INCREASING VALUE-ADDED HARDWOOD LUMBER PRODUCT EXPORTS TO INDIA THROUGH INFORMED PURCHASE DECISIONS
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The India sawmill industry is primarily comprised of thousands of small simple mills that are very rudimentary in their construction, allow for a low capital investment, and are labor intensive in operation. There is a misconception by Indian/Asian manufacturers that they can process logs into value-added lumber products more cheaply than importing value-added lumber products from the US. Freight costs and production quality issues negate this misconception. The intent of this project was to analyze India's wood industry, and assess the needs and issues within India's sawmill and secondary wood industry. The project identified opportunities for exporting value-added hardwood products from Wisconsin and the Great Lake States.

One of the project deliverables -- the "Lumber versus Log Import Estimator" -- is a powerful tool that enables companies to project the yields of lumber and grade of lumber from a distribution of logs. The spreadsheet can be adapted to consider India's 5% tariff on imported logs and 15% tariff on imported lumber by adding the tariff to the log cost as a percent increase in the deliver log cost. The sophistication of the estimator will allow a company, after some familiarization with the program, to be able to model their operation to make a more informed decision on purchase of logs or lumber.

FINAL REPORT

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Increase Value-Added Hardwood Lumber Product Exports

From Wisconsin and Lake States to India

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Executive Summary

This objective of this project is to increase exports and improve market share for value-added hardwood lumber products from Wisconsin and the Lakes States to India. Our goal is to demonstrate that it is more profitable for Indian/Asian companies to import kiln-dried value-added hardwood lumber products vs. hardwood logs from the US; thereby creating more profit and jobs in the USA.

There is a misconception by Indian/Asian manufacturers that they can process logs into value-added lumber products more cheaply than importing value-added lumber products from the US. Freight costs and production quality issues negate this misconception. The intent of this project was to analyze India's wood industry, in order to ascertain the needs and issues within India's sawmill and secondary wood industry. The end result of the inquiry was to identify opportunities for exporting value-added hardwood products from Wisconsin and Lake States. Based on the information gathered in India and accepted U.S. Forest Industry information, a spreadsheet was developed as one of the primary goals of the project. The "Lumber versus Log Import Estimator" is attached with this report.

The "Lumber versus Log Import Estimator" is a powerful tool that will allow companies to project the yields of lumber and grade of lumber from a distribution of logs. The program can be adapted to consider India's 5% tariff on imported logs and 15% tariff on imported lumber by adding the tariff to the log cost as a percent increase in the deliver log cost and the lumber price can be adjusted to reflect the lumber tariff. The sophistication of the estimator will allow a company, after some familiarization with the program, to be able to model their operation to make a more informed decision on purchase of logs or lumber.

The forest industry in India varies considerably, in comparison to the forest industry in the State of Wisconsin. The Indian primary (sawmill) industry is comparable, to a certain extent, to Wisconsin's sawmill industry 100 plus years ago, but on a very different scale in that Wisconsin, even a century ago, had mills that produced millions of board feet of lumber annually. India, on the other hand, has hundreds of small sawmills, with even the highest producers struggling to produce a million board feet in one year. The care and handling of logs and lumber in India is very rudimentary and results in substantial loss of both volume and quality.

However, there are several secondary wood manufacturing firms in India that have "state-of-the-art" equipment with automated and computerized operations. Although these high production companies are in the minority when it comes to number of companies, their automated production gives them a substantial share of the total products produced. The majority of the companies in the secondary industry are much more labor intensive, with a high proportion of their processing and assembly completed manually. Even with these completely different systems in place throughout India, there appears to be significant market share for both types of operations. The one thing both have in common is the need for high quality raw materials.

In the past, Teak was a species that was dominant throughout the Indian wood industry. With several countries in Asia either banning or heavily regulating the logging of Teak, many Indian companies are looking for an alternative species with a dark color. Although Black Walnut was mentioned repeatedly, and is currently being utilized by some companies, its high value does not make it a realistic alternative for large volume manufacturing. In the initial visit (12/12), the Wisconsin team discussed the

opportunities for marketing Black Locust and Black Ash, as dark wood alternatives to Teak. Although sawlog volumes of either one of these species are not abundant in Wisconsin, markets for them are sporadic and there is definite potential to establish a viable export market for both species. Another option is thermally modifying lighter colored species such as White Ash or Basswood, which are much less costly than Teak and Black Walnut, and would have the desired dark color, once thermally modified. There currently is not a company in Wisconsin that does thermal modification, but there is significant potential for one to be established. With the spread of Emerald Ash Borer throughout Wisconsin any process that will increase the value of and markets for Ash lumber will be welcomed. There is some use of thermally modified Beech, imported from Europe by Indian companies.

Another issue, which became quite apparent, is that most of the secondary industry companies often deal in small quantities of lumber for specific orders and many times, are unwilling to order a full container of one product. India representative for AHEC stated that Indian companies can order a mixed container of lumber from European companies that contain different species and grades of lumber, even from different mills, but that American exporters are unwilling to do the same. When asked what solution might be workable in order to get more American lumber imported to India, AHEC representative stated that he thought having volumes of various species and dimensions of lumber shipped to India and sold there could be a way to encourage increased sales of American lumber. There are several different ways to accomplish this and there would be a need to research the species and dimensions in the highest demand.

There is a definite opportunity for Wisconsin and Lake States' companies to provide lumber, parts, and other wood products from a variety of tree species. As demand for certified wood increases, Wisconsin and Lake States are well positioned to meet demand for certified lumber versus Indian sawmills having to be certified. The efforts put forth through this project in presentations, trade show booths, articles, and one on one company visits has opened the door for exporting Wisconsin wood products. Additionally, the calculator and continued effort of AHEC will provide further impetus.

The comparison between Indian companies importing Wisconsin kiln dried lumber versus importing and manufacturing Wisconsin logs shows a distinct advantage across all five species and three log grades that were examined. This advantage is evident even without figuring in the potential losses caused by rudimentary log sawing and drying techniques used in India which can cause rejecting of lumber, lumber parts, and even finished products due to not meeting quality specifications.

Importing kiln dried lumber from Wisconsin and Lake States has the distinct advantage of having a quality raw material going into the value-added manufacturing process that has been sawn and dried to very defined and identified standards. Lumber that is sawn and dried in India has the potential to have a high rejection rate of lumber, lumber parts, and finished projects than imported Wisconsin and Lake States lumber.

Comparison of Indian Lumber Yield and Drying Processes to Standard U.S. Industry Practices

Indian

The India sawmill industry is primarily comprised of thousands of small simple mills that are very rudimentary in their construction, allow for a low capital investment, and are labor intensive in operation.

Yield is commonly expressed in two different ways as overrun and lumber recovery factor (LRF). Overrun is the difference in lumber tally vs log scale expressed as a percentage of log scale. For example, if tally = 110, scale = 100, then overrun is (110-100)/100 or 10%. Overrun is significantly impacted by the log rule used, the log distribution being processed (particularly with regard to diameter), the sizes of product being sawn (particularly with regard to thickness) and the efficiency of the equipment and the workers involved in production and other things, such as if the lumber being produced is oversized or undersized in relation to its nominal dimensions. On the other hand, LRF is the lumber recovery per cubic foot of log input. LRF is also impacted by the log size (diameter) distribution but not to the extent that overrun is. LRF is the factor that is used in the report to describe the efficiency of sawmills and the variation in recovery when comparing Wisconsin processors to firms in India. The lumber yield from these mills in India would be expected to be an LRF of 5 to 6 board feet of lumber per cubic feet of log input while the Wisconsin hardwood sawmills that would export to India have an LRF of 6 to 7 board feet per cubic foot of log input, which is a 17-20% increase in log yield. This gap in lumber recovery is largely due to differences in sawmill technologies and kiln drying practices between the two countries.

The United States has had a sawmill improvement program offered nationally that has been delivered in coordination with State specialists. Wisconsin, in particular, has been very active in working with sawmills to improve efficiencies and production. This continuous improvement has resulted in high quality lumber produced to very exacting specifications that is essential to the production of high quality products.

The majority of the India mills consist of a small horizontal band saw with a very simple cable system for moving the saw up and down with a typical saw kerf of .110 inch. The saw is manually positioned by the sawyer using a steel ruler to determine board thickness. The log is drawn through the band saw on a carriage connected to a cable that is attached to a capstan that is turned by an employee turning a steering wheel. After the cut has been made the log carriage is just pushed back by a worker. The sawing pattern appeared to be more determined by the weight the laborer could lift than by a desire to optimize recovery. Larger logs were split into thirds, put on the carriage and sawn into boards with minimal turning of the log segment as shown in Photo 1. Turning of the log would be an essential step in maximizing lumber grade.

Photo 1. Log begin sawn into boards on a carriage.

The edging of the boards was done on a vertical band saw as shown in Photo 2. The straight line on the boards was established with the use of a chalk line and the operator edged the board by following the chalk line without the aid of a fence. A fence is essential to controlling uniformity of board width, without it width can vary on individual boards leading to considerable waste if the board is too narrow in places to meet specifications. The set works to determine widths was comprised of different sized board placed on the table to form a fence for the saw to establish the width of the board as shown in Photo 3. One operator that we observed would vary the boards place on the saws table to change the sets establishing the widths of the board. The operator appeared very skilled at doing this, but it is still considerably less accurate and more prone to error than an attached metal fence.

Photo 2. Edging of boards using a vertical band saw in an Indian Mill.

Photo 3. Boards being used as a fence to determine the width of the sawn board.

These sawmills cut small volumes and tended to cut to order for small furniture companies. Many of these companies use the "green" wood which then has the potential of leading to many defects in the finished product as drying occurs.

Some of the mills visited had dry kilns for drying the lumber. Similar to the sawmill operations, the kilns were very basic with minimal controls and lack of operator knowledge of the drying process added to the potential for lumber degradation. The kiln-dried lumber we measured at the mills visited was not dry, and routinely the range of high moisture content found was in excess of 20%. Photo 4 shows the moisture content being tested. The operator monitored the lumber primarily with an electric moisture meter, and did not use sample boards or check for drying stress. Kiln controls to monitor humidity and temperature in the kiln were rudimentary. The end product produced and sold to the furniture companies, for example could be boards that will shrink and have stresses that will lead to manufacturing problems and failure in the finished product as shown in Photo 5.

Photo 4. Moisture content reading.

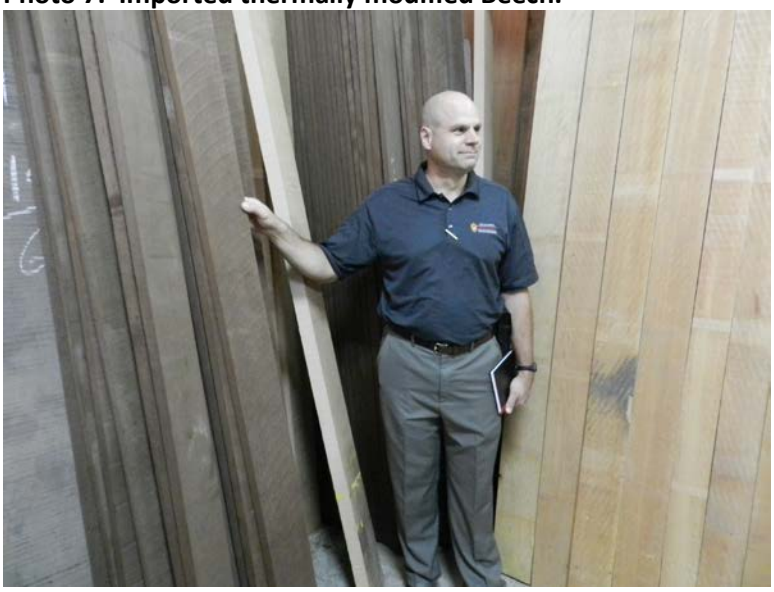
Photo 5. Stressed boards.

The secondary forest industry in India was mixed between very labor intensive shops and "state of the art" operations with a high degree of automation and computerization. A state of the art mill is shown in Photo 6. Although very few in numbers comparatively the latter operations, because of the increased production, had a substantial market share. The cheapness of labor in India makes the labor intensive companies viable, as well with considerably less volume produced per employee but with finished products still being produced at reasonable prices. A common issue for both types of operations is obtaining high quality lumber to use in their manufacturing process. All of the secondary manufacturing companies we met with had experience issues with purchasing the lumber they needed to their required specifications.

Photo 6. State of the art Indian mill.

Teak has been a mainstay in the Indian wood manufacturing industry for decades. With the more recent banning or high degree of regulation being imposed on Teak logging in many countries, there has been a shift to other species in response to the shortage of Teak. Thermally modified wood such as Beech imported from Europe has been one answer, as shown in Photo 7. Thermal modification is not widespread in the United States and potentially presents an opportunity for marketing some of Wisconsin's lower value hardwoods such as Ash or Basswood.

Photo 7. Imported thermally modified Beech.



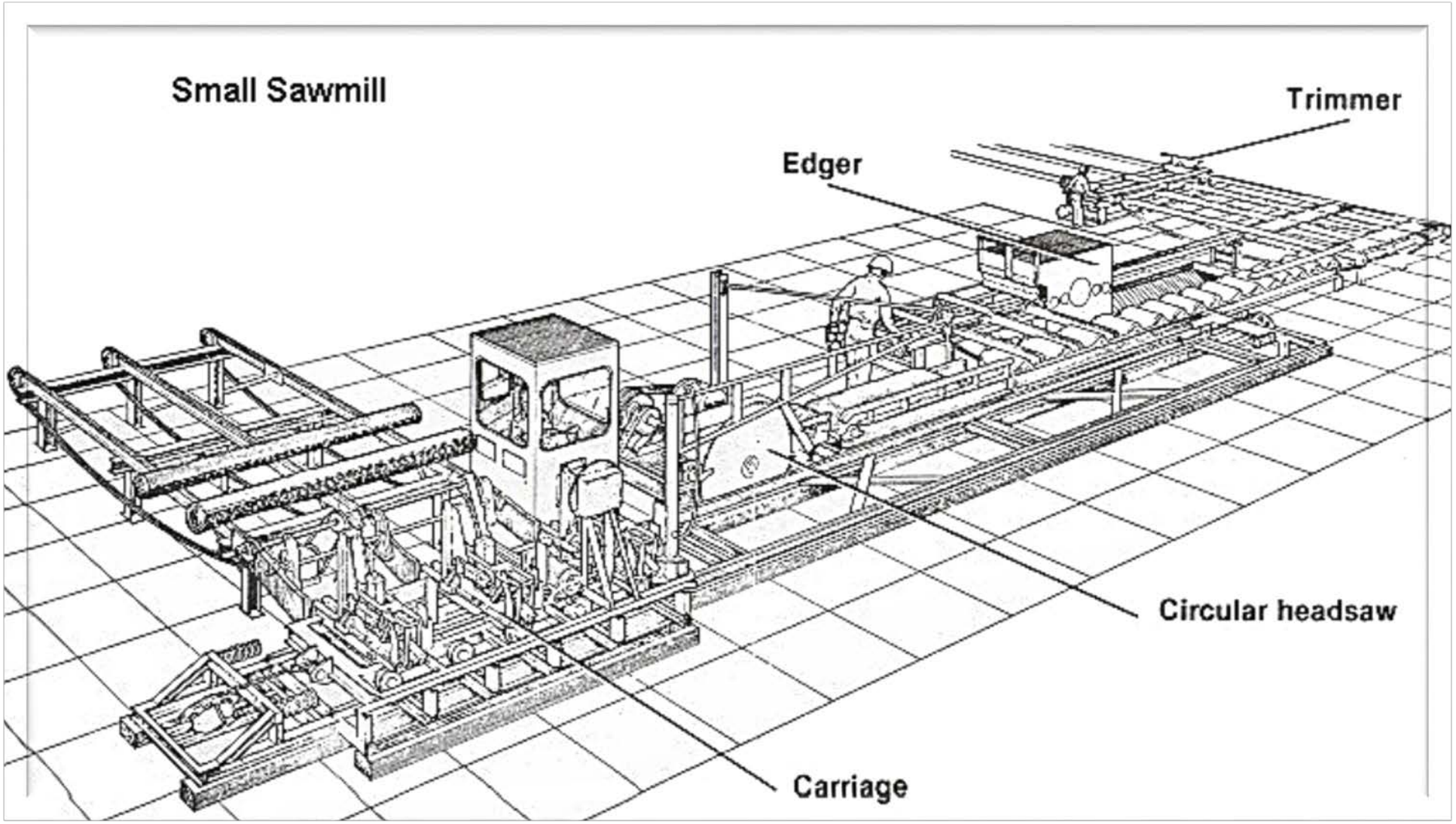
Wisconsin/American

In comparison, sawmills in Wisconsin, Lake States and the rest of the United States, especially those that are exporting, are very large, capital-intensive operations that use state of the art equipment. They have rigid performance standards for all aspects of processing lumber from initial sawing to drying.

The headrig will consist of either a band saw or circle saw although a bandsaw is more common because it has a thinner kerf, thus producing less waste than a circle saw. The log will be handled mechanically by the system, more importantly the operators' decisions are assisted by computers. A scanner will scan the log for its geometry and a sawing solution will be calculated to optimize the recovery with the market need taken into account. The equipment has excellent repeatability in changing it sets with tolerances of 0.001 of an inch. Due to market requirements of oversizing the boards, a lumber recovery of 7 bf per cubic foot of log input is a realistic average. Yield studies have found that sawmills using optimization technology will achieve an improvement of 10% additional recovery over mills not employing optimization technology.

The edging and trimming equipment downstream from the headrig may also have optimization technology, which additionally improves yield. These systems include scanner and computer assisted decision making that improves yields and accuracy. It has been proven that when you can automate the decision making in edging, yields can be improved by approximately 10%. Figure 1 shows the layout of a typical Wisconsin sawmill.

Figure 1. Diagram of a typical small Wisconsin sawmill.



