TECHNICAL NOTE

A Review and Qualitative Evaluation of Southern Yellow Pine in Japanese Housing and Decking Markets

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Abstract

The current status of southern yellow pine (SYP) lumber use in the Japanese housing and construction markets is reviewed and compared with other Asian markets. We look into the lack of SYP lumber penetration in the Japanese construction markets, approaching the topic from the perspective of regulations, product quality, awareness, and marketing. Finally, the analyses suggest how SYP producers can penetrate the Japanese market and develop increased demand for SYP products.

Southern yellow pine (SYP) from the Southeastern United States includes loblolly pine (*Pinus taeda*), longleaf pine (*Pinus palustris*), shortleaf pine (*Pinus echinata*), and slash pine (*Pinus elliottii*). Lumber made from SYP accounts for about 50 percent of softwood lumber production in the United States (US Census Bureau 2011) and is often used for both structural and decorative applications in the United States and abroad. Because of its treatability with preservative, SYP is one of the most ideal wood species for pressure-treated lumber. It is estimated that about 85 percent of all pressure-treated wood used in the United States is SYP (Southern Forest Products Association [SFPA] 2014a). Since the recent housing crisis, SYP lumber production has declined sharply (Hodges et al. 2011) and has yet to recover to its before-crash levels as of 2014. This weak demand for SYP lumber in the United States has been partially offset by a strong demand internationally (SFPA 2014b).

China and Japan are two of the largest export destinations for US softwood excluding North American Free Trade Agreement countries. In 2013, the United States exported 902,637 and 423,494 m^3 of softwood lumber to China and Japan, respectively (US International Trade Commission [US ITC] 2014). In the same year, the United States exported 5.8 million and 2.4 million m^3 of softwood logs to China and Japan, respectively. China and Japan are regional neighbors as well as large softwood consumers; hence, it is expected that both countries will import SYP similarly. Cao et al. (2011) explain that opportunities for SYP existed within the treated-wood industry in China. Because of this opportunity, the export volume of SYP lumber and logs to China has increased over the last decade. In contrast, though, SYP lumber has struggled to penetrate Japanese markets.

The purpose of this article is to explain the current limitations and explore the opportunities of SYP within Japanese markets. To do so, it is necessary to understand the legal requirements and business practices of the Japanese housing and decking industry, where a great majority of softwood lumber is being consumed. Market and legal information was collected about the current use of SYP and other softwood lumber in Japan. In addition, we visited Japan twice in 2013 to conduct semistructured interviews (Bernard 1988), in which we targeted Japanese lumber treaters, importers, industrial organizations, and builders who were familiar with Japan's construction and preservative-treatment markets. In the following section, comparisons are made between Japan and other Asian economies regarding market penetration of SYP and other species used in Japan. Japanese standards of pressure-treated lumber are then introduced, which are the main cause for the lack of SYP lumber use in Japan. The study then reviews the current market limitations and opportunities of SYP for wooden framed buildings and decking markets in Japan, with a final conclusion that includes recommendations to expand SYP markets.

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Forest Prod. J. 65(5/6):239–246.
doi:10.13073/FPJ-D-14-00070

Current Status of SYP Products Exports to Japan and Other Asian Markets

Most softwood lumber shipped to Japan from the United States is western species from the US West Coast, not SYP from the Southeastern United States. A possible explanation is perceived difference in transportation costs: shipping from the East Coast to Japan requires transport through the Panama or Suez Canal, which may be more expensive than directly shipping lumber from the West Coast. However, Mr. Norikazu Yoshikawa, a lumber exporter, says that shipping costs from Savannah, Georgia,[1] to Tokyo are often not much different from that from ports in the West Coast (personal communication, September 11, 2013), suggesting that shipping costs alone cannot explain why SYP is not supported by the Japanese markets.[2] This is also confirmed by the fact that Japan's neighbors, mainland China and Taiwan, import a large volume of SYP lumber (Fig. 1). From 2007 to 2013, the volume share of SYP lumber[3] to total softwood lumber exports from the United States to Japan was between 1.2 and 3.0 percent. During the same period, the SYP share of total US softwood lumber exports in volume to mainland China and Taiwan went from between 5.4 and 25.7 percent to between 31.6 and 51.4 percent, respectively. In aggregate, the Asian nations included in Figure 1 imported 7.2 percent of all SYP lumber exported from the United States in 2007 and 20.3 percent in 2013. However, Japan imported between 3,395 and 12,398 m^3 of SYP lumber, representing only between 0.3 and 1.3 percent of total US SYP lumber exports between 2007 and 2013 (US ITC 2014).

