use of substitute products, such as MDF with printed wood grain patterns, has grown because of their low prices and ease of installation/workability (ITTO 2010b).

Total tropical sawnwood imports by EU countries remained at a very low level in 2010, increasing slightly to 1.4 million m³, nearly half the peak level of 2007. In 2011, as economic uncertainty mounted, imports dropped to 1.3 million m³, the lowest level in ITTO's statistical records. Many EU member countries are experiencing government austerity measures, sluggish construction activity, and a continuing tendency for importers to maintain low stocks. There have also been some major structural changes in the sawnwood market, with the EU temperate hardwood sawnwood industry weathering the demand crisis better than most external suppliers. Its share of the EU hardwood sawn timber market increased from 66% to 74% during the period 2006–2010 while tropical hardwood's market share declined from 18% to 12%.

The Netherlands is the largest EU importer although a significant proportion is reexported to other EU destinations. It is mainly supplied by Cameroon, Brazil, and Malaysia. France is also a major importer, supplied mostly from Cameroon, Côte d'Ivoire, and Ghana, as well as significant imports from Brazil. A decline in furniture manufacturing in France and Belgium in recent years implies that there is a limited prospect for tropical sawnwood consumption and imports returning to the high volume import levels before the economic crisis.

Italy's tropical sawnwood imports, which have been significant in past years, have been declining continuously since 2007. The Italian hardwood furniture sector has undergone significant structural change, with demand for tropical sawnwood declining due to

the shift by larger manufacturers to lower-cost locations including in the tropics. Italy’s imports were mainly from countries within Africa—Cameroon, Côte d’Ivoire, and Gabon. Spain’s imports, which have been most affected by significant setbacks in the construction sector from 2008, remained depressed in 2010 and 2011 as the construction sector continued to decline and the important door manufacturing sector remaining depressed. Although economic conditions remained relatively positive in Germany in 2011, with new residential construction and renovations remaining strong, tropical sawnwood imports declined. This partly reflects changing fashion trends in Germany favoring character and grain, demand for which has been increasingly met by the application of stain or heat treatment to oak and ash (ITTO MIS).

3.3.4.2 Exports

Figure 3.20 shows the major tropical sawnwood exporters over the last 15 years. Thailand’s exports of tropical sawnwood jumped to 2.8 million m³ in 2010, well in excess of pre crisis levels. The growth is attributed to China’s surge in demand for low-cost raw materials (particularly rubberwood) for its export furniture and flooring industries with consumers in end-use markets demanding lower-priced furniture and flooring products during the economic crisis. Thai exports were predominantly to China (74%) and Malaysia (23%). Malaysia is also a significant exporter, recording exports of 2.6 million m³ in 2010, up to 32% on the previous year. In contrast to Thailand, Malaysia has more diverse market destinations, with Thailand importing the largest share (27%), but there were also a significant number of other important destinations, including Taiwan POC, China, Singapore, the Philippines, the United Arab Emirates, Maldives, Yemen, and Sri Lanka.

With some stability returning to global markets in 2010, Cameroon’s tropical sawnwood exports totaled 738,000 m³, the same level as 2009. Exports were mainly to European destinations—Italy, the Netherlands, Belgium, and France—with Cameroon as the largest