More important for the furniture makers than yield, is the consistency of these systems to produce uniformly sized lumber. This is measured in efficiency studies by developing sawing variation numbers calculated from measurements taken on the boards at different locations along their length. From these studies, the sawing variation numbers within board variation and between board variation are developed. Within board variation is a measure of the variability in the thickness of lumber produced due to various factors, such as the saw moving around while the board is sawn causing thick and thin areas on the board. Between board variation, is a measure of the variability of the from board to board, due to various factors such as the accuracy of the setworks equipment in setting for the board thickness. Well maintained modern sawmills routinely have within and between board variations which are each close to or in many cases less than 0.020 inch for each form of variation. In manual systems like those seen in India, you would expect to see a total variation or a total process standard deviation that is closer to 0.060 inch and sometimes exceeding 0.100 inch.

The importance of this uniformity in the production of lumber is that it allows the furniture makers to produce a consistent finished product with minimal product rejection due to lumber flaws. On the automated mills used in Wisconsin, a board rough finished at 1 1/8 inch after drying will actually finish at 1 inch with minimal board variation. While the variation found in the mills used in India, you will have trouble getting a 1 1/8 inch board to surface at ¾ of an inch without some parts of it still being rough. When you have extreme variation like that produced from the manual type mills in India, additional thickness is required on the boards so that after they are manufactured they will finish out to the desired thickness, hence you will have to use a thicker board for the part you want to produce which means a higher expense for more board feet of lumber to make the same product.

The other area of significant manufacturing quality difference is drying of the wood. The kilns observed in India were very rudimentary and the kiln operators were diligent but lacked training and the tools to properly monitor or evaluate the efficiency of their kilns. None of the operators that we met knew how to check a sample for drying stress, and they used just a moisture meter to monitor the kiln, used simplistic drying schedules, and did not use kiln sample boards which is a common practice in the U.S. During the visits to plants in India numerous moisture contents (MC) were taken, the outer shell of the boards were in the 10-15% MC while the core of the board was often found to be up to 20 to 25% MC, or double the moisture content of the shell or up to 10% higher in measured moisture content. This will create problems in the manufacturing of furniture. There will be excessive shrinkage and drying stresses that occur in the board. Variations in moisture contents and lumber that has not been properly conditioned to remove drying stresses will display checking, warping, glue failure, and other problems, leading to either rejection of parts used or the end product. Kiln operators in Wisconsin generally have significant initial and ongoing training in regards to kiln operation, drying processes, and specific qualities of different tree species.

In Wisconsin sawmills, the dry kiln is a very sophisticated machine with kiln controls that monitor the temperature and relative humidity in the kiln. Furthermore, most kiln operators in Wisconsin have a general knowledge of the drying process, and many complete advanced training in kiln drying. Kiln procedures are followed that allow for the checking of MC using the oven dry method and prong test which check for drying stress. This is done on kiln sample boards (used to monitor the progress of the lumber so it is properly dried and stress free) that are placed in strategic locations in the kiln charge

(volume of lumber dried at one time in one kiln. The number of sample boards depends on the kiln size. For the furniture company this means lumber that will behave in the manner expected, resulting in less waste, and a higher quality product and very minimal rejection of parts or final products.

In addition to implementing sophisticated sawmill technologies, many US wood manufacturers have utilized state and federal assistance to improve consistency, efficiency, and yield as mentioned previously. Additionally, there are a variety of training tools and information made available by trade associations and equipment manufacturers.

Examination of Shipping Costs: Comparing Raw Logs & Value-added Lumber Products

The growing acceptance of American hardwoods in India makes species such as American red oak popular with designers and architects. Like all businesses, Indian wood manufacturers must watch their raw material costs to remain competitive in the marketplace. Manufacturers will tell you that the cheapest price is not always equal to the best value. This is the case when comparing the import of American hardwood logs vs. American hardwood lumber. On the surface, importing American hardwood logs appears to be less expensive than buying pre-manufactured American hardwood lumber. However, let's consider this common perception and examine the true cost of importing logs vs. lumber.

To understand log and lumber pricing, we must first understand grades. American hardwood lumber can be broken into the following grade categories (Table 1). FAS, F1F, and Select[1] is the highest grade group, has the highest percentage of defect-free wood, and commands the highest price. #3 A & B is the lowest grade group, has the lowest percentage of defect-free wood, and commands the lowest price.

Table 1: Hardwood Lumber Grades and Prices for Kiln Dried American Red Oak (US$ per MBF, Source: HRX 03/14/2014).

Lumber Grade	Percentage Clear (no defect)	Price per MBF
FAS, F1F, and Select	83%	$1900
#1 Common	67%	$1400
#2 A & B	50%	$1120
#3 A & B (green pricing)	33%	$655

When purchasing pre-manufactured American hardwood lumber, a particular grade or mix of grades can be specified on the order invoice. This is not the case when purchasing logs. Logs will yield a mixture of grades when sawn. The resulting lumber grades depend upon the quality of the log.

Table 2 shows the standard log grades for American hardwoods. Veneer logs represents the highest grade group which is typically too valuable to be sawn into lumber and is used for veneer production. The grades of F1, F2, and F3 are typically sawn for lumber.

[1] FAS, F1F and Select refer to the top grades of US hardwood lumber. See www.americanhardwood.org for a full description.

Table 2: Hardwood Log Grades and Example Lumber Grade Recovery for Red Oak.

Log Grade	Log Price (MBF)	FAS, F1F, and	#1 Common	#2A	Below #2A
Veneer	$900+	NA	NA	NA	NA
F1	$800	49.0%	28.3%	14.6%	8.1%
F2	$600	22.0%	34.5%	25.3%	18.2%
F3	$425	7.0%	22.3%	34.4%	36.3%

Notice that all lumber grades are produced when processing a log into lumber. The highest grade sawlog, F1, will produce the largest percentage of FAS, F1F and Select lumber at 49%. The lowest grade sawlog, F3, will produce a much lower percentage of FAS, F1F, and Select lumber at 7% (Table 2).

One problem with shipping logs from the United States and sawing them in India is the large amount of low grade lumber that will be produced from these logs. In the United States, low grade material such as #3 lumber is used by the pallet and container industry; #2 lumber is used by the hardwood flooring industry. If an Indian manufacturer needs #1 Common or higher grades for their production facility, as much as 70% of the lumber could be low grade material if they are processing F3 logs in India. Another problem is the degradation of logs from the time they are harvested in the United States to when they are sawn in India. Staining and checking of logs during this time can have a dramatic impact on the grade and quantity of lumber produced from these logs. Changes in heat and moisture conditions that the logs are subjected to during the shipping and/or storage process can be major factors in the occurrence of staining and checking.

Photo 8. Severely checked log that was in an Indian factory.

Photo 9. Dr. Scott Bowe discussing whole log exporting.

Shipping logs vs. lumber poses another problem with the shipping container. As you would expect, rectangular lumber packages easily fit into standard ocean cargo shipping containers. Square edged kiln dried lumber stacks well and fits nicely within the rectangular container. Round logs pose more challenges. Logs take up more space and weigh more than the lumber that could be produced from that log. When shipping logs, you ship the bark, sawdust, and other waste products that are generated during the sawing process. Typically, these waste products account for 50% of the log. In addition, you ship a great deal of moisture (natural water found in the log). This large volume of water is not present in kiln dried hardwood lumber, which weighs about half as much a green lumber that has not been dried.

If you take into consideration the grade recovery when converting logs in to lumber, as well as the increased space requirement for shipping round logs, it takes several containers of logs to equal the equivalent of lumber. For example, shipping F1 logs might require 2.6 containers to generate the equivalent of 1 container of #2 and better lumber; while shipping F3 logs could require 3.8 containers to generate the equivalent of 1 container of #2 and better lumber. (The exact ratios would depend on a number of factors including species differences, grade differences, etc.) As shipping costs continue to increase, one needs to carefully consider the added costs of shipping logs vs. lumber.

If we consider grade recovery, shipping costs, sawing costs, etc., the costs of sawing and shipping grade F1 American red oak logs could exceed the lumber value by US$64 per thousand board feet (US$150 per cubic meter)[2] of logs or more. The costs of sawing and shipping grade F3 American red oak logs could exceed the lumber value by US$167 per thousand board feet (US$393 per cubic meter) of logs or more. Clearly, pre-manufactured American hardwood lumber in many cases provides the best value, saving hundreds of dollars per thousand board feet of finished lumber.

[2] One thousand board feet (1 MBF) = 2.36 cubic meters. 1 cubic meter = 35.315 cubic feet. See www.americanhardwood.org for more information.

To facilitate log vs. lumber cost comparisons, we have developed a costing tool, which is available here: http://www.fwe.wisc.edu/wood-products-publications. This simple spreadsheet can be adapted to your company and specific production costs. Shipping costs, lumber costs, logs costs, labor costs, and exchange rates can be modified to reflect your company's needs. The results will show the true cost of shipping logs vs. lumber.

Log vs. Lumber Costing Tool Examples

Let's examine five scenarios that demonstrate the capabilities of the Log vs. Lumber Costing Tool. These examples use typical costing data that would be found in Indian sawmill operations (sawing costs and drying costs). These five examples will demonstrate the cost of shipping logs vs. lumber from north central Wisconsin to Mumbai, India. Shipping estimates as of March 2014 were $4200 per 40 foot container. Examples include analysis of 4/4 Red Oak Lumber (data used in the example above), 4/4 Hard Maple, 4/4 Ash, 5/4 White Oak, and 5/4 Cherry.

Analysis of 4/4 Red Oak Lumber

Please refer to Figure 2 below. The analysis in Figure 2 was generated using the Log vs. Lumber Costing Tool. Given the difficulty of demonstrating the entire spread sheet in a printed format, Figure 2 represents a sample of the pertinent information generated in the analysis. The yellow box shown at the top shows the current log pricing for Red Oak. The yellow box in the middle shows the current kiln dried lumber pricing for Red Oak. The yellow box at the bottom shows the result of the analysis based on the current pricing trends input by the user. In this example, the negative values indicate it is more favorable to import kiln dried Red Oak rather than raw logs.

Figure 2. 4/4 Red Oak Comparison

Species being considered: ***Red Oak lumber in a 4/4 size as compared to Red Oak logs***

Log Grade	Log price
F1	*$800.00*
F2	*$600.00*
F3	*$425.00*

(Note: in this example, log price premiums are paid for premium mix of larger diameters and longer lengths required)

Species being considered: ***Red Oak lumber in a 4/4 size as compared to Red Oak logs***

Log Grade	Log price
F1	*$800.00*
F2	*$600.00*
F3	*$425.00*

(Note: in this example, log price premiums are paid for premium mix of larger diameters and longer lengths required)

Species being considered: ***Red Oak lumber in a 4/4 size as compared to Red Oak logs***

Log Grade	Log price
F1	*$800.00*
F2	*$600.00*
F3	*$425.00*

(Note: in this example, log price premiums are paid for premium mix of larger diameters and longer lengths required)

Analysis of 4/4 Hard Maple

Please refer to Figure 3 below. The yellow box shown at the top shows the current log pricing for Hard Maple. The yellow box in the middle shows the current kiln dried lumber pricing for Hard Maple. The yellow box at the bottom shows the result of the analysis based on the current pricing trends input by the user. In this example, the negative values indicate it is more favorable to import kiln dried Hard Maple rather than raw logs. In fact the difference is much higher (more negative) than the Red Oak example demonstrating that it is far more cost effective to import Hard Maple lumber vs. logs.

Figure 3: 4/4 Hard Maple Comparison

Species being considered: ***Hard Maple lumber in a 4/4 size as compared to Hard Maple logs***

Log Grade	Log price
F1	*$950.00*
F2	*$700.00*
F3	*$450.00*

(Note: in this example, log price premiums are paid for premium mix of larger diameters and longer lengths required)

Species being considered: ***Hard Maple lumber in a 4/4 size as compared to Hard Maple logs***

Log Grade	Log price
F1	*$950.00*
F2	*$700.00*
F3	*$450.00*

(Note: in this example, log price premiums are paid for premium mix of larger diameters and longer lengths required)

Species being considered: ***Hard Maple lumber in a 4/4 size as compared to Hard Maple logs***

Log Grade	Log price
F1	*$950.00*
F2	*$700.00*
F3	*$450.00*

(Note: in this example, log price premiums are paid for premium mix of larger diameters and longer lengths required)

Analysis of 4/4 Ash

Please refer to Figure 4 below. The yellow box show at the top shows the current log pricing for Ash. The yellow box in the middle shows the current kiln dried lumber pricing for Ash. The yellow box at the bottom shows the result of the analysis based on the current pricing trends input by the user. In this example, the negative values indicate it is more favorable to import kiln dried Ash rather than raw logs. Like Hard Maple, the analysis shows that importing Ash lumber is very favorable when compared to importing Ash logs.

Figure 4: 4/4 Ash Comparison

Species being considered: ***Ash lumber in a 4/4 size as compared to Ash logs***

Log Grade	Log price
F1	$425.00
F2	$250.00
F3	$200.00

(Note: in this example, log price premiums are paid for premium mix of larger diameters and longer lengths required)

Species being considered: ***Ash lumber in a 4/4 size as compared to Ash logs***

Log Grade	Log price
F1	$425.00
F2	$250.00
F3	$200.00

(Note: in this example, log price premiums are paid for premium mix of larger diameters and longer lengths required)

Species being considered: ***Ash lumber in a 4/4 size as compared to Ash logs***

Log Grade	Log price
F1	$425.00
F2	$250.00
F3	$200.00

(Note: in this example, log price premiums are paid for premium mix of larger diameters and longer lengths required)

Analysis of 5/4 White Oak Lumber

Please refer to Figure 5 below. The yellow box shown at the top shows the current log pricing for White Oak. The yellow box in the middle shows the current kiln dried lumber pricing for White Oak. Note that this company has indicated lower costs for sawing and drying their lumber (yellow box at the bottom center). This result is reasonable give the thicker dimension of the White Oak will require less handling during sawing and drying. The yellow box at the bottom right shows the result of the analysis based on the current pricing trends input by the user. In this example, the negative values indicate it is more favorable to import kiln dried White Oak rather than raw logs even with the lower Indian sawing and drying rates.

Figure 5: 5/4 White Oak Comparison

Species being considered: ***White Oak lumber in a 5/4 size as compared to White Oak logs***

Log Grade	Log price
F1	$810.00
F2	$610.00
F3	$425.00

(Note: in this example, log price premiums are paid for premium mix of larger diameters and longer lengths required)

Species being considered: ***White Oak lumber in a 5/4 size as compared to White Oak logs***

Log Grade	Log price
F1	$810.00
F2	$610.00
F3	$425.00

(Note: in this example, log price premiums are paid for premium mix of larger diameters and longer lengths required)

Log Grade	Estimated Lumber Value per MBF Log	Estimated Purchased log cost (US) per MBF Log	Estimated Shipment cost per MBF Log	Estimated Sawing cost per MBF Log	Estimated Drying cost lumber per MBF Log	Estimated net value of lumber per MBF Log	Estimated net value of residuals per MBF Log	Estimated Total Net Value Lumber and residuals per MBF Log
F1	$1,415.96	$810.00	$741.73	$45.00	$40.00	-$220.77	$26.56	-$194.20
F2	$1,153.58	$610.00	$741.73	$45.00	$40.00	-$283.15	$26.56	-$256.58
F3	$963.66	$425.00	$741.73	$45.00	$40.00	-$288.07	$26.56	-$261.50

Analysis of 5/4 Cherry Lumber

Please refer to Figure 6 below. The yellow box shown at the top shows the current log pricing for Cherry. The yellow box in the middle shows the current kiln dried lumber pricing for Cherry. Note that this company has indicated lower costs for sawing and drying their lumber (yellow box at the bottom center). This result is reasonable give the thicker dimension of the Cherry will require less handling during sawing and drying. The yellow box at the bottom right shows the result of the analysis based on the current pricing trends input by the user. In this example, the negative values indicate it is more favorable to import kiln dried Cherry rather than raw logs even though this Indian company reported extremely low sawing and drying rates.

Figure 6. 5/4 Cherry Lumber Comparison

Species being considered: ***Cherry lumber in a 5/4 size as compared to Cherry logs***

Log Grade	Log price
F1	*$790.00*
F2	*$590.00*
F3	*$300.00*

(Note: in this example, log price premiums are paid for premium mix of larger diameters and longer lengths required)

Species being considered: ***Cherry lumber in a 5/4 size as compared to Cherry logs***

Log Grade	Log price
F1	*$790.00*
F2	*$590.00*
F3	*$300.00*

(Note: in this example, log price premiums are paid for premium mix of larger diameters and longer lengths required)

Species being considered: ***Cherry lumber in a 5/4 size as compared to Cherry logs***

Log Grade	Log price
F1	*$790.00*
F2	*$590.00*
F3	*$300.00*

(Note: in this example, log price premiums are paid for premium mix of larger diameters and longer lengths required)

A comparison of the fives species examples are summarized in Table 3.

Table 3. A comparison of the five species examples.

	Red Oak	Hard Maple	Ash	White Oak	Black Cherry
Grade					
F1	-63.37	-145.83	-175.03	-194.20	-47.08
F2	-105.07	-188.10	-189.60	-256.58	-183.38
F3	-166.57	-172.22	-318.10	-261.50	-182.05

If grade 1 logs were imported, the advantage to purchasing lumber versus logs ranged from $63.67/MBF in Red Oak to $194.20/MBF in White Oak. If grade 2 logs were imported, the advantage to purchasing lumber versus logs ranged from $105.07/MBF in Red Oak to $256.58/MBF in White Oak. If grade 3 logs were imported, the advantage to purchasing lumber versus logs ranged from $166.57/MBF in Red Oak to $318.10 in Ash.

Again, these comparisons are based on prices at a point in time; the actual prices for any importing company would have to be run through this spreadsheet for "real time" analysis. However, it is fairly clear that there is a distinct advantage to utilizing imported lumber over importing logs and processing them in India.

Also, these examples do not take into account the potential losses from rejection of lumber and lumber parts throughout the entire manufacturing process due to improper sawing and drying, as evidenced in the lumber shown in Photo 10. As mentioned throughout this report, the rudimentary sawmilling and drying practices used in India will most likely significantly increase the profitability of utilizing Wisconsin kiln dried lumber over obtaining lumber processed from Wisconsin logs in India.

Photo 10. Lumber rejected due to improper sawing and drying.