Figure 2 shows the unit price per thousand board feet (mbf) of nontreated SYP lumber exported to major countries. The average free on board (FOB) price per mbf to Japan was US$955 and to Spain was US$948 in 2012. Those FOB prices were 28.9 and 27.9 percent higher than the average unit FOB price of saps[4] in 2012 according to Yearbook 2012 by Random Lengths (2013, p. 297). This

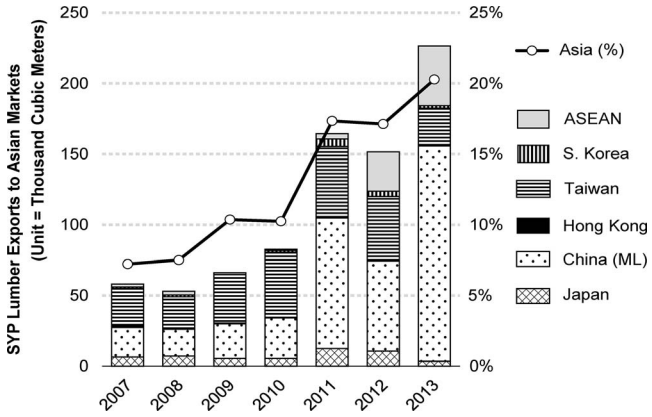

Figure 1.—Southern yellow pine (SYP) lumber exports to Asian markets from 2007 to 2013. Only East Asia and Southeast Asia are included here. SYP lumber in this chart includes both solid lumber and preservative-treated lumber. The number is the sum of harmonized code 4407100146 and 4407100147 plus 4407100102 only from port districts in the Southeast. (Source: US Internal Trade Commission 2014).

implies that Japan mainly imports high-grade SYP lumber, such as clear boards, and not much commodity grade SYP lumber. On the other hand, mainland China and Taiwan import large amounts of commodity grade SYP lumber. During visits to Japan, there were two furniture manufacturers that were using high-grade SYP lumber, but no builder was using SYP dimensional lumber.

The rise of SYP lumber exports to mainland China and Taiwan may be explained by climate, competitive prices, and economic development. The hot and humid tropical climate in Taiwan accelerates the decay of wood products, especially for exterior applications, which makes it necessary to use durable wood products in that region. In this regard, chromated copper arsenate (CCA)–treated SYP lumber has an excellent reputation for quality in Taiwan and is cheaper than other durable products, such as imported tropical hardwood lumber, naturally durable local species (including Formosan cypress [*Chamaecyparis formosensis*] and Taiwan cypress [*Chamaecyparis*

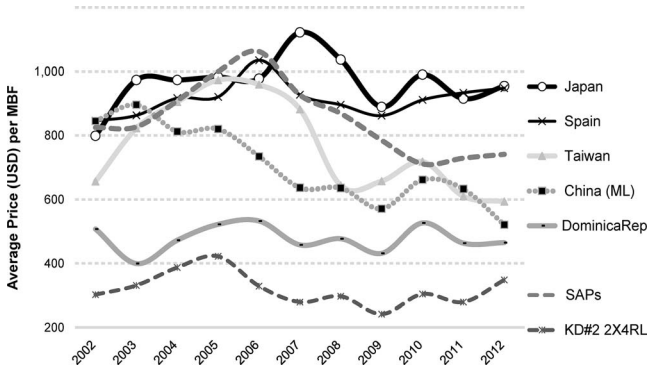

Figure 2.—Annual average export price (free on board) of southern yellow pine (SYP) lumber to major countries. This figure only includes SYP solid lumber and does not include preservative-treated lumber. Note that the product wholesale prices of kiln-dried (KD) 2 is just a reference because they do not include transportation costs to the port. (Sources: US Internal Trade Commission 2014, Random Lengths 2013.)

[1] Many exporters to Asia prefer to use the Port of Savannah in the US South because it is easy to find direct-route container shipping to shorten lead time.

[2] Ocean freight prices vary greatly depending on many factors, including freight forwarders, contract type, origin/destination, container size, transit time, merchandise ready date, customs clearance, and charges at destination. Consequently, it is difficult to obtain comparable data. One of a few comparable statistics is China Containerized Freight Index (Shanghai Shipping Exchange 2014). Ocean container freight from Asia to the US East Coast is usually 20 to 30 percent more expensive than to the US West Coast. However, this price fluctuates greatly. For example, the ocean freight fee from Asia to the East Coast was occasionally cheaper than to the West Coast in 2012.