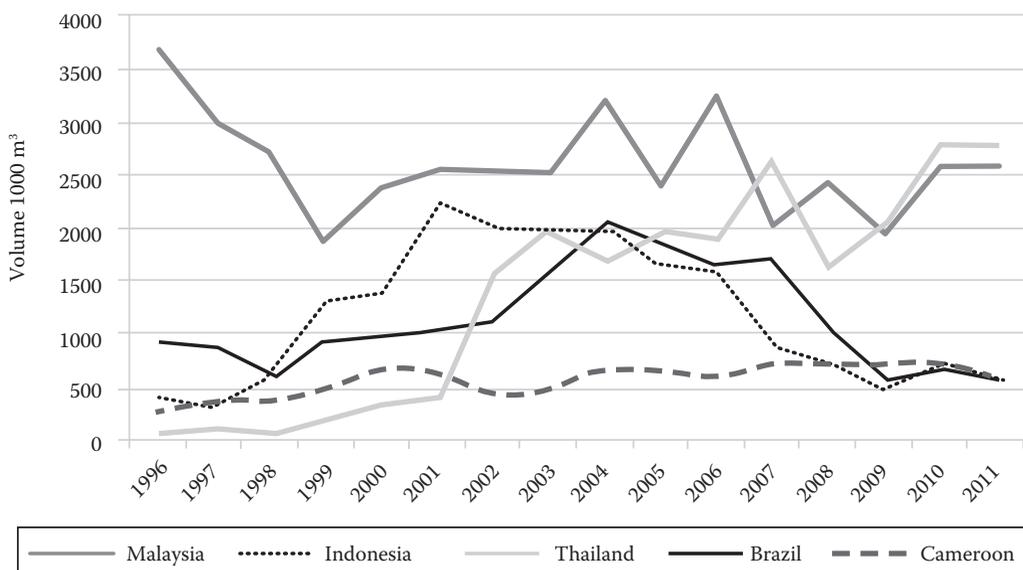


FIGURE 3.20
Major tropical sawnwood exporters, 1996–2011.

single supplier of tropical sawnwood to Europe. In 2010, Cameroon's sawnwood exports were assisted by Gabon's log export ban that reduced tropical log supplies and strengthened demand for tropical sawnwood imports, particularly okoumé, from other African sources. In 2010, the Cameroon government reimposed log export quotas on several species, and demand for iroko sawnwood (one of the major species exported) had strengthened. However, in 2011 and early 2012, with an uncertain economic outlook for the euro zone countries, exports were declining. West and Central African exporters have the advantage of shorter lead times and lower freight costs to Europe compared to competitors from Southeast Asia.

Brazil's exports have plunged in recent years. In 2007 Brazil exported 1.7 million m³, declining steadily to 571,000 m³ in 2009 and increasing slightly to 668,000 m³ in 2010. Over this period, Brazil's export competitiveness declined as the currency continued to appreciate relative to the US dollar, domestic demand grew, and sawnwood demand in Brazil's major sawnwood export markets, particularly the United States, declined. Brazil's major markets in 2010 were China (which has grown in importance in recent years), the Netherlands, France, and the United States. Indonesia's exports of tropical sawnwood increased in 2010 to 635,000 m³, although this was still less than before the global economic crisis. Estimates for Indonesia's exports of tropical sawnwood have underestimated total trade in previous years, particularly with China.

3.3.5 Future Tropical Sawnwood Market Trends

International tropical timber markets are continually undergoing dynamic structural changes that threaten the competitive position of tropical timber products compared with other wood and non-wood products. Changes in factors such as price, product availability, technology, shipping and freight costs, manufacturing costs, environmental concern, and consumer taste have been impacting on the relative competitiveness of tropical wood products. Substitution of tropical sawnwood in outdoor decking applications, for example, has occurred from both new wood-based products and plastics. Tropical hardwoods such as meranti and sapele, which have been highly favored for window manufacture for their technical and aesthetic attributes at the high end of European window markets, are losing market share to engineered wood products. Innovations in product development and processing have generally benefited softwoods and other materials rather than tropical hardwoods, with global research focusing on improving the ability of softwoods to match the technical performance of tropical hardwoods rather than the development of new and innovative products and applications to extend the market share of tropical hardwoods. In EU markets, European hardwood products with targeted performance attributes are being developed and marketed as alternatives to tropical hardwoods in the external joinery and furniture sectors.

Market perceptions of the environmental credentials of tropical wood products and emerging public and private timber procurement policies also represent a major challenge for tropical timber exporters, impacting their competitiveness in some markets. In EU markets, environmental concerns have benefited FSC and PEFC certified hardwoods, the majority of which are sourced from Europe rather than tropical supplying regions. The lack of availability of certified tropical sawnwood remains a concern given the numerous trade policy measures now being implemented with the aim of improving forest law enforcement in tropical supplying countries and countering the trade in illegal harvested timber. There is widespread expectation in the EU that demand for certified tropical wood products will pick up strongly as the EU moves toward

full implementation of the EU Timber Regulation in 2013. Tropical producer countries, particularly in the African region, are underrepresented in the global supply of environmentally certified wood products that are derived overwhelmingly from forests in Europe and North America. However, these policy measures will increasingly need to accommodate legality verification procedures in more complex value-added wood product supply chains, given the shift in tropical sawnwood trade toward Asian countries, particularly China, which further process and reexport products to EU and North American markets.

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The Global Forest Sector

Changes, Practices, and Prospects

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