Precise and Consistent Lumber Production Practices in the U.S. Are Lacking in Asian Sawmills

The small local sawmills that were common in 1800's served the local markets, and as technology developed the mills became more productive producing quantities that could not be absorbed by the local markets. To sell their products on regional, national and global markets, a standardization of lumber/board sizes, grades and moisture contents was needed. This need was recognized by the industry as early as 1897 when the National Hardwood Lumber Association began the development of standard lumber grades which set the standards for the industry. These lumber grades allow customers to buy lumber unseen and have reasonable expectations of what they will receive. These grades include how much variation is allowed in the board, minimum thickness, minimum lengths of boards, and percent of clear area in the board to meet the grade as well as many more specifications for each of the grades. This process is just starting to be accepted in the Asian markets and the larger manufactures are starting to use these grades, having at a minimum, an understanding of the NHLA lumber grading system. The Indian sawmills tend to resemble the small US sawmills of the past in that they cut for a local market where the end user inspects the lumber on site and both parties mutually agree to the quality and a price.

The grading system has become even more important in the US industry as technologies have further increased the size and production capacity of hardwood sawmills. With a need to improve yield comes the need to improve dependability of the system. There is a heightened desire to optimize operator decision making so that the maximum volume of product can be obtained from the log at an acceptable quality for the customer. The focus is on uniformly producing products that meet industry standards. The more efficient a sawmill is, the better its ability to compete for raw material and make a profit in a very competitive industry. This became even more important as the price of sawlogs rose.

The progression of technology has improved machinery accuracy. The most common primary system for initially sawing the logs is the headrig carriage with either a band saw or circle saw. The carriage rides on tracks and is pulled back and forth by the saw. There are normally three knees that can move to enable the operator to set the knee so that proper thickness of board is produced when the carriage passes the saw. This movement is controlled by what is called the set works. For example, in the 1950's the mechanism for setting board thickness when sawing logs was a geared system with accuracy of about a 1/8 inch. With this type of system, set works are tight and achieve good accuracy when moving the knees toward the saw, but when moved away from the saw accuracy is lost. In this case, to maintain tight tolerances you must move the knees further back than you actually need to for the thickness and then come forward to achieve accurate sizing.

The next major advancement was the ball screw set works. The ball screw simplistically described is a nut on a bolt. When the bolt turns the nut moves and this moves the knees forward or back very accurately and achieves tolerances of around 0.003 of an inch. The nut is designed such that it puts tension on the threads of the bolt to eliminate slack in the system. The disadvantages of this system are that they're expensive to build and wear out rapidly.

Hydraulic servo set works is the most recent generation. A basic description is you have a hydraulic cylinder with a wire inlaid in the cylinder so that the position can be accurately monitored as the piston

moves in and out. These set works have accuracies in the 0.001 of inch realm. The hydraulic systems are controlled by computers and infinitely adjustable. The reliability of this system is excellent and is very common in higher production mills.

In the 1960's, the USDA Forest Product Laboratory developed the "best opening face" (BOF) computer program which began the automation of the hardwood sawmill industry. This computer program used a very basic linear programing to find the solution for optimum processing of the log. The computer available at this time would take hours to find the solution for one log. Researchers using this new program developed algorithms to simulate the program's output reducing the time to find a solution, and making it possible to do these calculations in real time while sawing the log. BOF was used as part of the USDA FS Sawmill Improvement Program. BOF began the process of the introduction of computer-controlled and optimization technology. As this was developing, scanning technology was also developing. The two technologies together create a complete system that scans the log and calculates the best way to saw the log for the desired products, with the operator overseeing the process. This process was also aided by the advances in computer technology.

A state of the art hardwood sawmill consists of a computer assisted debarker, optimizing headrig, edger, and trimmer.

The de-barker will use a computer and scanner to minimize breakage of the logs. The scanner will identify the shape and size of the log and open the knives on the debarker and then close them precisely on the end of the log with just the right amount of pressure to remove the bark. Prior to this innovation, the logs pushed into the knives opening them and the pressure was set as an average of what was processed. This worked well for many logs, but a significant number of small logs were destroyed by the debarker. This waste has been eliminated by the computer/scanner advancement.

The optimizing headrig is comprised of the headrig and a scanner. The headrig and saw will normally be canted 21 degrees so the weight of the log is used to hold the log against the knees of the carriage. The log is scanned for it basic geometry prior to loading onto the carriage. The operator will see his recommended cutting pattern on a screen in the operator booth. The sawyer can saw the log as it is recommended or make changes based on what he/she observes. This computer aided decision normally results in a greater proportion of upper grade lumber being produced and up to 10% more total lumber production.

The optimizing edger works by recommending a cutting pattern to the operator after it is scanned. The operator can override it or let the machine automatically do it. The computer controls the placement of the saws by placing the saw lines in the edging part of the board which improves yield. The production is increased because on most boards the operator accepts the solution and the board is edged according to the optimized recommendation. Yields are also significantly increased due to eliminating operator error in edging the board too narrowly. On average, an optimizing edger costs about 1 million dollars; the mills that have these installed have reported a one year to eighteen month pay back on the investment.

The optimizing trimmers use a scanner to determine the board lengths and can identify some characteristics such as sweep, crook, and splits. After scanning is complete, the trimmer will then automatically be set to do the needed cutting. The operator can override it if need be. These systems

are also starting to do some basic grading of the boards, but this process is in the development stage and is currently very costly.

The equipment is very expensive; a sawmill using optimization technology can cost from 10 to 30 million dollars depending on the equipment purchased. The benefits of the technology are higher yields, extremely uniform lumber, and more accurately graded lumber.

While the accuracy and repeatability provide a superior product, this is all to no avail if the wood is not properly dried. As the technology for sawing has improved, similar changes have been occurring in the drying of lumber. Dry kilns with rudimentary controls to monitor humidity and temperature that are adjusted manually by the kiln operator have given way to computer aided systems and sophisticated monitoring systems. Some modern dry kilns have scales built into the floor to constantly weigh the charge of lumber so general moisture content is constantly monitored. Constant moisture content monitoring is also done with probes placed in the loads of lumber at different points. Air movement is also monitored. All of this data is monitored by the operator using computer programs that constantly adjust the system to minimize drying defects.

All of the sawing efforts and the value of the product can be lost in the dry kiln if the wood is not dried to the proper moisture content in a stress free manner. The new drying system makes this much easier to consistently achieve. From the end users point of view, well dried, stress free lumber produces quality products with minimal waste.

Using U.S. Lumber Will Reduce Waste and Production Time for Asian Furniture/Cabinet Producers

Currently many Indian/Asian furniture/cabinet producers are using locally produced lumber for their production. Many of the mills that are producing this lumber have very rudimentary equipment including using steel rulers as the set works for the sawmill and the operators' judgment to select the cut. The drying of the wood is treated like more of an art than a science; none of the plants visited were producing a product that was adequately dried and stress free.

A majority of boards sampled for MC tended to have a gradient of moisture content with the outside of the lumber being 10% MC and the core being 20% MC. This type of variation creates stress and defects. While the lumber is being stored it will cup and warp as it finishes drying. The stresses that are put into the board by having variability in moisture content can lead to the board not remaining straight when sawed into a part, glue joints failing because of high moisture, and parts separating and even breaking in the furniture. Lumber thicker than what is required requires additional fiber to be removed which takes time, has additional energy costs, and is creating unnecessary residue. Lumber thinner than what is required may not meet minimum specifications and can cause the individual piece to become waste or even worse, it gets into the finished piece of furniture or cabinet causing it to be rejected. The high moisture content also creates gluing problems possibly causing joint failure, panels cracking, and excessive shrinkage all of which will potentially cause furniture parts to not meet quality standards.

The use of properly sized and dried lumber will minimize waste because specifications are met. Having stress free lumber means that the wood is stable and the parts will stay straight which also minimizes waste.

Properly dried lumber eliminates most of the glue failures that can cause rejection of the finished product. Proper drying will also minimize failure in laminated panels that are primarily used for the wide tops of furniture and sides, as the wood is stable and glue failure is minimized or eliminated.

The amount of cup and other types of warp in the boards will be significantly reduced, which increase yield and significantly reduce processing costs. Cup and other types of warp manifest themselves as drying defects that increase processing costs by requiring the ripping of boards to eliminate cup and further planing to get the boards flat.

This also creates a quality product and a satisfied customer, which leads to a more profitable bottom line for the company.

There have been numerous misperceptions by Indian and other Asian importers that U.S. lumber is inferior because of the way American logs and lumber are processed in these countries. The lumber gets the bad reputation even though it was the processing that led to the flawed lumber. This gives added incentive to bring American processed lumber to those markets to prove the quality of American produced lumber while demonstrating the tremendous cost savings.

Finished product failures resulting from improperly dried lumber add substantial production expense for Asian manufacturer

Finished product failure is extremely costly to companies and the stores selling the product. Improperly dried lumber may have high moisture content, variable levels of moisture content, drying defects such as checks and collapse, and drying stresses. These can lead to cracking in panels and failed glue joints. The stress can actually result in structural pieces of the furniture breaking from the part twisting, warping, or cracking. All of these are extremely costly because they occur for the most part after the furniture has been assembled. All of the manufacturing costs have been incurred, and quite often the piece of furniture is not repairable or will require significant cost to repair. Customer satisfaction becomes an issue. Asian manufactures normally are contract manufactures that are making product for a specific company to that company's designs. If these failures occur too often, the company may lose customers or the price the customers are willing to pay will decline.

One of the best examples of the impacts of product failure might be Simons Juvenile Furniture. The company moved their production to China and closed their plant in Wisconsin when they thought the product quality was adequate for their primary customer, Babies "R" Us©. The product quality began to decline. The cribs were being assembled with lumber that had excessive moisture content. There were also other manufacturing problems, but the major one was the moisture content of the wood used to build the cribs. When they were placed into service in the U.S., they had a high rate of failure which led Babies "R" Us© to cancel their contract with Simons Juvenile Furniture. The furniture company closed and the contract companies lost the business of manufacturing the cribs. At one time this company was producing 10% of the cribs for the U.S. market.

Statistical Evidence of the Ability of the Great Lakes Region to Supply Certified Products to Asian Markets

There are two forest certification programs in the U.S., Forest Stewardship Council (FSC) and Sustainable Forestry Initiative (SFI), which includes Tree Farm. Managed Forest Law (MFL) is a program in Wisconsin for private woodland owners to save on property taxes in return for managing their woodlands according to a property specific management plan. Acreage of Wisconsin certified forestlands are summarized in Table 4. Table 5 lists certified forestlands in the Great Lakes Region. Certified sawmills and veneer mills in Wisconsin and their locations are listed in Table 6. The map shown in Figure 7 identifies the locations of certified Wisconsin sawmills and veneer mills.

Table 4: Acres of Certified Forestlands in Wisconsin.

Wisconsin Certified Forest Lands (Acres)				
Type	**FSC**	**SFI**	**FSC/SFI**	**Total**
State			1,558,761	1,558,761
County	165,495	723,100	1,472,869	2,361,464
MFL			2,546,256	2,546,256
Other	523,322	268,395		791,717
Totals	**688,817**	**991,495**	**5,577,886**	**7,258,198**

Table 5: Acres of Certified Forestlands in the Great Lakes Region.

Great Lakes Region Certified Forest Lands (Acres)				
	Type	**FSC**	**SFI**	**FSC/SFI**
Wisconsin	State			1,558,761
	County	165,495	723,100	1,472,869
	MFL			2,546,256
	Other	523,322	268,395	
	Total	688,817	991,495	5,577,886
Michigan	State			3,892,000
	County		50,000	
	Other	203,675	5,071,907	
	Total	203,675	5,121,907	3,892,000
Minnesota	State		19,076	4,960,177
	County	924,968	892,938	700,400
	Other	25,829	474,000	
	Total	950,797	1,386,014	5,660,577
All States		1,843,289	7,499,416	15,130,463
Total Certified Acres				**24,473,168**

Table 6: Location of FSC Certified Saw and Veneer Mills in Wisconsin.

Company Name	Wisconsin Location	Type
Banks Hardwoods, Inc.	Menominee	Sawmill
Besee Lumber Company	Ladysmith	Sawmill
Birchwood Manufacturing Company	Rice Lake	Sawmill
Buffalo Tie and Hardwood	Fountain City	Sawmill
Columbia Forest Products	Mellen	Sawmill
Florence Hardwoods, LLC	Florence	Sawmill
Frahm Wood Products	Athens	Sawmill
Johnson Timber - Summit Lake Timber Corp	Hayward	Sawmill
Johnson Timber Corporation	Hayward	Sawmill
MacDonald & Owen Veneer & Lumber Co.	Sparta	Sawmill
Meister Log and Lumber	Reedsburg	Sawmill
Menominee Tribal Enterprises	Neopit	Sawmill
Metro Hardwoods	Jackson	Sawmill
Park Falls Hardwoods	Park Falls	Sawmill
Pukall Lumber Co., LLC	Woodruff	Sawmill
Reedsburg Hardwoods	Reedsburg	Sawmill
Superior Kilns	Superior	Sawmill
Tree Star LLC	Hazel Green	Sawmill
Twin Oaks Lumber, LLC	Hazel Green	Sawmill
Welter Forest Products, Inc dba Granite Valley Forest Products	Marathon	Sawmill
Westby Hardwood Products	Westby	Sawmill
Wieland & Sons Lumber Co., Inc.	Muscoda	Sawmill
Specialty Veneer Company	Antigo	Veneer Mill
Bayland Veneer, Inc.	Green Bay	Veneer Mill
Birchwood Lumber & Veneer Company dba BirchwoodBest	Birchwood	Veneer Mill
Birds Eye Veneer Company	Butternut	Veneer Mill
Butternut Veneers, Inc.	Butternut	Veneer Mill
Goodman Veneer & Lumber Company	Goodman	Veneer Mill
Marion Plywood Corp. dba Great Lakes Veneer Inc.	Marion	Veneer Mill
Wisconsin Veneer & Plywood, Inc.	Mattoon	Veneer Mill
Woodland Face Veneer LLC	Two Rivers	Veneer Mill
Cleereman Export & Veneer	Laona	Veneer Mill

Figure 7. Mapped locations of certified Wisconsin sawmills and veneer mills.

Current and future barriers that Wisconsin exporters need to overcome to increase value-added lumber exports

In conclusion, there is considerable opportunity to export more value-added wood products from Wisconsin/United States to India, but a continued and concerted effort needs to be made to explain why American produced lumber is a better value than Indian produced lumber from American logs. Working with AHEC to identify potential opportunities such as a sellers cooperative with a lumber outlet in India are worth exploring. Lists of Wisconsin companies that have expressed interest in exporting are attached.

A major barrier to business is that Indian wood markets are very sensitive to price. Many buyers are in the "cheaper is better" mindset. Also, Wisconsin's distance to ports puts the State at a competitive disadvantage because of the added freighting costs. In addition, many Indian importers do not understand the uses and limitations of Wisconsin species; Wisconsin has few abundant hardwood species to substitute for teak (nor any production of thermally modified products, although this is an opportunity for Wisconsin in the future.) Indian wood users' preference for small orders rather than full

containers is another barrier that needs to be overcome as well as the higher tariffs on imported lumber.

How to improve market share for U.S. value added hardwood lumber products in India/Asia

A growing population, changing demographics, increasing disposable income and banning of domestic timber harvest on all government lands to protect the environment have contributed significantly to the large number of logs/lumber products being imported into India in recent years.

As the numbers below show, there has been an increase of exports of Wisconsin wood products to India.

United States Exports (Origin of Movement - Total) To India Via Wisconsin								
Commodity: 44, Wood And Articles Of Wood; Wood Charcoal								
YTD Comparison: January - December								
		U.S. Dollar			% Share			% Change
HTS	Description	2011	2012	2013	2011	2012	2013	2013/2012
44	Wood	255,640	363,577	388,188	100	100	100	6.77
4409	Tongued/Grooved	234,241	311,280	312,926	91.63	85.62	80.61	0.53
4407	Lumber > 6Mm Thick	4,309	0	46,693	1.69	0	12.03	
4415	Pack/Etc;Pallet/Collr	11,400	49,100	28,569	4.46	13.5	7.36	-41.81
4421	Othr Articles Of Wood	5,690	3,197	0	2.23	0.88	0	-100

However, more needs to be done. Improving market share for U.S. value added hardwood lumber products in India/Asia will require a multi-faceted approach of education, trade missions, and reverse trade missions. Through these approaches, business management skills within the India/Asian companies can be developed so that they recognize the financial advantages of importing U.S. value-added hardwood lumber products.

The first educational need is in quality control. Companies need to understand the defects and costs associated with using Indian/Asian domestically sawn lumber that has excessive variation and moisture content. In the plants visited in India the quality control efforts were minimal. There was virtually no assessment of incoming lumber for variation, proper sizing, or moisture content. The storage of lumber observed did not adequately protect it from moisture or sun. Without constant quality control monitoring of the entire system, there is no way of knowing when or what caused the degradation in the product or what part of the process was responsible. This could be a role for AHEC to provide training to help companies understand the importance of quality control and how to effectively implement it. There is a need to develop a system to itemize costs of operations so companies have the data needed to compare the cost of using lumber from local mills to the cost of importing a higher quality product from the U.S. The skill set to actually do some tests in their plants for this comparison is a must if the managers are going to be able to justify importing lumber. Once the data shows that

importing value added hardwood lumber products from the U.S. reduces operation costs, the market share for these products should improve.

The second educational need is to promote the properties of the U.S. lumber including its workability, hardness, strength, and color variation. This has been done in the past on trade missions in seminars and individual meetings. The properties of U.S. hardwood lumber have been well documented at the USDA FS Forest Product Laboratory and are published in the "Wood Handbook, Wood as and Engineering Material (General Technical Report FPL-GTR_190)". The need is to present the properties of the U.S. hardwood lumber in a way that is relevant to the India/Asia market. In many cases the benefits of the different properties need to be explained so their value is understood. Key properties are strength, screw holding, shrinkage, density and specific gravity. Another important aspect of this educational effort is promoting visual characteristics such as color and grain patterns which can be an important aspect of marketing.