[3] SYP lumber includes commodity 4407100146 and 4407100147 plus 4407100102 from port districts in the Southeast. Treated lumber (4407100102) is not categorized by species; however, it is safe to assume that all treated lumber from the southeastern ports are SYP treated lumber. From 2007 to 2012, between 69.8 and 85.6 percent (between 185,000 and 309,000 m^3) of US treated lumber exports were from the southeastern ports. On the other hand, between 13.6 and 26.4 percent of US treated lumber exports were from ports on the West Coast, which is likely a mix of Western hemlock, Douglas-fir, Ponderosa pine, hem-fir, and other species.

[4] FOB price for kiln-dried SYP saps (Gulf or East Coast Port) clear 1 by 6 random lengths 10 to 16 feet and larger.

taiwanensis] lumber), and wood–plastic composite. Thus, preservative-treated SYP dominates the wooden outdoor construction market in Taiwan, and some Taiwanese companies have even imported SYP logs and lumber to produce preservative-treated lumber locally (Braden 2001). As the economy of mainland China grows, its demand for preservative-treated lumber has risen rapidly, especially in public projects. Some Taiwanese companies that have operations in mainland China have started SYP business operations by importing CCA-treated SYP lumber, nontreated SYP lumber, and SYP logs to China. Other Chinese companies soon followed, and SYP has now become one of the most popular preservative-treated lumber species in China (Cao et al. 2011).

Preservative-treated SYP lumber is not doing well in Japan because lumber markets there are quite different. In spite of two decades of stagnant growth since the 1990s, the wooden housing market in Japan is still the second largest market in the world in terms of housing starts. Japanese people prefer to build houses with wood, and about 90 percent of Japanese single family homes have wooden frames (Sasatani et al. 2010). Wooden housing starts composed 56 percent of residential units (549,971 units) in 2013 (Ministry of Land, Infrastructure, Transport and Tourism [MLIT] 2014), with the rest consisting of nonwood high-rise condominiums and apartments. The housing industry accounts for about 40 percent of the forest products consumed in Japan, and a great majority of softwood lumber is used for wooden frame buildings (Japan Forestry Agency 2011). Figure 3 depicts the estimated volume of softwood lumber consumed in Japan by species in 2013. It is estimated that 27 million m^3 of softwood lumber was consumed in 2013, with the majority used in the construction sector. With respect to species, it is estimated that about 40 percent of Japanese softwood lumber was sugi (Japanese cedar, *Cryptomeria japonica*); 24 percent was any type of imported spruce, pine, and fir (SPF), including SPF from Canada and European Whitewood (Norway spruce, *Picea abies*); 10 percent was Douglas-fir (*Pseudotsuga menziesii*); 9 percent was hinoki (Japanese cypress, *Chamaecyparis obtusa*); and 8 percent was Japanese larch (*Larix kaempferi*). Interestingly, the share of lumber made from Japanese domestic species has increased substantially in recent years due to at least six programs[5] that have been adopted in Japan to promote the use of domestic wood over imported wood (Aga 2014, Eastin and Sasatani 2014). Note that the estimated share of SYP in Japanese softwood lumber consumption was only 0.013 percent in 2013.

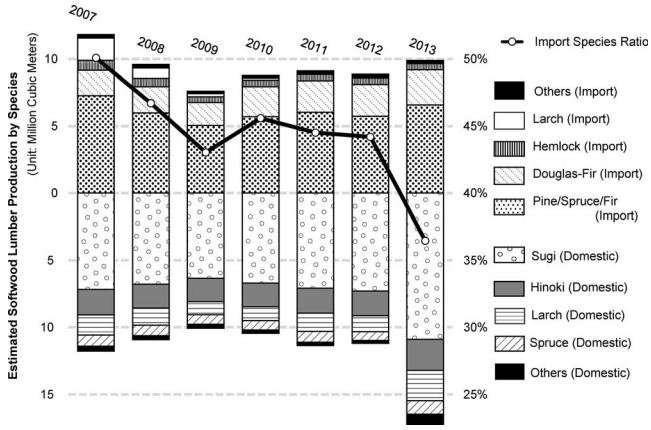

Figure 3.—Estimated share of softwood lumber available in Japan by species from 2007 to 2013. Bar charts above zero represent lumber made from imported species and below zero represent lumber made from Japanese domestic species. Trade statistics are compiled from Japan Customs' Trade Statistics (Ministry of Finance 2014) and lumber production statistics are from Forest Products Statistics (Japan Forestry Agency 2014). It is assumed that all imported softwood logs were converted to lumber, and the conversion rate is 62.9 percent based on Ikami and Murata (2003).