Some examples are:

- Hard Maple - The wood is commonly white with a fine texture, strong, hard, slightly resistant to decay, and has high shrinkage (radial shrinkage of 4.8%, tangential shrinkage of 9.9%, and volumetric shrinkage of 14.7%). It is commonly used for flooring, cutting boards, pianos, and cabinets.
- White Oak – The wood is light brown, decay resistant, strong, hard, high shrinkage (radial shrinkage of 5.6%, tangential shrinkage of 10.5%, and volumetric shrinkage of 16.4%), has a distinct grain pattern, heartwood pores are plugged, and the rays in the wood are very visible. It is commonly used for cooperage because of the plugged rays, furniture, flooring and millwork. Its rot resistance makes desirable for agricultural implements, truck floors, and railroad ties.
- Black Locust – The wood is dark brown, decay resistant, strong, hard, and has moderate shrinkage (radial shrinkage of 4.6%, tangential shrinkage of 7.2%, and volumetric shrinkage of 10.2%). Its grain pattern is distinct and heartwood pores are plugged with tyloses. The wood is difficult to season and prone to warp and twist. Its high decay resistance makes it desirable for numerous applications.
- Black Ash – The wood is light brown, of moderate strength and shrinkage (radial shrinkage of 5.0%, tangential shrinkage of 7.8%, and volumetric shrinkage of 15.2%), and has a distinct grain pattern similar to red oak. Ash's similarity to red oak makes it useful in similar applications as oak, but at lower raw material costs.

Additionally, there is a need to educate U.S. companies on staying focused and business management practices to maintain a minimum level of quality so that they don't bow down to pressure and sell lower quality products in order to meet a price point.

Trade missions are needed to introduce U.S. companies to specific export markets and to start building relationships with companies in those markets. A strategy, that has worked successfully in the past, is to have a, a two pronged approach - participation in tradeshows combined with individual company visits (in Wisconsin and Lake States) has been successful. . Face to face meetings are a must to develop a relationship so that potential import companies will be comfortable enough to purchase from new suppliers.

Regulatory barriers in terms of high tariffs is another issue that needs to be addressed. Tariff barriers appear to be a particular problem for value-added lumber export growth as India's import tariff structure for wood products remains favorable to logs instead of lumber. In addition, the complexity of import regulations, customs procedures and the lack of knowledge of some of India's Customs officials with respect to wood products, means that the import process is often fraught with difficulties and open to abuse in India. Unless the import tariffs change for value added lumber, it is likely that the majority of American hardwoods consumed by Indian manufacturers will be cut from imported logs or, perhaps, brought in live---sawn and green. Therefore, policy changes are required at the national government level between India and USA to facilitate increased export of American lumber.

Articles & Presentations

Dr. Scott Bowe delivered the findings of the previously completed State of Wisconsin DATCP study at the Mumbaiwood Seminar series. The article titled, *The State of Wisconsin Department of Agriculture, Trade & Consumer Protection (DATCP) secured State and Federal funding in 2012 to conduct a study in to the Indian hardwood market, entitled Increasing Value---Added Hardwood Lumber Product Exports to India through Informed Purchase Decisions*, as reported in the September – October 2013 AHEC Market Report for Africa, the Middle East, South Asia, and Oceania is found in Appendix A.

By Dr. Scott Bowe published *Lumber Versus Logs: The Benefits of Importing Value--Added American Hardwood Lumber* Great Lakes TPA Magazine October 2013, No 10: 60-66.

State funds for this project were matched with Federal funds under the Federal-State Marketing Improvement Program of the Agricultural Marketing Service, U.S. Department of Agriculture.

Appendix A.

The State of Wisconsin Department of Agriculture, Trade & Consumer Protection (DATCP) secured State and Federal funding in 2012 to conduct a study in to the Indian hardwood market, entitled Increasing Value---Added Hardwood Lumber Product Exports to India through Informed Purchase Decisions.

By Dr. Scott Bowe

As published in the September – October 2013 AHEC Market Report for Africa, the Middle East, South Asia, and Oceania

The idea was to look at normal hardwood consumption patterns and to calculate how importing and using kiln---dried American hardwood lumber in furniture or joinery production as opposed to domestically---produced lumber from imported logs could increase yield, minimize waste and, therefore, lower material costs. AHEC was able to facilitate DATCP in their field research in December 2012 when they travelled to Delhi and Bangalore. At Mumbaiwood this year, the findings of the DATCP study were presented as part of the show's seminar series by Dr. Scott Bowe, Professor of Wood Products from the University of Wisconsin---Madison. Dr. Bowe also presented a Lumber vs. Log Estimator for Indian importers and manufacturers to help calculate material costs. One of the key conclusions of the report was that, "tariffs in India pose as a major obstacle in the decision to import value---added lumber. Further, the perception that importing logs is less expensive than importing lumber is a second major obstacle. However, once a manufacturer understands that the recovery is much greater for higher quality raw materials in comparison to low quality raw materials, the manufacturer can decide to pay more for high quality lumber since the useable volume is so much higher." Of course, not all hardwood consumed in India is for high end manufactured products and low quality raw materials may be acceptable and even more cost---effective in many instances. However, AHEC believes that as the wood processing sector develops and as more furniture and joinery products are made in India, manufacturing standards will rise. This will then lead to greater demand for high quality hardwood lumber.

Appendix B.

Lumber Versus Logs: The Benefits of Importing Value--Added American Hardwood Lumber

By Dr. Scott Bowe

As published in Great Lakes TPA Magazine - Lumber vs. Logs: The Benefits of Importing Value-Added American Hardwood Lumber. TPA Magazine. October 2013, No 10: 60-66.

The growing acceptance of American hardwoods in India makes species such as American red oak popular with designers and architects. Like all businesses, Indian wood manufacturers must watch their raw material costs to remain competitive in the marketplace. Manufacturers will tell you that the cheapest price is not always equal to the best value. This is the case when comparing the import of American hardwood logs vs. American hardwood lumber. On the surface, importing American hardwood logs appears to be less expensive than buying pre--- manufactured American hardwood lumber. However, let's consider this common perception and examine the true cost of importing logs vs. lumber.

To understand log and lumber pricing, we must first understand grades. American hardwood lumber can be broken into the following grade categories (**Table 1**). FAS, F1F, and Select[1] is the highest grade group, has the highest percentage of defect---free wood, and commands the highest price. #3 A & B is the lowest grade group, has the lowest percentage of defect---free wood, and commands the lowest price.

Table 1: Hardwood Lumber Grades and Prices for Kiln Dried American Red Oak (US$ per MBF).

Lumber Grade	Percentage Clear (no defect)	Price per MBF
FAS, F1F, and Select	83%	$1535
#1 Common	67%	$1030
#2 A & B	50%	$905
#3 A & B	33%	$400

When purchasing pre-manufactured American hardwood lumber, you can specify a particular grade or mix of grades on the order invoice. This is not the case when purchasing logs. Logs will yield a mixture of grades when sawn. The resulting lumber grades depend upon the quality of the log. **Table 2** shows the standard log grades for American hardwoods. Veneer represents the highest grade group which is typically too valuable to be sawn into lumber and is used for veneer production. The grades of F1, F2, and F3 are typically sawn for lumber.

Table 2: Hardwood Log Grades and Example Lumber Grade Recovery for Red Oak.

Log Grade	Log Price (MBF)	FAS, F1F, and Select	#1 Common	#2A	Below #2A
Veneer	$700+	NA	NA	NA	NA
F1	$600	49.0%	28.3%	14.6%	8.1%
F2	$450	22.0%	34.5%	25.3%	18.2%
F3	$300	7.0%	22.3%	34.4%	36.3%

Notice that all lumber grades are produced when processing a log into lumber. The highest grade sawlog, F1, will produce the largest percentage of FAS, F1F and Select lumber at 49%. The lowest grade sawlog, F3, will produce a much lower percentage of FAS, F1F, and

Select lumber at 7% (**Table 2**).

As you can see, a problem with shipping logs from the United States and sawing them in India is the large amount of low grade lumber that will be produced from these logs. In the United States, low grade material such as #3 lumber is used by the pallet and container industry; #2 lumber is used by the hardwood flooring industry. If an Indian manufacturer needs #1 Common or higher grades for their production facility, as much as 70% of the lumber could be low grade material if they are processing F3 logs.

Shipping logs vs. lumber poses another problem with the shipping container. As you would expect, rectangular lumber packages easily fit into standard ocean cargo shipping containers. Square edged kiln dried lumber stacks well and fits nicely within the rectangular container. Round logs pose more challenges. Logs take up more space and weigh more than the lumber that could be produced from that log. When shipping logs, you ship the bark, sawdust, and other waste products that are generated during the sawing process. Typically, these waste products account for 50% of the log. In addition, you ship a great deal of moisture (natural water found in the log). This water is not present in kiln dried hardwood lumber, which weighs about half as much a green lumber that has not been dried.

If you take into consideration the grade recovery when converting logs in to lumber, as well as the increased space requirement for shipping round logs, it takes several containers of logs to equal the equivalent of lumber. For example, shipping F1 logs would require 3 containers to generate the equivalent of 1 container of #2 and better lumber; shipping F3 logs would require 5 containers to generate the equivalent of 1 container of #2 and better lumber. As shipping costs continue to increase, one needs to carefully consider the added costs of shipping logs vs. lumber.

If we consider grade recovery, shipping costs, sawing costs, etc., the costs of sawing and shipping grade F1 American red oak logs exceeds the lumber value by US$302 per thousand board feet (US$128 per cubic meter)[2] of logs. The costs of sawing and shipping grade F3 American red oak logs exceeds the lumber value by US$377 per thousand board feet (US$160 per cubic meter) of logs. Clearly, pre---manufactured American hardwood lumber provides the best value, saving hundreds of dollars per thousand board feet of finished lumber.

To facilitate log vs. lumber cost comparisons, we have developed a costing tool, which is available here: http://www.fwe.wisc.edu/wood---products---publications. This simple spreadsheet can be adapted to your company and specific production costs. Shipping costs, lumber costs, logs costs, labor costs, and exchange rates can be modified to reflect your company's needs. The results will show the true cost of shipping logs vs. lumber. Funding for this costing tool was provided by the Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP) and the United States Department of Agriculture Federal---State Marketing Improvement Program (FSMIP).

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[2] One thousand board feet (1 MBF) = 2.36 cubic meters. 1 cubic meter = 35.315 cubic feet. See www.americanhardwood.org for more information.

Appendix C.

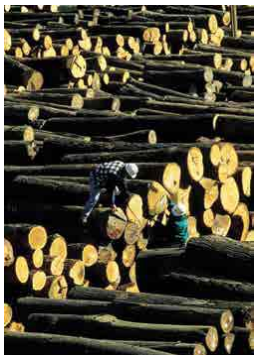
ANTARYA Institute of Indian Interior Design Magazine, ISSUE 01 JAN–FEB 2013

Title: American Hardwood: Hard-selling Wood to Bangalore Users

In partnership with American Hardwood Export Council, IIID Bangalore Chapter conducted a seminar on "Designing and Working with American Hardwoods" for Architects, Designers and Manufacturers. The seminar included presentations by Dr. Scott Bowe – Professor & Wood Products Specialist in the Department of Forest and Wildlife Ecology at the University of Wisconsin and Mr. Roderick Wiles – Regional Director of the American Hardwood Export Council for Africa, Middle East, India and Oceania. Range and diversity of the American hardwood forest, sustainable management, production for export, working properties of species and end use applications, were some of the aspects covered in the presentation. The event was held in Le Meridien Hotel, and was followed by cocktails and dinner.

American Hardwood: Hard-selling wood to Bangalore users

The American Harwood Export Council (AHEC) made a presentation of their product to IIID members, going into detail on the sustainable methods adopted in cultivation and processing and their multiple applications in interiors and architecture. Detailed information was given on the extent of area under hardwood cultivation in the United States, the method of processing used to ensure its quality and lengthy durability, the grading standards adopted to meet international quality specifications, the nuances involved in understanding and selecting processed wood.



AHEC is a leading international trade association for the US hardwood industry, representing US hardwood exporters and major US hardwood product trade associations. AHEC runs a worldwide program to promote a full range of American hardwoods in over 50 export markets. Hardwood, which is essentially broad leaved and deciduous trees like red and white oak, tulip, maple and cherry, is naturally grown in the US and harvested on maturity. Since they are not planted, area under its cultivation does not get totally cleared when harvesting takes place as each tree would be under different stages of maturation. However, softwood, unlike hardwood, is planted, with the entire field under its cultivation cleared on maturity. Currently, the US has about 304 million hectares of forest land out of which 208 million hectares are used for producing timber. Most of the forest land is owned and managed privately, amounting to roughly 38 per cent of the total area. At present the quantum of growth of timber exceeds the quantum harvested, with the ratio of growth to harvest standing at 2.5:1. Interestingly, the US hardwood, which is abundant and renewable in its methods of cultivation, also uses less energy in processing as compared to that sourced from other parts of the world. They are carbon neutral, releasing less carbon during its processing as compared to the quantum it absorbs from the atmosphere during cultivation. This makes their cultivation and processing highly sustainable. A major factor that affects the quality of wood and their durability is the level of moisture content retained after processing. Logs are perishable and hence need to be treated right soon after harvesting. To protect them and prevent excess drying, end-coating of logs is resorted to after harvesting. This also prevents staining which is particularly a problem in vulnerable wood varieties like white maple. White maple is prone to fungus and end-coating checks this. Yet another is colouration that happens is due to enzymes in the log, especially in white wood and this is prevented through end-checking where it is ensured that the lumber is properly dried and treated. Once logs are processed into lumber, similar quality controls and checks on moisture content and end-coating need to be undertaken to prevent discolouration. When lumber is dried to the desired level and kept dry forthwith, its lifetime increases as the wood remains stable with its consistent moisture content. The next step is grading, based on the level of clear area of the board offered. It is important to note that, wood being a natural substance, the patterns displayed on lumber is purely based on the manner in which they are sawed. Right from the outer rings of the log, referred as sapwood, to the central portion of the log, referred as heartwood, the pattern of the grains as well as the colouring vary, with colour taking a deeper hue as the inner layers are accessed. While choosing the wood for décor, this variation in pattern and colour needs to be kept in mind and

accordingly sourced. Since wood used for outdoors is exposed to extreme weather conditions, it requires special treatment to withstand. One such treatment is thermal modification where the hardwood is put in a heating chamber, where its physical constitution undergoes a change, making it water repellent, fungus repellent. In short, the physical and chemical changes brought about in its composition makes it ideally suitable for outdoor use. Currently, a major part of American hardwood on offer is oak with red oak targeting the domestic market and white oak the international market. Some of the popular varieties used for cabinets, flooring and furniture are Red alder, American ash, Cherry, Maple, Tulip, besides red and white oak. American oak is very popular in the Indian market. While the white timber is commonly used for doors, the Indian market uses it extensively for cladding. Cherry which was very fashionable over the last decade but has declined in demand currently, is also well sourced by Indian market. Hard maple is very popular for sports floors while soft maple, which is extremely versatile, is used for furniture and floors, and can be stained easily for other uses. Red oak, which is pinkish in colour, is readily available in the Indian market, used in multiple areas. Tulip wood is not a very popular species though it comes in various colour varieties and takes stain easily, enabling it to replicate many furniture colours. It is quite popular amongst Italian furniture because of its capacity to stain effortlessly. Interestingly, wood, which has fantastic acoustic properties, making it an endearing material for theatres and concert halls, is also strong, though many are unaware of the extent of its strength. The use of wood beams in place of steel to hold the glass in one section of the London Parliament is a classic example of its inherent strength. Given its versatility and multiple patterns that emerge naturally, where no two pieces appear identical, wood also lends itself effortlessly to depict art and creativity, where a myriad set of patterns can be created on a floor or wall to lend character to an interior.

End

Lumber Versus Logs: The Benefits Of Importing Value-Added American Hardwood Lumber

Mumbai, India

2nd October 2013

Professor Scott Bowe, PhD

THE UNIVERSITY of WISCONSIN
WOOD PRODUCTS

Outline

- U.S. Hardwoods Basics
  - Hardwood Log Grading
  - Hardwood Lumber Grading
- Quality U.S. Hardwood Lumber Manufacturing
- Lumber Versus Log Import Estimator

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Project Support

- American Hardwood Export Council (AHEC)
- University of Wisconsin
- Wisconsin Department of Natural Resources Division of Forestry
- Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP)
- Federal-State Marketing Improvement Program of the Agricultural Marketing Service, United States Department of Agriculture (FSMIP)

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U.S. Hardwoods Basics

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U.S. Hardwood Basics

- Grading
  - Hardwood Log Grading
  - Hardwood Lumber Grading
- Grading provides a standard to assign value to logs and lumber.

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Hardwood Roundwood Products

- Hardwood Roundwood Products
  - Veneer Logs
  - Sawlogs
  - Bolts
  - Pulpwood
  - Fuelwood
- How are these valued?

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Roundwood Values

October 2012 – March 2013

TIMBER MART NORTH
PRICE REPORT

Volume 19, Number 1

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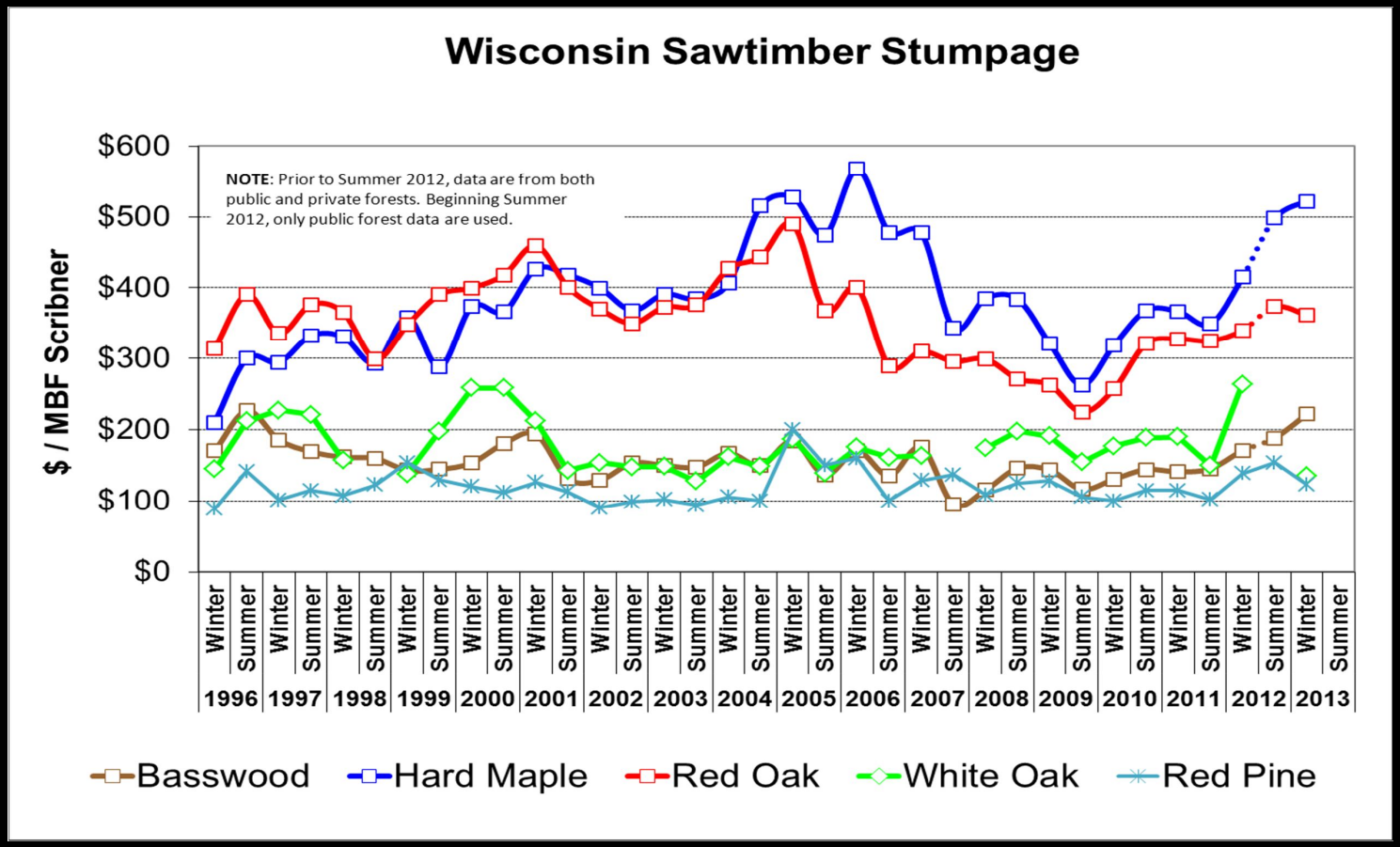

Wisconsin Sawtimber Stumpage
$ / MBF Scribner
$600
$500
$400
$300
$200
$100
$0
NOTE: Prior to Summer 2012, data are from both public and private forests. Beginning Summer 2012, only public forest data are used.
Winter
Summer
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Basswood
Hard Maple
Red Oak
White Oak
Red Pine

Hardwood Log Grades

- Sawlogs are grouped into three grades:
  - Grade 1 (sometimes called F1)
  - Grade 2 (sometimes called F2)
  - Grade 3 (sometimes called F3)

HARDWOOD VENEER LOG GRADING RULES

Grade Factors	Prime Veneer	Veneer
Min. Diameter	14"	12"
Log Length	8'8" - 17'6" Other lengths specified - 8" trim allowance	
Surface Defects	None	8'8" - one allowed. 17'6" - two; if one falls in each half of log. Two defects allowed as one if perfectly in line. Knots - not to exceed 3". Bark Distortion - considered as surface defect. Seam - straight and tight up to 4' considered as one standard defect. 10' and 12', 2 defects in line. 14' and 16' - 2 defects if one in each half.
End Defects	Well centered doze and holes individually or in combination allowed. 12" and 13" dia. - up to 2" 14" dia. - up to 3" 5" dia. - up to 4" Logs must be free of mineral, ring shake and heavy bird peck. One worm hole allowed in one end. 50% heart allowed in hard maple. Starred hearts, bark pockets, ring shakes and flutted butts will not be accepted.	
Straightness	Logs 13" or under must be straight. 14" and up allowable sweep is 1/6 the diameter of the small end of the log.	
Grain Direction	No wavy, curly, figured or cross grain logs accepted. Spiral grain allowed only if not more than 1" in 12" of length.	

Variations of this Standard should be agreed upon by both buyer and seller.

Veneer logs graded on 4 faces.

HARDWOOD SAWLOG GRADES FOR STANDARD LUMBER

Grade Factors	Log Grade 1	Log Grade 2	Log Grade 3
MINIMUM DIAMETER	12"	10"	10"
*MINIMUM LENGTH (including trim)	8'4"	8'4"	8'4"
CLEAR CUTTINGS (on the 3 best faces)			
Length (minimum)		3'	2'
**12"-15" Diameter	7'		
**16"-19" Diameter	5'		
20" + Diameter	3'		
Number on Face (maximum)	2		Unlimited
8-11'		2	
12'+		3	
Yield in Face Length (minimum)	5/6	4/6	3/6
SWEEP AND CROOK DEDUCTION (maximum)	15%	30%	50%
CULL DEDUCTION, Including Sweep (maximum)	40%	50%	50%
SOUND END DEFECTS, Area (maximum)	– See Instructions–		

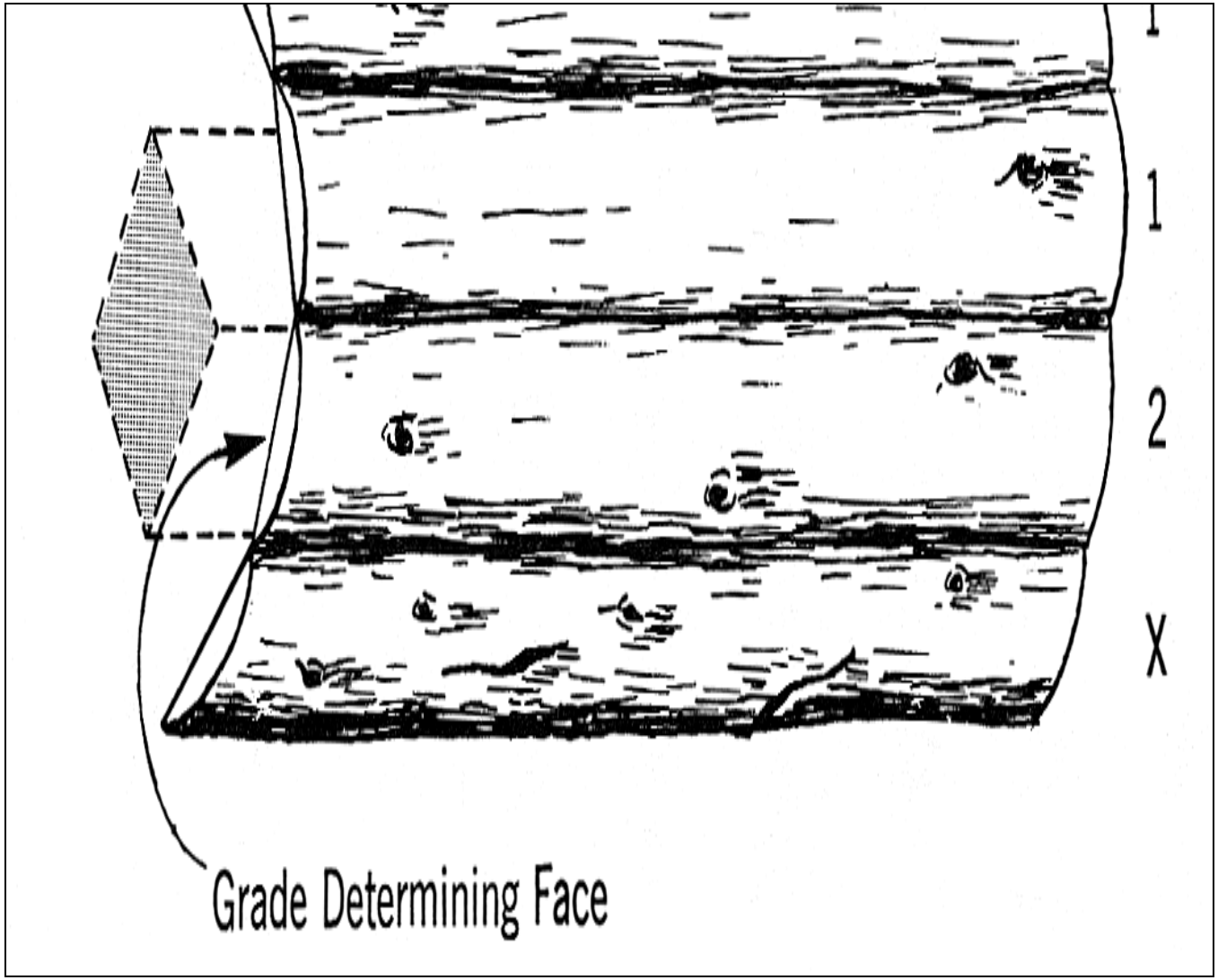
Exceptions:

Grade 2 – 10" d.i.b must be grade one surface quality.
Grade 2 – 11" d.i.b. limited to two cuttings.
Sweep and crook allowance reduced 1/3 in logs with more than 1/4 diameter in sound end defects.
Sixty percent cull deduction permitted in Grade 2 if otherwise of Grade 1 quality.
Sixty percent cull deduction permitted in Grade 3 if otherwise of Grade 2 quality.

* Unless mill requires more trim.

** Grade 1 – 8-foot long logs must be 5/6 clear (6 2/3') in one cutting on 3 best faces. Two cuttings 3'+ admitted to logs 20" and up in diameter.

Select the Grading Face



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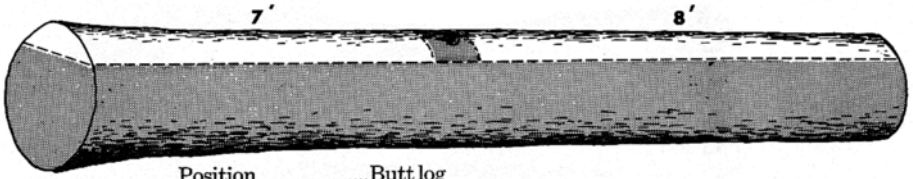
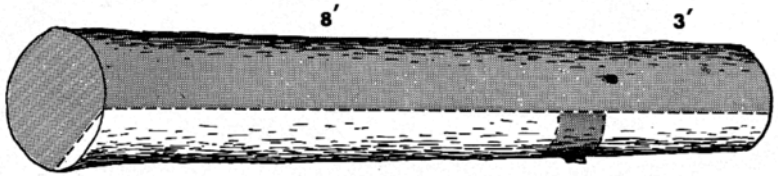
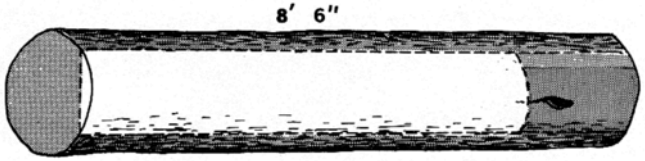
Grade 1 Examples



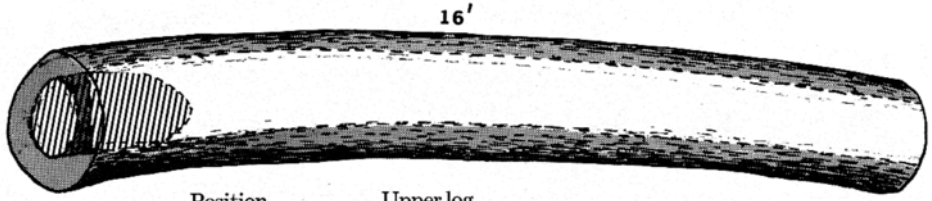
Position .....Butt log
Size .....Length 16′, diameter 13″ at small end
Straightness .....Straight
Soundness .....Sound
Cuttings .....More than 5/6 of its grading-face length is clear in two sections 7 and 8 feet long



Position .....Upper log
Size .....Length 12′, diameter 20″ at small end
Straightness .....Straight
Soundness .....Sound
Cuttings .....5/6 of its grading-face length is clear in two sections 8 and 3 feet long



Position .....Upper log
Size .....Length 10′, diameter 16″ at small end
Straightness .....Straight
Soundness .....Sound
Cuttings .....More than 5/6 of its grading-face length is clear in one section 8 feet 6 inches long



Position .....Upper log
Size .....Length 16′, diameter 20″ at small end
Straightness .....10 percent deduction for 4″ of absolute sweep
Soundness .....5 percent deduction for center rot (sweep and rot deductions less than 40 percent maximum permitted)
Cuttings .....One cutting 16′
Comments .....Rot is confined to permissible rot zone and does not affect clear grading face

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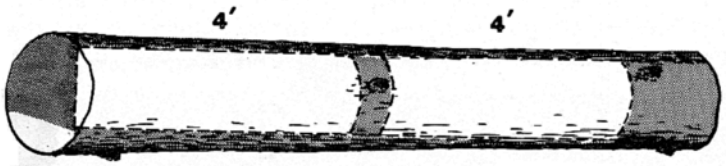
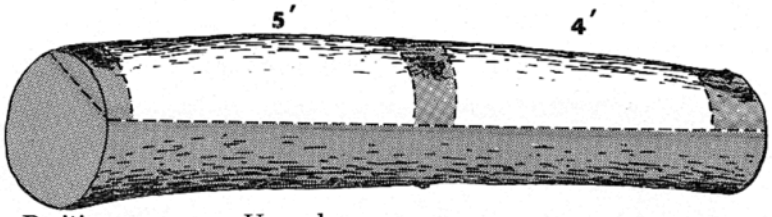
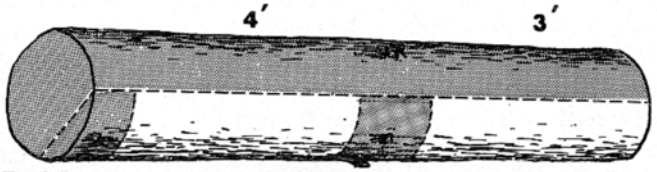
Grade 2 Examples



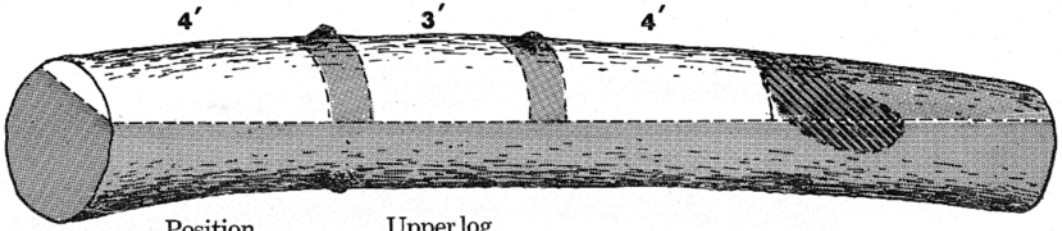
Position ..... Upper log
Size ..... Length 10′, diameter 11″ at small end
Straightness ..... Straight
Soundness ..... Sound
Cuttings ..... More than ⅔ of its grading-face length is clear in two sections each 4 feet long



Position ..... Upper log
Size ..... Length 11′, diameter 18″ at small end
Straightness ..... Deduction of 28 percent for 6½ inches of absolute sweep (sweep less than 30 percent maximum allowance)
Soundness ..... Sound
Cuttings ..... More than ⅔ of its grading-face length is clear in two sections 5 and 4 feet long



Position ..... Upper log
Size ..... Length 9′, diameter 12″ at small end
Straightness ..... Straight
Soundness ..... Sound
Cuttings ..... More than ¾ of its grading-face length is clear in two sections 4 and 3 feet long



Position ..... Upper log
Size ..... Length 16′, diameter 22″ at small end
Straightness ..... 9 percent deduction for 4 inches of absolute sweep
Soundness ..... 20 percent deduction for rot (sweep and rot deductions less than 50 percent maximum permitted)
Cuttings ..... Rot limits cutting on grading face, but clear cuttings of 4, 3, and 4 feet give more than the required ⅔ of grading-face length

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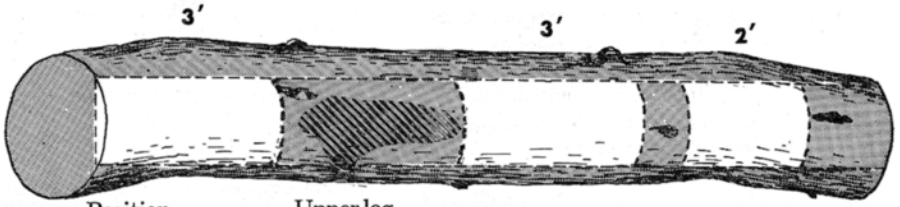
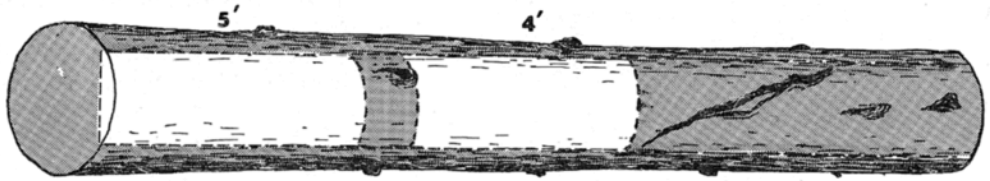
Grade 3 Examples

Position ..... Upper log
Size ..... Length 8′, diameter 8″ at small end
Straightness ..... Straight
Soundness ..... Sound
Cuttings ..... One-half of its grading-face length is clear in two sections, each 2 feet long

Position ..... Upper log
Size ..... Length 12′, diameter 14″ at small end
Straightness ..... Straight
Soundness ..... 15 percent rot deduction (less than 50 percent maximum permitted)
Cuttings ..... More than ½ of its grading-face length is clear in two sections, 4 and 3 feet long
Comments ..... Interior rot outside the rot zone limits cuttings



Position ..... Upper log
Size ..... Length 14′, diameter 22″ at small end
Straightness ..... 12 percent deduction for 6″ x 3′ of crook on both ends of log
Soundness ..... 15 percent rot deduction (crook and rot less than 50 percent maximum deduction)
Cuttings ..... More than ½ of its grading-face length is clear in three sections, 3, 3, and 2 feet long



Position ..... Upper log
Size ..... Length 16′, diameter 22″ at small end
Straightness ..... Straight
Soundness ..... Sound
Cuttings ..... More than ½ of its grading-face length is clear in two sections, 5 and 4 feet long

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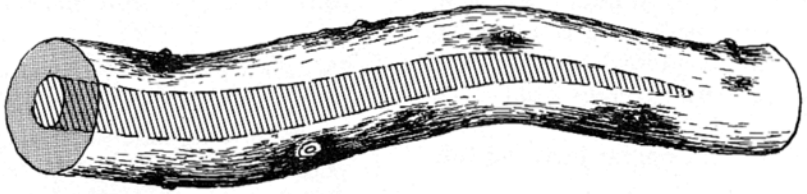
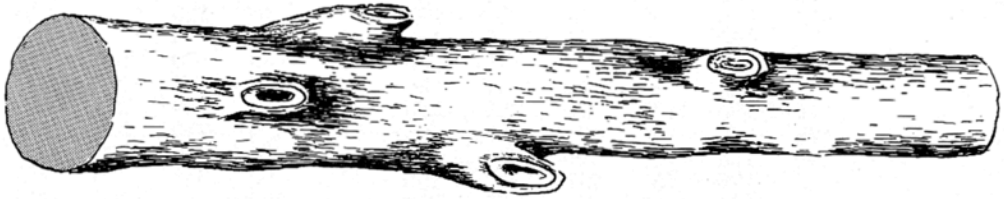
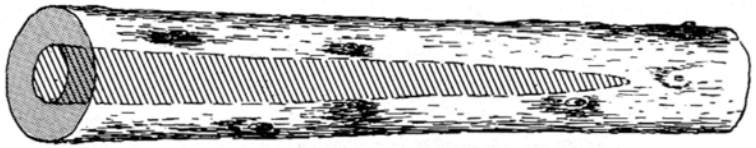
Below Grade



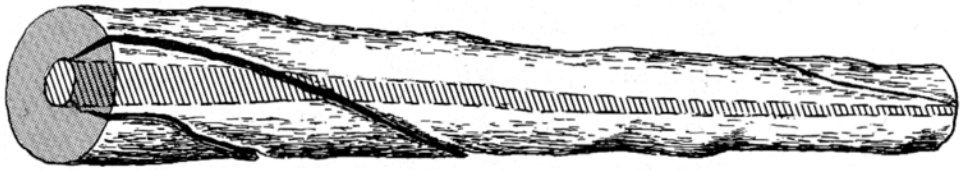
A 14-foot log 16 inches in diameter at the small end. It does not have minimum cuttings required for a factory log. It is too crooked and unsound to meet construction specifications. Sweep and rot deductions are less than 67 percent.