Laws and Regulations on Pressure-Treated Lumber in Japan

SYP lumber must satisfy legal requirements in order to be used in the Japanese construction markets. In Japan, pressure-treated lumber is a value-added forest product, which is controlled by both industrial and agricultural standards. The Japanese Industrial Standards (JIS) specify the standards used for industrial activities. The preservatives used for treating lumber are specified by JIS K 1570: 2013, ''Wood Preservatives'' (Japanese Standards Association [JSA] 2013), and the manufacturing process of pressure-treated lumber is specified by JIS A 9002: 2012, ''Preservative Treatments of Wood Products by Pressure Processes'' (JSA 2012). JIS A 9002 has been periodically revised to incorporate technological advancement and environmental regulations. The most recent revision was made in March 2012 (Kitada 2013). Because JIS only specifies the actual treating process and certifies the treating factories, it does not certify material performance (e.g., structural values).

On the other hand, Japanese Agricultural Standards (JAS) are made specifically for the agriculture and forestry industry. JAS specifies and certifies the performance of lumber. JAS states that the types of preservatives applicable to lumber are based on JIS K 1570. Once lumber products satisfy JAS criteria and pass sample testing conducted by government-backed rating bureaus, they receive JAS labels. According to Section 37 of Japan's Building Standard Law (BSL), building materials, such as lumber, must satisfy either JIS or JAS or be approved by the MLIT. JAS uses specification-based criteria, which are rather inflexible and may prevent some new products from entering into construction markets. In order to solve this problem, the Japan Housing and Wood Technology Center offers a third-party performance-based certification scheme called approved quality (AQ) certification for quality wood-based materials. Once a product satisfies AQ criteria, it obtains an AQ label and is treated as an equivalent to JAS certification. Virtually all domestically produced pressure-treated lumber for construction has either a JAS or AQ label.

As shown in Table 1, there are four large categories of wood preservatives for treatment specified by JIS K 1570: water-soluble wood preservatives (used by dissolving in water), emulsified wood preservatives (used by emulsifying

[5] Six programs include the Long-Term Superior Housing Program, Residential Housing Eco-Points Program, Promotion for the Use of Wood in Public Buildings Act, Forest and Forestry Revitalization Program, Feed-in Tariff System, and Wood Use Points Program.

Table 1.—Types of preservatives specified by the Japanese Industrial Standards (JIS) and the performance specification by Japanese Agricultural Standards (JAS).[a]

Category	Preservative	Abbrev.	JAS specification (kg/m^3)[b]		
			K4	K3	K2
Water-soluble wood preservatives	Quaternary alkyl ammonium compound	AAC	9	4.5	2.3
	Ammonical copper quaternary	ACQ	5.2	2.6	1.3
	Copper azole	CUAZ	2	1	0.5
	Boron quaternary	BAAC	6.4	3.2	1.6
	Quat. nonester pyrethroid compound	SAAC	5	2.5	1.3
	Azole quat. nonester pyrethroid compound	AZAAC	No specification under JAS		
	Azole quat. neonicotinoid compound	AZNA	4.8	2.4	1.2
Emulsified wood preservatives	Naphithenic acid (copper)—emulsified	NCU-E	1.5	1	0.5
	Naphithenic acid (zinc)—emulsified	NZN-E	4	2	1
	Versatic acid pyrethroid zinc	VZN-E	5	2.5	1.3
Oil-soluble wood preservatives	Naphithenic acid (copper)—oil borne	NCU-O	1.2	0.8	0.4
	Naphithenic acid (zinc)—oil borne	NZN-O	3.2	1.6	0.8
	Azole neo-nicotinoid compound	AZN	0.3	0.15	0.08
Oil-based wood preservatives	Creosote oil	A	80	NA	NA

[a] The lumber treated by the preservatives that are on JIS but not on JAS can be certified under approved quality (AQ).
[b] In order to satisfy a certain JAS specified category, it is required to use at least a certain amount (kg) of the preservatives absorbed per cubic meter of lumber. NA = not applicable.

in water), oil-soluble wood preservatives (used by dissolving in organic solvent), and oil-based wood preservative (to be used with the stock solution as is). Water-soluble preservatives can be further classified based on whether copper is used (e.g., ammonical copper quaternary, copper azoles) or not (e.g., quaternary alkyl ammonium compound, boron quaternary, quaternary nonester pyrethroid compound). Among pressure-treated lumber produced by the 25 large and midsized firms and their 44 factories belonging to the Japan Wood Preservers Industry Association (JWPIA),[6] copper-type water-soluble wood preservatives were used in 50.6 percent of the pressure-treated lumber produced in Japan during the first quarter of 2013. During this same period, non–copper-type water-soluble wood preservatives, emulsified and oil-soluble wood preservatives, and oil-based wood preservatives were 29.0, 12.9, and 5.9 percent of the pressure-treated lumber production, respectively (JWPIA 2013).