A 16-foot log 18 inches in diameter at the small end. It does not have the cuttings required for a factory log. Although it is sound, several knots are too large for the construction class.



A 12-foot log 18 inches in diameter at the small end. It does not have the cuttings required for a factory log. It has no large knots and no sweep, but it has an unsound heart for which scale deductions will be less than 67 percent.



A 16-foot log 20 inches in diameter at the small end. It does not have the cuttings required for a factory grade 3 log because of the deep spiral seams. It will not qualify as a construction log because of unsound heart.

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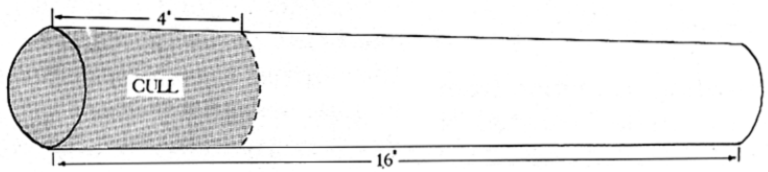
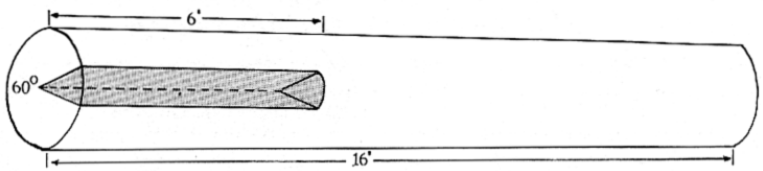
Scale Deductions

(Examples based on a 16-foot log with 20-inch scaling diameter)



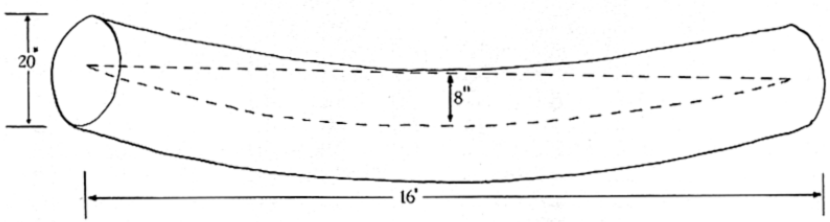
Defect section (rule 1):

Percent deduction $= \frac{4}{16} = 25\%$



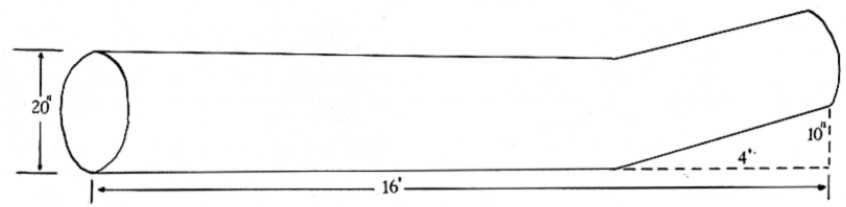
Defect section (rule 2):

Percent deduction $= \left(\frac{6}{16}\right)\left(\frac{60}{360}\right) = 6\text{-}1/4\%$



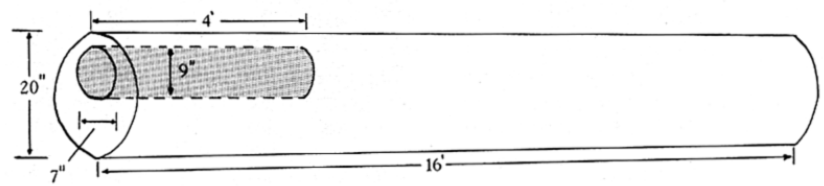
Sweep (rule 3):

Percent deduction $= \frac{8-2}{20} = 30\%$



Crook (rule 4):

Percent deduction $= \left(\frac{10}{20}\right)\left(\frac{4}{16}\right) = 12\text{-}1/2\%$



Interior defect (rule 5):

Percent deduction $= \frac{(8)\ (10)}{(20-1)^2} \times \frac{4}{16} = 5\text{-}5/9\%$

In practice each elipse axis can be divided by $(20 - 1)$ and rounded to nearest tenth if desired.

Thus $\frac{8}{19} = .4$, $\frac{10}{19} = .5$, and $(.4)\ (.5)\left(\frac{4}{16}\right) = 5\%$

From: Grosenbaugh, L. R., SHORT CUTS FOR CRUISERS AND SCALERS, USDA Forest Serv. South. Forest Exp. Sta., Occas. Paper 126, 1952.

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Hardwood Lumber Grades

- Hardwood lumber is grouped into the following grades:
  - FAS
  - F1F
  - Select
  - #1 Common
  - #2 A & B
  - #3 A & B

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HARDWOOD LUMBER GRADES STANDARD INSPECTION

	FAS	FIF	SELECT	#1 Common	#2A & 2B Common	#3A Common	#3B Common	FAS Limits	
Minimum Size Board	6" x 8'	Same as FAS for species being graded	4" x 6'	3" x 4'	3" x 4'	3" x 4'	3" x 4'	Pith = SM in inches Wane = 1/2 Length Knot = 1/3 SM Warp = Entire board must be flat enough to S2S to S.S.T. Splits = not to exceed 2x SM or 12" which ever is greater Splits shall not diverge 1" in 12" First Lineal Foot Rule: Applies to both ends of Board, to contain not over 25%, unsound wood.	**Wane in FAS 1 FACE** FAS limitation applies to Better Face. #1 Com side: 1/3W x 1/2 L Widest Wane added together: Length can be on both edges.
Minimum Size Cutting	4" x 5' 3" x 7'	BETTER FACE TO GRADE FAS POOR FACE TO GRADE #1 COM		4" x 2' 3" x 3'	3" x 2'	3" x 2'	Not less than $1^1/_2$" wide containing 35 sq. inches		
Basic Yield	SMx10 83-1/3%			SMx8 66-2/3%	SMx6 50 %	SMx4 33-1/3%	SMx3 25%		**Wane in Selects Pcs. 6" & Wider** FAS limitation applies to Better Face. #1 Com side: 1/3W x 1/2 L Widest Wane added together: Length can be on both edges.
Formula to Determine Number of Cuts	SM 4 (4 Max)			(SM+1) 3 (5 max)	(SM) 2 (7 max)	Unlimited	Unlimited Sound Cuttings		
SM Needed to Take Extra Cutting	6 - 15' SM			3 - 10'SM	2 - 7'SM				**Pcs. 4" & 5" Wide** 1/3 W x 1/2 L applies to both faces. Add widest Wane together. Add total length of wane from both edges.
Extra Yield Needed for Extra Cutting	SMx11 91-2/3 %			SMx9 75%	SMx8 66-2/3%				
Special Yields	97% Rule-2 cuts full width any length; pcs 6" and wider with 6-12' SM, SM x 11.64 for yield	97% rule on Better Face	2'+ 3'SM to be 100% clear or SM x 11 in one cutting on Better Face 97 % Rule	1' SM-100% 2' SM-SM X 9	1'SM-SMx8 #2A Common Clear Face Cuttings #2B Common Sound Cuttings	#2A Com on Better Face and Reverseside of cuttings sound: will also qualify for3A Com			Note: This chart summerizes the main requirements for the standard grades. For complete information, consult the appropriate section of the NHLA Rule Book.

Basic Yield for FAS

FAS (Firsts and Seconds)—The FAS grade will provide the user with long, wide, clear cuttings. Best suited for high quality furniture, interior trim, and solid wood mouldings. The FAS grade includes a range of boards which yield from 83⅓% (10/12ths) to 100% clear wood in minimum sized cuttings at least 3″ wide by 7′ long or 4″ wide by 5′ long.

Note: Diagrams show two examples of the clear yield (unshaded area) needed to make each grade. The shaded area contains defects and is not used in calculating the yield, although users may very well crosscut and rip the lumber in a different pattern and use portions of the board in the shaded area.

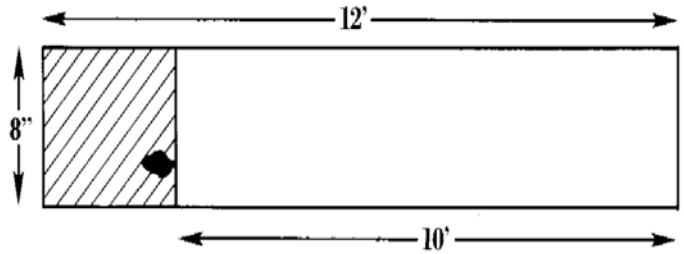

Diagram 1. FAS

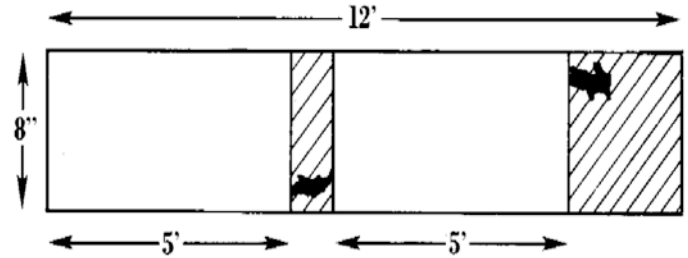

Diagram 2. FAS

FAS1FACE or Selects—In FAS1FACE ("FAS one face") and Selects, the grade is established using both faces of the board. The best face must meet the requirements for FAS, and the reverse side must essentially grade No. 1 Common. FAS1FACE and Selects are virtually the same grade, except for minimum width and length. The minimum board size for Selects is 4″ x 6′ ; and for FAS it is 6″ x 8′.

FAS

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Basic Yield for No. 1 Common

No. 1 Common—Will provide the user with clear cuttings of medium length and width. Best suited for furniture, cabinets, and a multitude of solid wood manufactured products. The No. 1 Common grade includes a range of boards which will yield from 66⅔% (8/12ths) to 83⅓% (10/12ths) clear wood in minimum sized cuttings at least 3″ wide by 3′ long or 4″ x 2′.

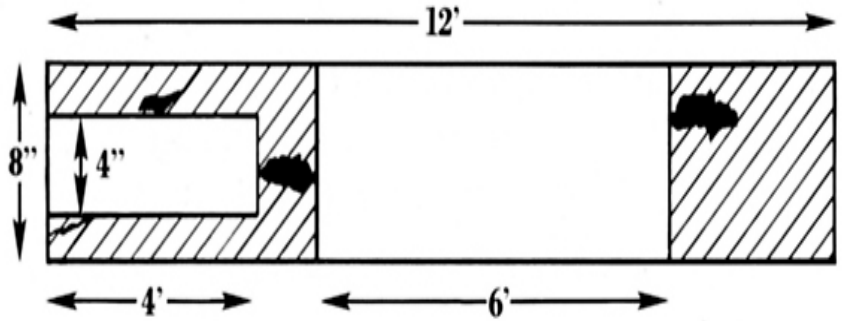

Diagram 3. No. 1 Common

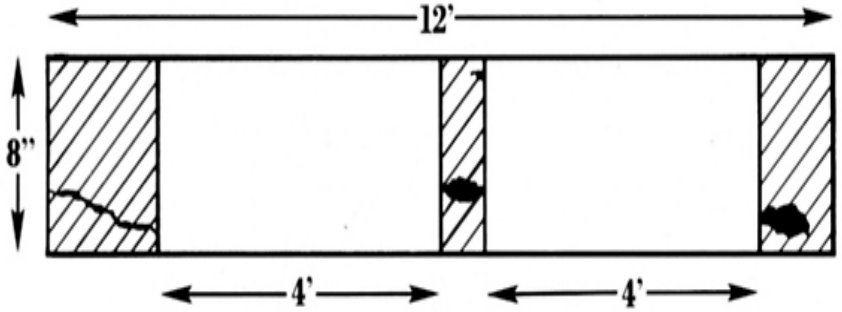

Diagram 4. No. 1 Common

No. 1 Common

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Basic Yield for No. 2 Common

No. 2 Common—Will provide the user with short, narrow clear cuttings economically priced, for use in unexposed furniture frames, picture frames, cabinet rails and frames, and novelties. The No. 2 Common grade includes a range of boards which will yield from 50% (6/12ths) to 66⅔% (8/12ths) clear wood in minimum sized cuttings at least 3″ wide by 2′ long.

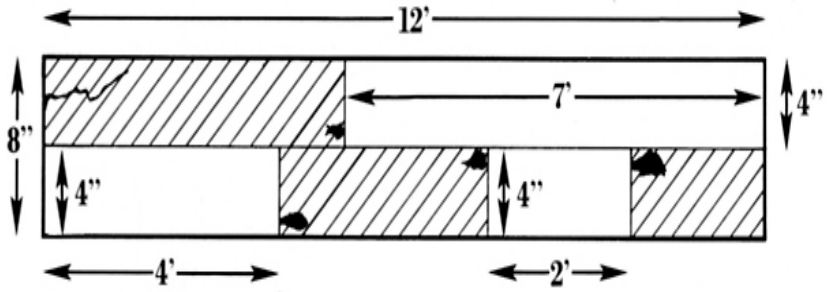

Diagram 5. No. 2 Common

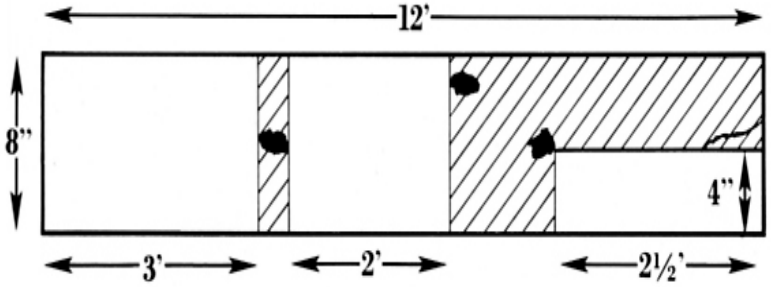

Diagram 6. No. 2 Common

No. 2 Common

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Yield to Make Grade

Lumber Grade	Percentage Clear (no defect)	Price per MBF
FAS, F1F, and Select	83%	$1535
#1 Common	67%	$1030
#2 A & B	50%	$905
#3 A & B	33%	$400

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Grade Yield from Hardwood Logs

Lumber Grade	Percentage Clear (no defect)	Price per MBF
FAS, F1F, and Select	83%	$1535
#1 Common	67%	$1030
#2 A & B	50%	$905
#3 A & B	33%	$400

Log Grade	Log Price (MBF)	FAS, F1F, and Select	#1 Common	#2A	Below #2A
Veneer	$700+	NA	NA	NA	NA
F1	$600	49.0%	28.3%	14.6%	8.1%
F2	$450	22.0%	34.5%	25.3%	18.2%
F3	$300	7.0%	22.3%	34.4%	36.3%

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Quality U.S. Hardwood Lumber Manufacturing

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WOOD PRODUCTS

Established Industry

- Forest Management
- Quality sawlogs and veneer logs
- Sawing
- Drying
- Standards
- Quality
  - Hardwood Lumber
  - Hardwood Parts
  - Hardwood Veneer

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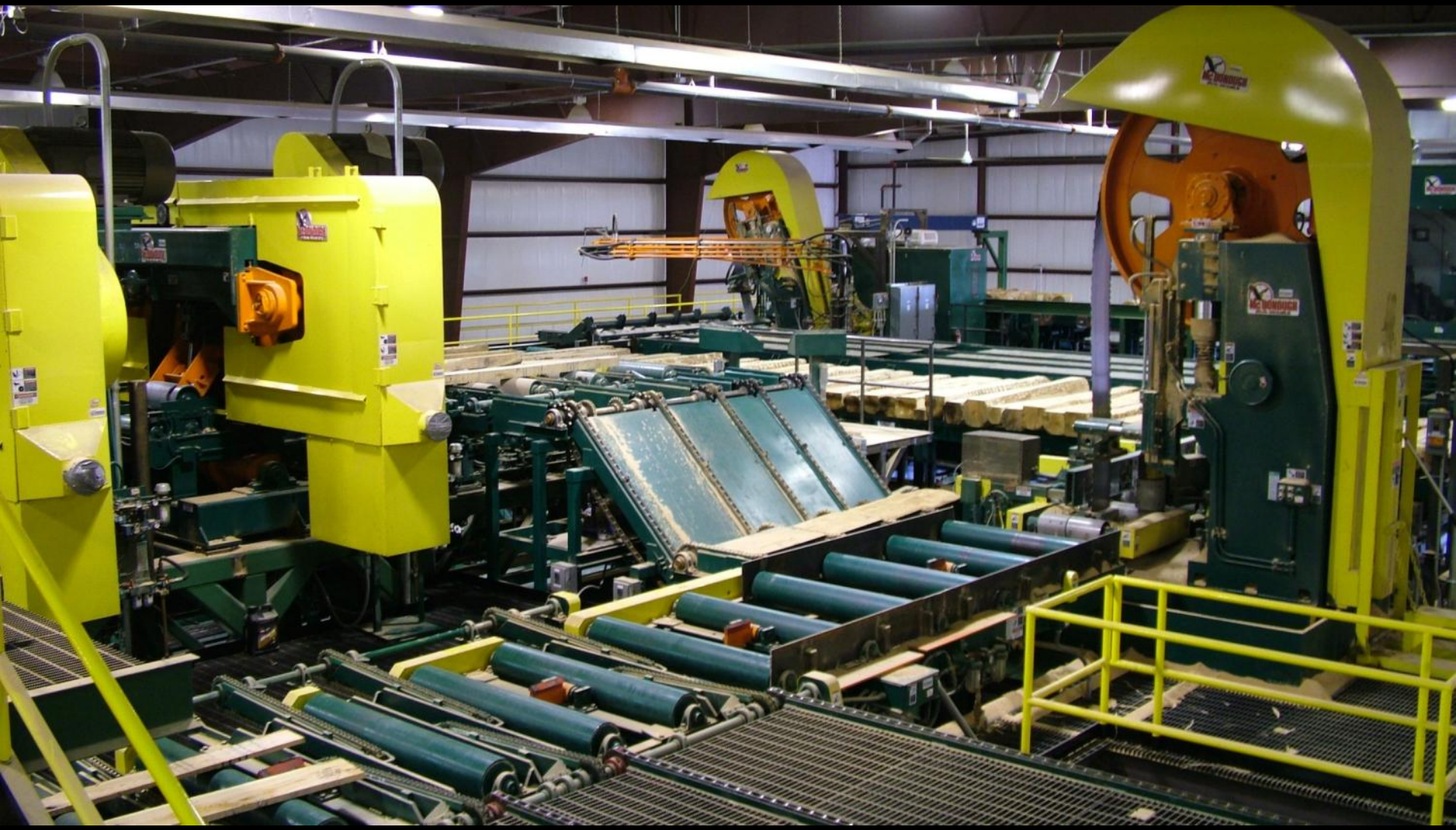
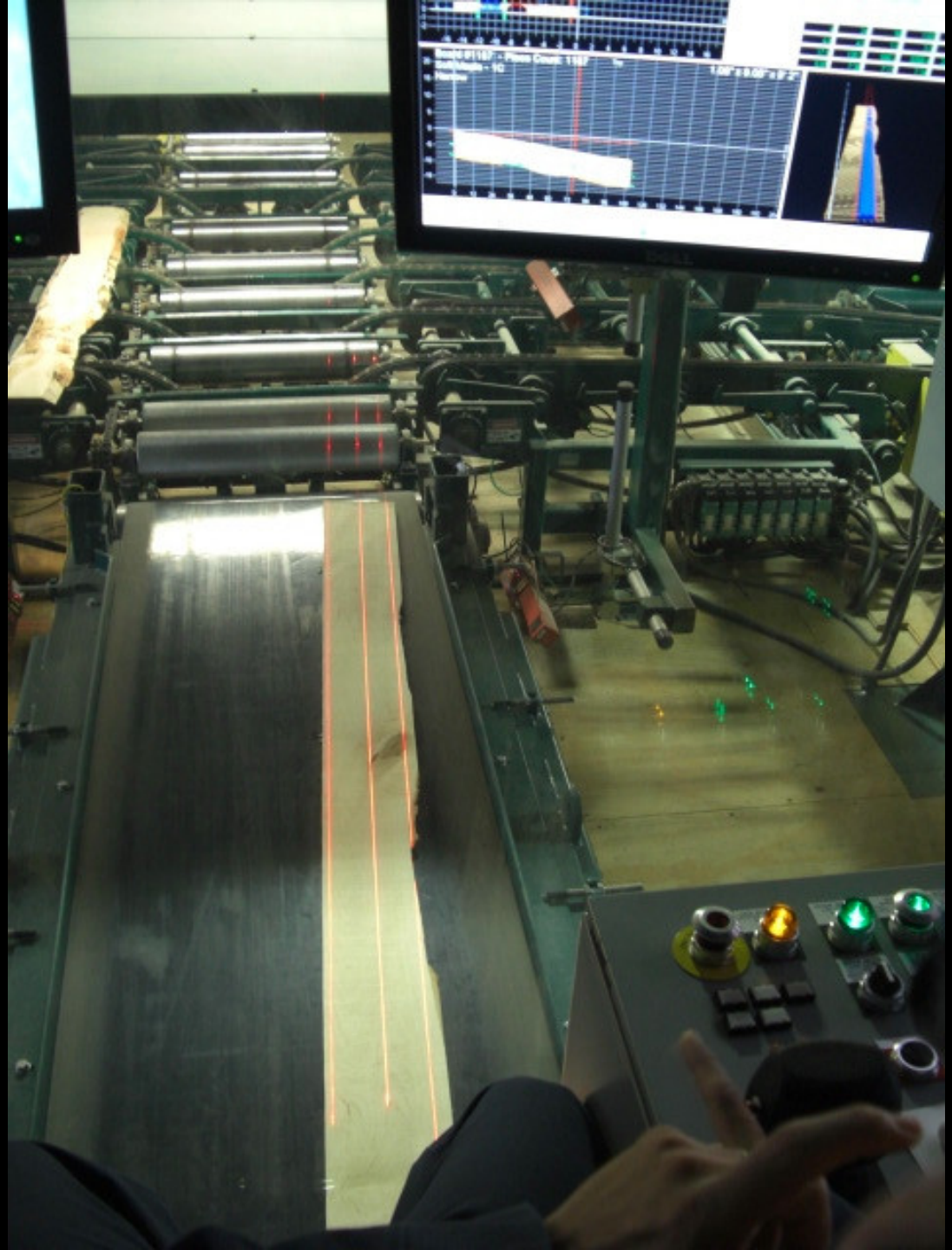
Quality from the Forest

- Careful harvesting
- Proper log handling and storage
- Proper log end-coating
  - Prevents staining
  - Prevents end-checking
- Dangers of whole log exports
  - Stain and mold
  - End-checking
  - Oxidative Enzymatic Stain

THE UNIVERSITY of WISCONSIN WOOD PRODUCTS

INDVEC
McDONOUGH
McDONOUGH





Quality Lumber Manufacturing

- Proper lumber handling and storage
- Proper lumber end-coating
  - Prevents staining
  - Prevents end-checking
- Proper grade sorting

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Quality Lumber Drying

- Consistent and uniform moisture content
- Proper equalizing and conditioning

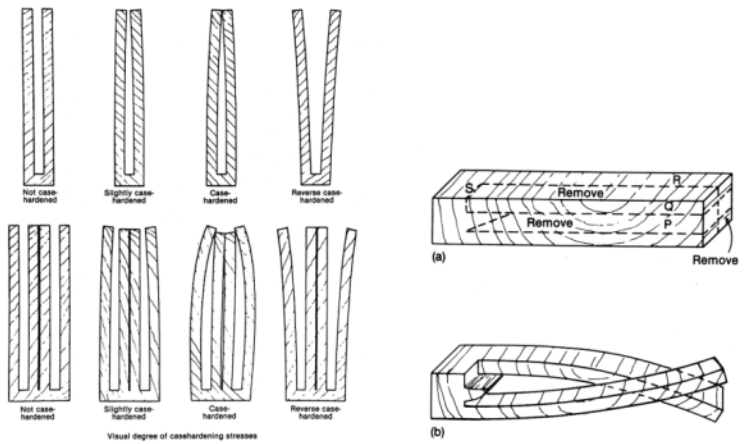

Figure 6-4—Method of cutting stress sections for casehardening tests. Lumber that is less than 1-1/2 in thick is cut into three prongs, and the middle prong is removed; lumber that is 1-1/2 in thick or thicker is cut into six prongs, and the second and fifth prongs are removed. (ML88 5585)

Figure 6-5—(a) Method of cutting stress sections for severe casehardening tests. (b) Prongs are offset so that they can cross and indicate severity of casehardening. (ML88 5584)

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Lumber Versus Log Import Estimator

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Lumber Versus Log Import Estimator

- Simple Excel spreadsheet
- Adaptable to your…
  - Lumber needs
  - Location and shipping needs
  - Costs
  - Changing raw material costs
  - Changing exchange rates

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Safari File Edit View History Bookmarks Window Help 71°F 05:10:42 (100%) Tue 1:40 PM SCOTT BOWE

4_4_LUMBER_VERSUS_LOG_IMPORT_ESTIMATOR-09-19-2013.xlsx

M59 FAS, F1F, & Select

	A	B	C	D	E	F	G	H	I	J	K	L
33	Species being considered			*Red Oak lumber in a 4/4 size as compared to premium red oak logs*								
34												
35	Log Grade	Log price	(Note: in this example, log price premiums are paid for premium mix of larger diameters and longer lengths required)									
36	F1	*$600.00*										
37	F2	*$450.00*										
38	F3	*$300.00*										
39												
40	Board foot yield per MBF log scale estimated for diameter distribution and cutting scenario considered =							*1005*				
41	From PROYIELD module - the board foot yield per MBF log scale estimated for diameter distribution and cutting scenario considered was =									1005		
42		This is equivalent to an overrun of			0.5%							
43							Scribner	International		Expanded		
44	Estimated cubic feet of logs per MBF log scale =				*130.1*		Decimal C	1/4 rule	Doyle	Scribner		
45	From CONVERT module, the estimated cubic feet of logs per MBF log scale was =						130.1	129.1	133.9	129.3		
46	Estimated cubic meters of logs per MBF log scale =				*3.68*							
47	From CONVERT module, the Estimated cubic meters of logs per MBF log scale was =						3.68	3.66	3.79	3.66		
48												
49	Estimated board feet of log scale per cubic foot of logs =				7.7							
50	Estimated board feet of log scale per cubic meter of logs =				271.4							
51												
52	Estimated board feet of lumber recovered per cubic foot of logs =					7.7						
53	Estimated board feet of lumber recovered per cubic meter of logs =					272.7						
54												
55												
56	Average bone dry units (2,400 dry pound equivalent) of sawmill residue wood and bark, per MBF of log scale processed =								*0.94*			Projected for grad
57	From PROYIELD module, average bone dry units of sawmill residue wood and bark, per MBF of log scale processed =								1.02			

Lumber vs Log Import Estimator | CONVERT | PROYIELD | Container Estimator

Problems with Shipping Logs

- Roundwood in a rectangular container
- Moisture content and stain
- Large volumes of low value byproduct
- Grade recovery

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Problems with Shipping Logs

- Grade Recovery
  - As much as 70% of the lumber could be low grade material if they are processing grade 3 logs
  - Shipping F1 logs would require 3 containers to generate the equivalent of 1 container of #2 and better lumber; shipping F3 logs would require 5 containers to generate the equivalent of 1 container of #2 and better lumber.

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Grade Yield from Hardwood Logs

Lumber Grade	Percentage Clear (no defect)	Price per MBF
FAS, F1F, and Select	83%	$1535
#1 Common	67%	$1030
#2 A & B	50%	$905
#3 A & B	33%	$400

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F2	$450	22.0%	34.5%	25.3%	18.2%
F3	$300	7.0%	22.3%	34.4%	36.3%

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Lumber Versus Log Import Estimator

- Lumber Versus Log Import Estimator

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Questions?

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Madison, WI 53706-1598, USA
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WOOD PRODUCTS

India, An Emerging Export Market for Wisconsin Lumber

LSLA Winter Meeting 2013

Scott Bowe

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WOOD PRODUCTS

India

- Second to China in Population
  - 1.24 billion people (1.34 billion in China)
  - Religions
    - 80.5% of the population of India practice Hinduism
    - Islam (13.4%)
    - Christianity (2.3%)
    - Sikhism (1.9%)
    - Buddhism (0.8%)
    - Jainism (0.4%)
  - A country of extremes

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Our India Project

- American hardwood logs vs. lumber in India
  - Shipping
  - Quality
    - Log degrade
    - Indian sawing variation
    - Indian kiln drying
  - American hardwood lumber sawn in India is still sold as American hardwood; poor in-country sawing will hurt our quality reputation

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Kabul
Afghanistan
Islamabad
Jammu and Kashmir
Himachal Pradesh
Lahore
Faisalabad
Ludhiana
Chandigarh
Tibet
Pakistan
Multan
Punjab
Uttarakhand
Haryana
New Delhi
Uttar Pradesh
Nepal
Kathmandu
Sikkim
Bhutan
Jaipur
Rajasthan
Lucknow
Kanpur
Assam
Bihar
Meghalaya
Karachi
Bangladesh
Madhya Pradesh
Jharkhand
Gujarat
Ahmedabad
India
West Bengal
Rajkot
Vadodara
Chhattisgarh
Tripura
Surat
Nagpur
Orissa
Nashik
Mizoram
Maharastra
Mumbai
Pune
Visakhapatnam
Hyderabad
Andhra Pradesh
Goa
Karnataka
Bay of Bengal
Bangalore
Chennai
Arabian Sea
Tamil Nadu
Coimbatore
Madurai
Kerala
Map data ©2013

Export Statistics to India

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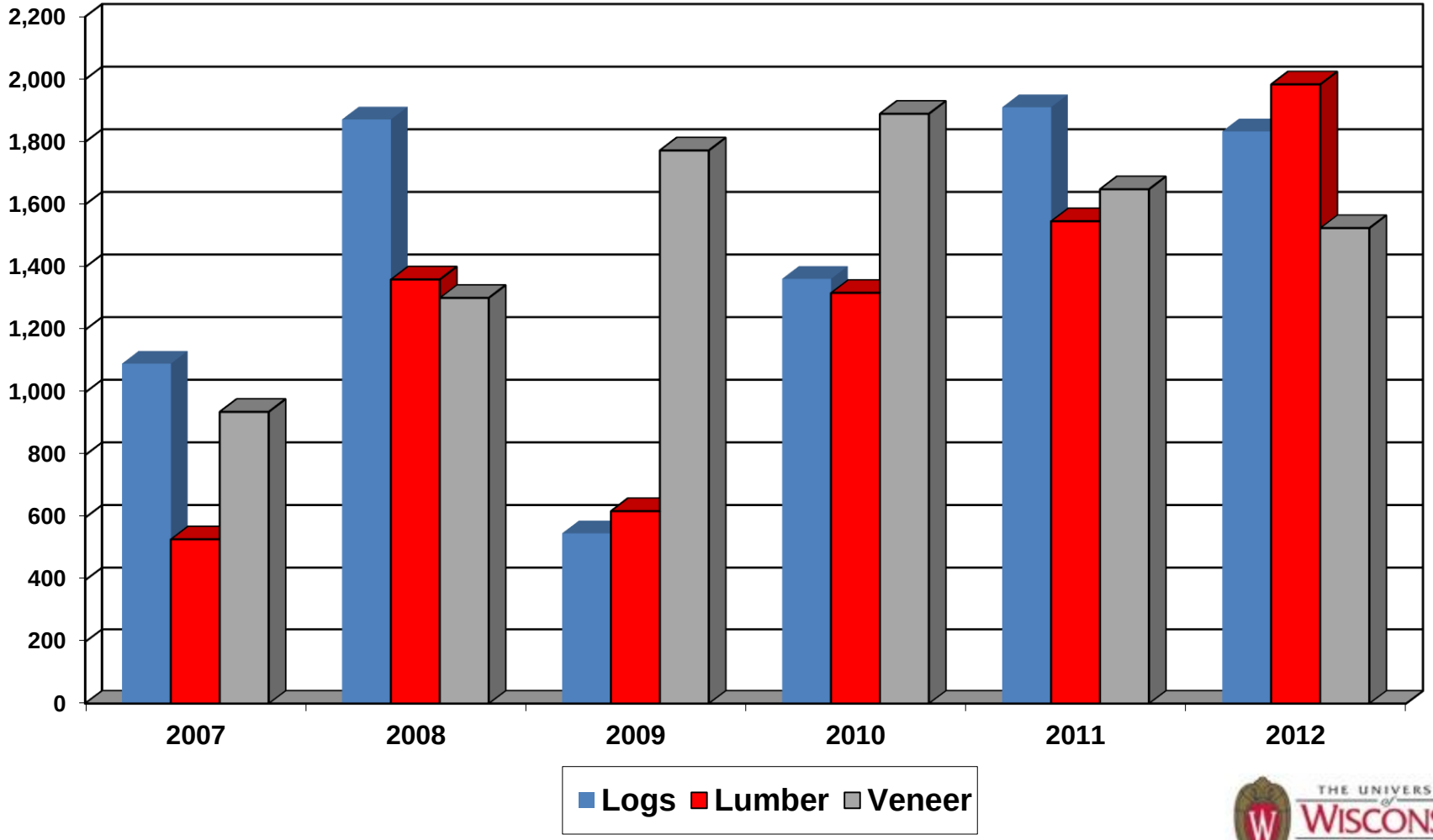
Direct Exports of US Hardwood Products to India

2007 – 2012 (USD thousand)