There are two trends in the Japanese pressure-treated lumber market. The first is the decreased use of creosote oil type wood preservatives over the last 40 years. Creosote-treated wood, mostly used for railroad ties and utility poles, has gradually been replaced by concrete in Japan since the late 1960s. The second is the disappearance of CCA-treated lumber in Japan. Because CCA was inexpensive and highly effective, it was mostly used in treating Western hemlock (*Tsuga heterophylla*) structural lumber for framing in Japan. However, since the mid-1990s, the health hazard of CCA-treated lumber has raised public concern because the poisonous chromium and arsenic compounds may leach from the CCA-treated lumber into surrounding soils, especially in an acidic environment (Iwasaki 2003). Furthermore, the revised Japanese Water Quality Pollution Control Act in 1997 put a restriction on arsenate emissions to discharged water. Thus, many factories decided to use alternative preservatives to avoid investments in expensive water clarification facilities. The Japanese treated-wood industry has voluntarily shifted to using preservatives that do not contain arsenic or chromium, such as quarterly alkyl ammonium compound (AAC) wood preservatives (Freeman et al. 2003). Finally, CCA was deleted from JIS in 2004 and from JAS in 2006 (Miyauchi and Mori 2009). Consequently, CCA has been virtually eliminated from Japanese markets.

Figure 4 shows the volume of treated lumber by usage in Japan. As mentioned, the use of treated lumber for railroad ties has been replaced by concrete, especially in urban areas. Between 73 and 83 percent of the pressure-treated lumber produced in Japan was used for structural lumber during the period of 1998 through 2012. About two-thirds of pressure-treated structural lumber in construction is for ground sills (dodai), the horizontal structural lumber closest to the

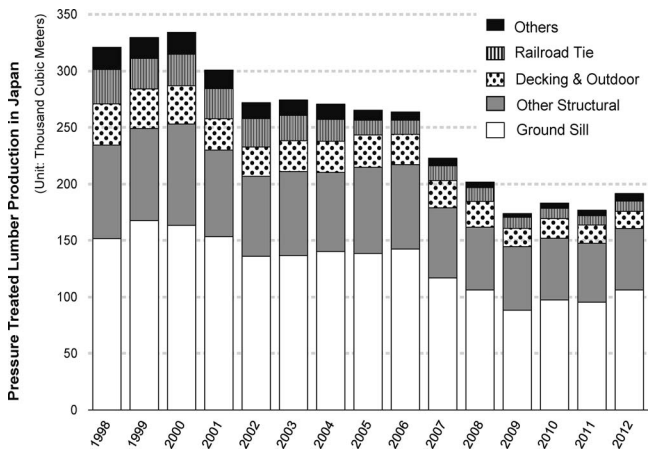

Figure 4.—Production volume of pressure-treated lumber by application. (Source: Japan Wood Preservers Industry Association 2013).

[6] JWPIA estimates there are 50 to 70 nonmember firms that produce pressure-treated lumber in Japan. However, all of them are small firms. All large and midsized firms in Japan are members of JWPIA.

ground. Pressure-treated lumber for exterior use, such as decking, exterior furniture, and playground equipment, accounted for about 8 to 11 percent during this same period. Because most pressure-treated lumber produced in Japan is for wood building construction, as housing starts decreased in Japan owing to the stagnant economy and changing demographics, the volume of pressure-treated lumber produced also decreased.

JAS assigns letters to treated lumber, such as K2, K3, and K4, based on the amount of preservatives absorbed and the degree of preservative penetration, which reflect different levels of performance. The degree of preservative penetration is different between D1 species[7] and other species. If pressure-treated lumber is made from D1 species, the degree of preservative penetration can be less than that made from other species to obtain the same level of performance. JWPIA (2013) explains that this level of performance is based on where the product is best suited: K2 (equivalent to AQ3) is for ground sills in cooler regions, K3 (equivalent to AQ2) is for ground sills in warmer regions, and K4 (equivalent to AQ1) is for exterior use.

Opportunity One: SYP Lumber for Structural Use in Housing Construction

Based on construction methods, wood houses in Japan are categorized as post and beam (P&B), 2 by 4, and wooden prefabricated construction (Sasatani et al. 2005). In 2013, total P&B construction starts were at 412,892 units (75.1% of wooden housing starts) and 2 by 4 starts were at 120,111 units (21.8% of wooden housing starts). Those two construction methods consume very different types of wood products.