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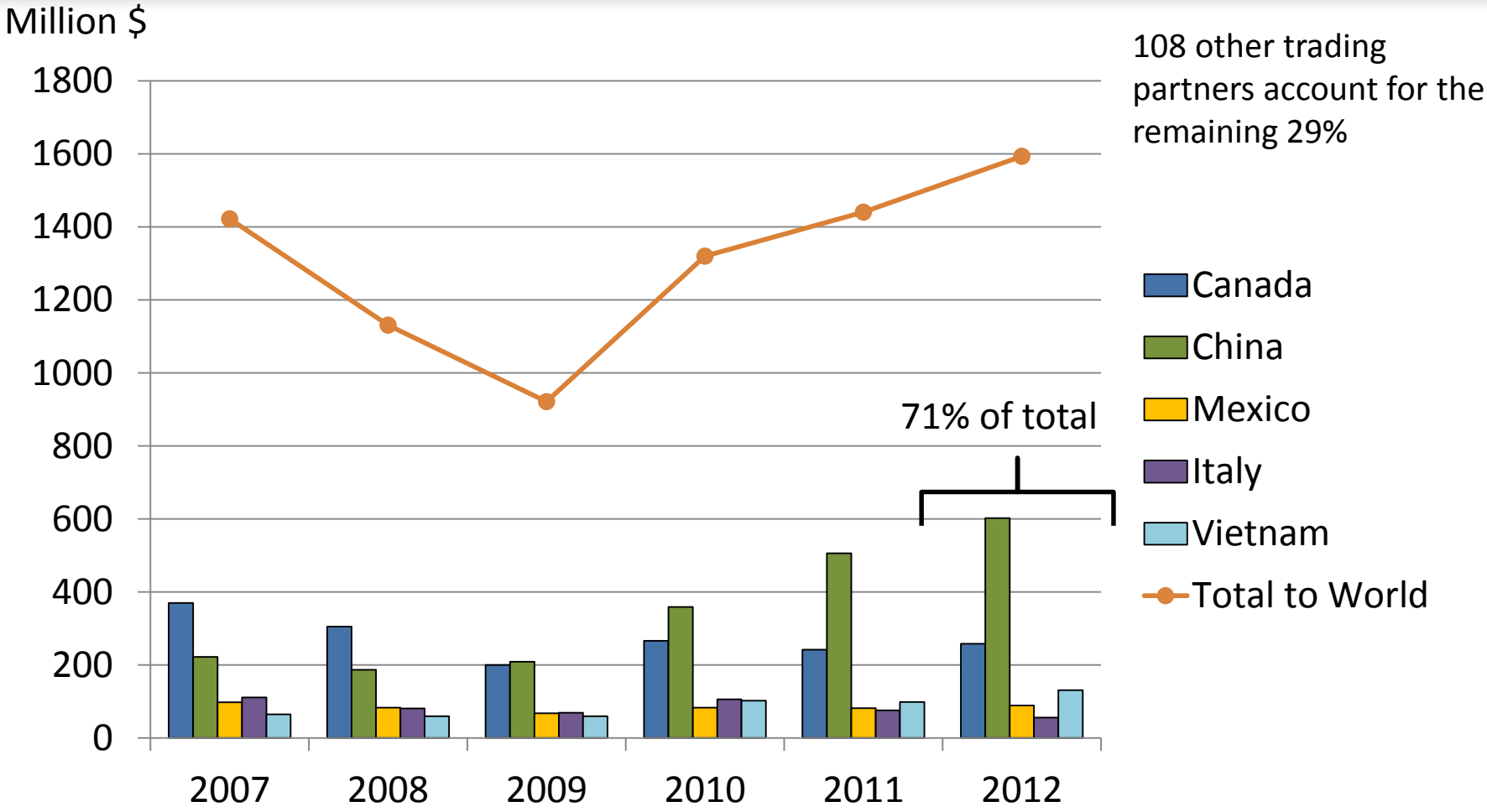
Source: USDA Foreign Agricultural Service

U.S. Hardwood Lumber Exports

(top 5 destinations)



* Japan and the UK were slightly higher than Italy in 2012, dropping Italy to 7th for 2012

Data: USDA Foreign Agricultural Service

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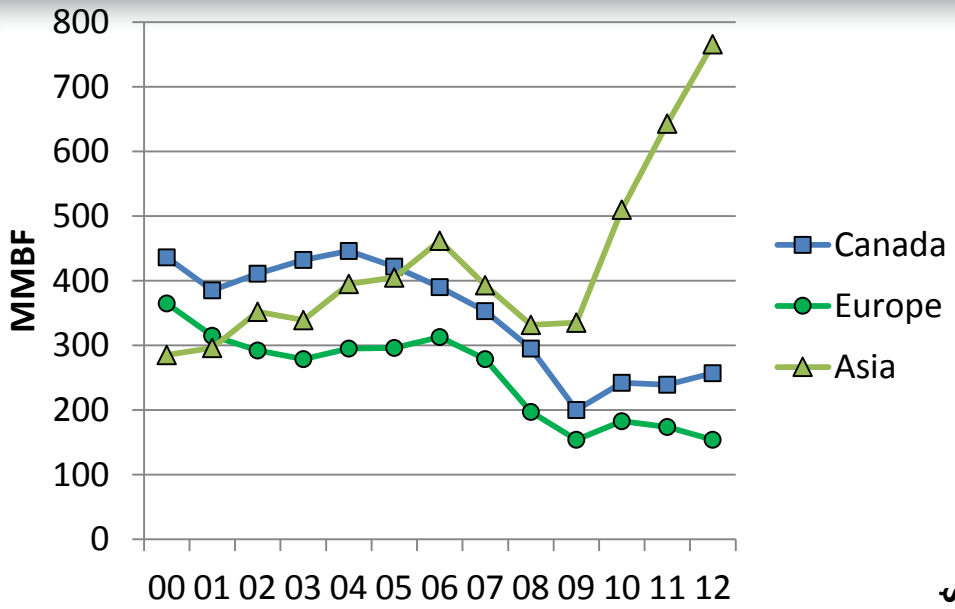
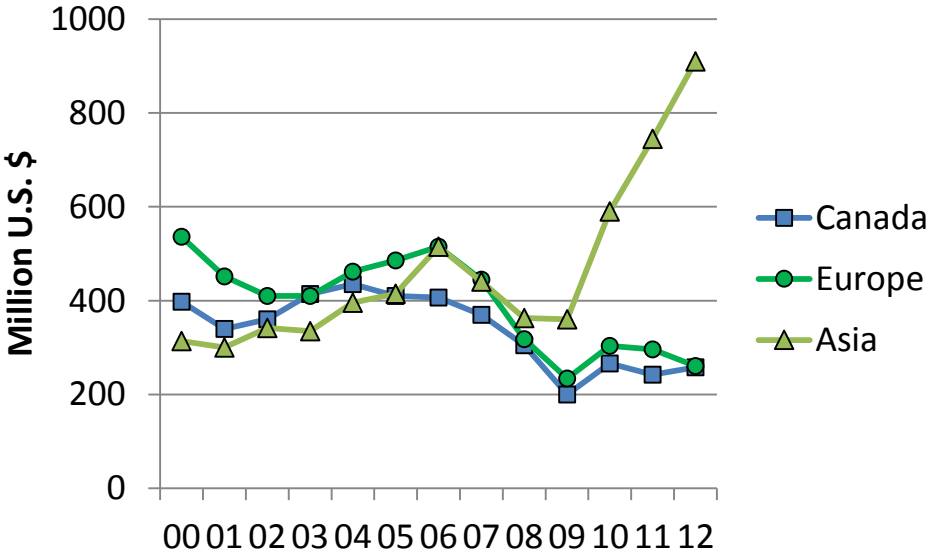
U.S. Hardwood Lumber Exports





Data: USDA Foreign Agricultural Service

Barriers to American Hardwoods

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Barriers to American Hardwoods

- Craft production vs. factory production

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7838996700
DL4S
BM 3112

ALL
INDIA
CNG

IMRAN - 8527848561 - 7838996700
C0385

Example Hardwood Lumber Production in India

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Typical Indian Sawmill

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Typical Indian Resaw

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Residual Uses

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6965-54
6966-55
6967:56
6963-59
6964:55
9811-48
9810-56

130

Barriers to American Hardwoods

- Craft production vs. factory production
- Species familiarity

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Thermally Modified Hardwood

- Modified wood structure using heat
  - Physical and chemical changes
  - Dimensionally stable
  - Water repellent
  - Not prone to rot or insect attack
  - Deep rich color

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Barriers to American Hardwoods

- Craft production vs. factory production
- Species familiarity
- Price

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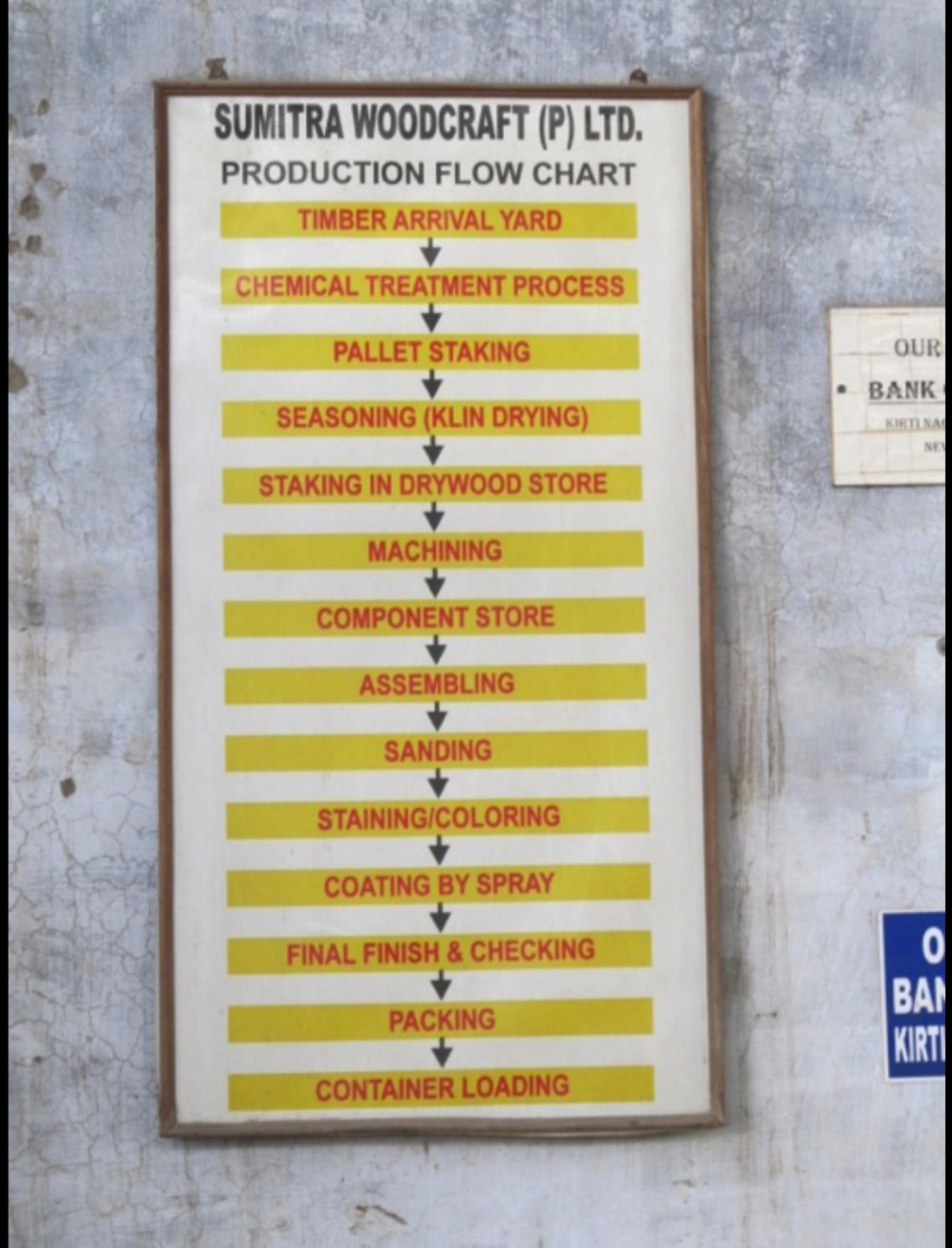
SUMITRA WOODCRAFT (P) LTD.
PRODUCTION FLOW CHART
TIMBER ARRIVAL YARD
CHEMICAL TREATMENT PROCESS
PALLET STAKING
SEASONING (KLIN DRYING)
STAKING IN DRYWOOD STORE
MACHINING
COMPONENT STORE
ASSEMBLING
SANDING
STAINING/COLORING
COATING BY SPRAY
FINAL FINISH & CHECKING
PACKING
CONTAINER LOADING

OUR BANK
BANK OF INDIA

SEASONING CHECK POINTS

1. Checking of moisture after chemical treatment.
2. Air drying upto FSP level.
3. Proper wood stacking in seasoning chambers .
4. Check sample plank as per seasoning schedule.
5. Control moisture from 6-10.

सुखाने के तरीके

1. केमिकल करने के बाद में मोएस्चर चैक करें।
2. हवा में एफ.एस.पी. लेवल के हिसाब से चैक करें।
3. लकड़ी को सही तरीके से लगायें।
4. समयानुसार सेम्पल वाले फट्टे की जाँच करें।
5. 6% से 10% मोएस्चर तक माल निकालें।

west elm
west elm
west elm
west elm
west elm
INGALLS
INGALLS
INGALLS
INGALLS
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HT 273

Barriers to American Hardwoods

- Craft production vs. factory production
- Species familiarity
- Price
- Understanding American hardwoods
  - AHEC
  - Wisconsin DATCP

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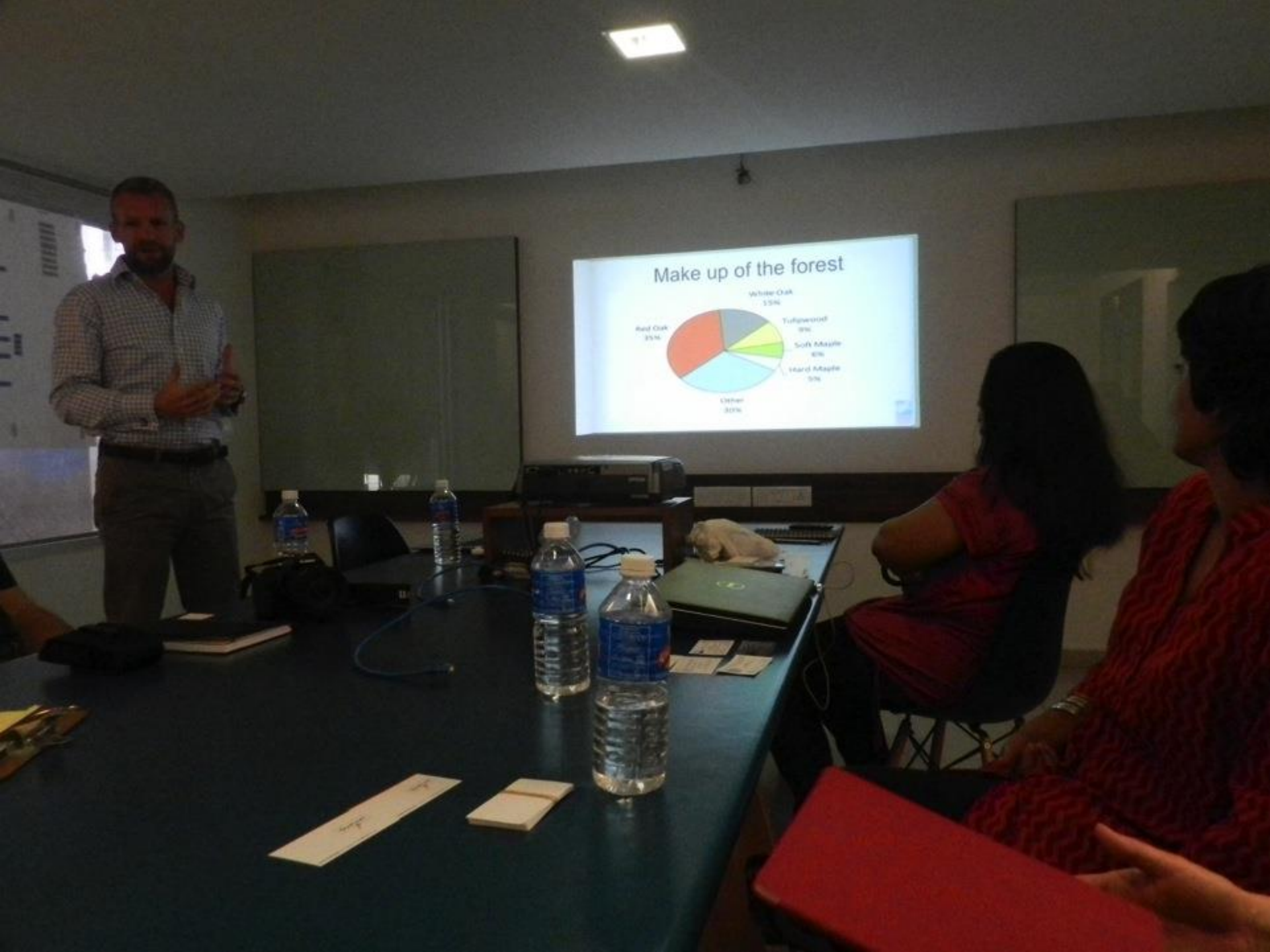
AMERICAN HARDWOOD EXPORT COUNCIL

U.S. Hardwoods – the Basics
• Hardwood vs. Softwood
– Hardwood: broad leaf and deciduous
– Softwood: needle leaf and evergreen
INSTITUTE OF INDIAN INTERIOR DESIGNERS
Bangalore Regional Chapter


Make up of the forest
White Oak
15%
Tulipwood
9%
Soft Maple
8%
Hard Maple
5%
Other
30%
Red Oak
35%

U.S. Hardwood Regions

Barriers to American Hardwoods

- Craft production vs. factory production
- Species familiarity
- Price
- Understanding American hardwoods
  - AHEC
  - Wisconsin DATCP
- Culture Shock

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Consumers: Discharge Your Responsibilities, Assert Your Rights
"Every child has a right to care, protection and family"
Fine Living !
ACECITY
Coca-Cola

SML
New Horizon Gurukul

Questions?

Contact Information

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