SYP lumber for P&B construction

In contrast to North American 2 by 4 construction methods, Japanese P&B systems use a larger number of structural components and component sizes are greatly varied (Eastin and Larsen 2007). Based on the Japanese proverb of using the right lumber for the right place, builders usually use multiple ''right lumber species'' for a single P&B house. Although P&B construction methods are relatively complex, the Japanese P&B industry has enhanced its operational efficiency through technological innovation using precut lumber, especially after the Great Kobe Earthquake in 1995 and BSL's major revision in 1998 (Sasatani et al. 2010). Precut lumber is cut and routed by a computer-controlled process in a factory before being delivered to the job site. The lumber package is labeled by assembly order and bundled together as a house package, and even unskilled labor can assemble it at the job site.

A typical Japanese P&B house is built on short concrete foundation walls over a concrete slab, and its ground sills (dodai) are laid on the top of the foundation walls. Once dodai is installed, it is extremely difficult to replace. Section 49 of BSL states that structural lumber within 1 m of the ground (such as dodai) should be appropriately treated for antiseptic and termite prevention. But this law does not specify how the treatment should be done. Rather, some voluntary programs and policies specify the types of lumber that home owners can use for dodai. For example, if home buyers use the Japan Housing Finance Agency's (JHFA)[8] 35-year fixed mortgage plan, Flat 35, they must use either naturally durable species, such as hinoki, hiba, Alaska yellow-cedar, Port Orford cedar, and Western red-cedar, or K3 pressure-treated lumber from JAS for dodai (K2 in Hokkaido and Aomori prefectures).

As shown in Figure 4, dodai accounts for about half of the pressure-treated lumber manufactured in Japan. Eastin and Larsen (2007) estimates that dodai accounts for about 5.1 percent of structural wood of Japanese P&B constructions. Because the total volume of structural lumber used in P&B houses in 2013 was approximately 6.13 million m^3, it is estimated that 313,000 m^3 of dodai was used for new P&B houses built in 2013.[9]

According to JHFA (2012), 47.8 percent of the new wooden houses built in 2012 used pressure-treated lumber, 23.5 percent used lumber coated by preservatives, and 25.8 percent used nontreated lumber for their dodai. Among nontreated dodai used in 2012, 68.6 percent was hinoki, and the remaining species were hiba (17.5%), Alaska yellow-cedar (10.3%), and Port Orford cedar (1.4%; JHFA 2012). There was a larger variety of species used for pressure-treated lumber in 2012: 23.4 percent Douglas-fir, 18.4 percent hinoki, 6.6 percent Japanese larch, 6.4 percent European redwood (Scotch pine, *Pinus sylvestri*), 6.1 percent Alaska yellow-cedar, 2.1 percent hiba, and 1.4 percent sugi. The great majority of the remaining 35.2 percent was likely pressure-treated Western hemlock.[10] According to Mr. Tokio Sekizawa of JWPIA, pressure-treated SYP may not have been used at all for dodai in 2012 (personal communication, December 5, 2013).

Pressure-treated SYP can be an appropriate product for dodai because of its durability. However, several issues need to be resolved for pressure-treated SYP manufacturers to enter this market. First of all, the cross-sectional measurements of dodai in Japan are usually 105 by 105 mm, or sometimes 120 by 120 mm. In the US South, most SYP lumber is cut to North American dimensions (Cao et al. 2011). More importantly, in order to sell to Japanese home builders, US lumber treaters need to provide JAS- or AQ-certified pressure-treated lumber, which is extremely difficult and costly for foreign suppliers.

According to anonymous responses by a number of lumber traders and home builders, one large home builder bought SYP logs and manufactured SYP pressure-treated glulams locally for dodai in the 1990s. This operation did

[7] D1 species are naturally durable species including hinoki, hiba (*Thujopsis dolabrata*), sugi, Japanese larch, Port Orford cedar (*Chamaecyparis lawsoniana*), Western red-cedar (*Thuja plicata*), Alaska yellow-cedar (*Cupressus nootkatensis*), Douglas-fir, and Dafurian larch (*Larix gmelinii*).

[8] JHFA, formerly the Government Housing Loan Corporation, is an incorporated administrative agency wholly owned by the government. JHFA used to directly lend housing mortgages to home owners, but it has changed its business model to focus on enhancing securitization of long-term fixed-rate housing loans for eligible home owners.

[9] Total floor area of new housing starts of P&B houses (excluding 2 by 4 and wooden prefabricated houses) is estimated as 44,577,283 m^2, because the wood consumption per square meter of a P&B house is estimated to be 0.191 m^3 based on JAWIC, and 72 percent of that is structural lumber.

[10] Although pressure-treated western hemlock is very popular for dodai, JHFA did not record statistics since it is not a D1 species of JAS.

not work out because the pressure-treated SYP glulam had some defects. Even though it was due to the company's own manufacturing process, SYP lumber has gained a bad reputation in Japan ever since.

SYP lumber for 2 by 4

In 1974, the North American 2 by 4 construction method was allowed in Japan. Yet, the accompanying ministerial announcement related to ''Technical Code of Wood-Frame Construction Method'' (BSL No. 56) by the Ministry of Construction (MoC) forced 2 by 4 builders to use only JAS certified lumber (JAS 600 for dimensional lumber and JAS 701 for finger-jointed lumber) for the frame parts of 2 by 4 constructions. In 1997, this was revised to adopt performance-based criteria instead of specification-based criteria, and the ministerial announcement BSL No. 1452 by the MoC in 2000 specifies the design value–based criteria for 2 by 4 construction methods. Further, the ministerial announcement by MLIT (the MoC merged with the Ministry of Transport in 2001 and became MLIT) in 2001 states that the lumber species group shown in announcement No. 1540 can be applied to structural parts of 2 by 4 construction even though they are not JAS certified. Consequently, US dimensional lumber, machine stress–rated lumber, and finger-jointed lumber with approved US grade stamps from the Pacific Lumber Inspection Bureau, the West Coast Lumber Inspection Bureau, the Western Wood Products Association, and the Southern Pine Inspection Bureau (SPIB), have been approved as strength-assigned materials for use in 2 by 4 constructions.

Currently, Japanese 2 by 4 construction is dominated by SPF and hem-fir dimensional lumber from the Western part of North America because of well-established distribution channels, especially between Canadian manufacturers and Japanese 2 by 4 home builders. Dimensional lumber made from domestic species exists, but their supply is limited.[11] For the ground sill part of 2 by 4 houses, some builders prefer to use pressure-treated lumber, which can absorb more preservative than SPF, such as Western hemlock and Douglas-fir.

Although SPIB-certified SYP lumber is applicable for 2 by 4 constructions in Japan, several problems need to be solved before SYP can be used. First, the distribution channels of SYP are not well established. As such, 2 by 4 builders in Japan cannot purchase SYP dimensional lumber on a regular basis, and some Japanese builders are not even aware of SYP lumber. Regardless of price, no one is going to use lumber that is not constantly available. Second, reduced design values for SYP in June 2012 have caused confusion among Japanese architects and builders. SYP species are included in the category of ''Douglas-fir–Larch'' in ministerial announcement No. 1540. The presumption of the standard was that the design values of Douglas-fir and SYP are very similar. However, the reduction of SYP strength values by the American Lumber Standards Committee of around 25 to 30 percent has hindered the potential uses of SYP in Japan.

[11] There are 15 JAS-certified 2 by 4 lumber sawmills (7 in Hokkaido and 8 elsewhere) in Japan, which process Japanese domestic species, such as sugi, hinoki, Japanese larch, Sakhalin fir (*Abies sachalinensis*), and Yezo spruce (*Picea jezoensis*), as of February 2013 (Japan 2×4 Home Builders Association 2013).

Opportunity Two: Decking

Because BSL only specifies the performance criteria for structural parts of the building, it does not regulate decking installation projects. In addition, JAS does not have any specifications for lumber used in exterior applications. Hence, contractors and homeowners who would like to install small-scale decks can freely choose their building materials. Although a typical Japanese single family house and its lot are relatively small, the decking market in Japan has steadily grown over several decades (Kanai 2009). The Japan Exterior Industrial Association estimates that the size of decking products made of natural wood was approximately 5.5 billion yen (US$53 million; the average USD/JPY exchange rate in 2008 was 103.36) and decking products made of wood composite materials was around 8.5 billion yen (US$82 million) in 2008 (Kanai 2009).

Although the decking market will likely continue to grow in the future, decking builders who were interviewed gave three reasons why wood composite materials have gained market share at the expense of natural wood materials. One is that wood composite materials are uniform, durable, maintenance free, and almost defect-free. Second, large wood composite manufacturers have established distribution channels and have been vigorously promoting their products. Finally, most wood composite materials are not controlled by fire code, so they could be used in dense urban areas. In fact, the production volume of wood–plastic recycled composite in Japan was 26,870 tons in 2012, an increase of 54.7 percent since 2008 (Japan Construction Material and Housing Equipment Industries Federation 2013).

Regarding decking materials made of wood, domestic species such as hinoki and sugi, Western red-cedar, treated SPF, and tropical hardwood such as ipe (*Handroanthus* spp.) and ulin (*Eusideroxylon zwageri*) are often available in retail stores (e.g., pro dealers and do-it-yourself [DIY] retailers) and widely used. Western red-cedar has a rich color, grain, texture, and good appearance, but often its color varies piece to piece. It is nonetheless durable, easy to cut, and does not need to be pressure treated. Commonly used tropical hardwoods are naturally durable due to their density. However, these woods are expensive and more difficult to cut, making installation more labor intensive. Hinoki, a naturally durable domestic species, has a beautiful appearance and is easy to cut but is also relatively expensive. SPF lumber is readily available in virtually all DIY retail stores and is perhaps one of the cheapest options for decking material. Most SPF lumber for decking is treated with preservatives. As the heartwood parts of some SPF lumber do not absorb preservatives, the durability of SPF lumber is, however, in question for outdoor applications, especially in warm regions.

Many professionals in the US South believe that pressure-treated SYP is the most ideal product for decking. Many deck builders in the United States hold the view that pressure-treated SYP lumber is widely available, inexpensive, and durable (Ganguly et al. 2011). In Japan, some large treaters produce pressure-treated SYP decking installation packages and sell them for home builders. However, most decking installations are small projects by contractors or home owners who usually go to DIY home centers to purchase their building materials. As of now, most DIY retailers do not carry pressure-treated SYP. Perhaps the

fundamental issue of pressure-treated SYP use in Japan is the lack of awareness. According to a survey by American Softwoods, only about 20 percent of Japanese builders, contractors, and architects who attended the Japan Home Show were familiar with SYP, while 43 percent of them have never heard of it (Igarashi 2007).

Strategic Steps for Selling SYP Lumber in Japan

Although high-grade SYP lumber has a niche market in the furniture manufacturing industry, commodity grade SYP has not been used for housing and decking in Japan. A majority of SYP lumber producers in the United States see international markets as great opportunities for the sale of excess product. Hence, they adopt a ''sales-push'' approach (Sasatani 2013). However, this approach does not work in the Japanese market. In order to penetrate the Japanese market, SYP producers need to adopt a market-driven approach—a company should start by researching the Japanese market and then decide its offering in terms of products, services, and promotions. However, there would be limitations on the entry of a single company into this market because the Japanese market is already ''locked-in.''

The current status of the Japanese housing and decking markets described in this article is a result of historical developments. Firms in the industry are interdependent, and many factors, such as architectural design, technology, standards, and perception, create network externalities in the markets. Once firms decide to focus on some species of lumber, it is costly for them to switch to another species. Precutters and builders prefer readily available species and invest in learning how to use those species efficiently and effectively with their business operations. Knowledge and technology on the use of certain species spreads through these industries over time. Policymakers will then often set up regulations considering the use of popular species and tend to overlook less used species. Products made from more popular species have high customer loyalty; these customers repeatedly purchase those products. As these customers are locked-in to the use of particular species, other products from species such as SYP will have a difficult time penetrating markets without a substantial marketing effort. This lock-in could be broken by a significant shift in regulations, technology, knowledge, consumer tastes, or other market factors. Thus, SYP lumber producers need to make a concerted effort in order to gain some market share in Japan. Breaking the lock-in is extremely difficult for an individual firm, and a coordinated effort by several firms or even the whole SYP industry can lead to a successful penetration of SYP into a lucrative market like Japan.

As for tactics, the SYP industry as a whole can do several things to promote SYP lumber in Japan. First, problems regarding standards and other regulations must be resolved. At the moment, US treaters cannot sell SYP pressure-treated lumber without a JAS or AQ label to Japanese house builders. Meeting all the requirements associated with Japanese regulations and business customs is challenging, but without meeting these requirements it is not possible to sell SYP lumber in Japan. On the other hand, SYP producers should lobby against any policies that can unfairly limit the market opportunity for SYP products in Japan. Second, it is necessary to increase customer awareness of SYP species and to promote the beneficial features of SYP pressure-treated lumber to DIY retailers, decking builders, precut manufacturers, and home builders in Japan. Perhaps funds generated from the softwood lumber check-off program could be used for this purpose. Finally and most importantly, there needs to be a well-established distribution channel for SYP lumber between the Southeastern United States and Japan. Yasuyuki Horikawa, who is the president of Chugoku Mokuzai, the largest sawmill firm in Japan, stresses that the most value to his company comes from transportation logistics (Mokuzai Kenzai Weekly 2012). Securing market share is important from the beginning. Shipping SYP logs to Japanese sawmills and allowing them to procure lumber for Japanese housing applications is a start. Then investing on how to use SYP efficiently in home construction could benefit the entire SYP industry for the long term.

Douglas-fir, Canadian SPF, and European whitewood glulam are currently popular within the Japanese residential market. Many companies, organizations, and individuals collectively have put in effort to penetrate and develop markets for those species. The SYP industry has the size and resources to replicate this success.

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