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**A Strategic Analysis for
Aspen Solid Wood Products in Saskatchewan**

by

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Introduction

Approximately forty percent of the mixed forest resource of Saskatchewan is aspen (*Populus tremuloides*). Today aspen is used as the major source of raw material in Pulp and OSB production.

Three aspen production facilities, two located near Meadow Lake and one located in the Hudson Bay region consume approximately 2.4 to 2.7 million M3 of aspen logs annually. This consumption is a suitable use for a large percentage of the fibre but there is the possibility that a portion of this resource may have higher value alternatives.

This report takes a strategic analysis approach to exploring opportunities for aspen solid wood products manufactured in Saskatchewan. It combines past research conducted by FPInnovations with current internet research and consideration of current global markets, logistics and manufacturing techniques.

The report is made up of four sections. The first section presents an industry analysis with a brief summary of the existing aspen wood products, current producers, technical species data and a discussion of geographic markets, end-use segments and competition.

The second section examines internal factors that influence the potential for aspen solid wood product manufacturing in Saskatchewan. These factors include an examination of the available timber volume and an assessment of the timber quality.

Section three of the report explores the strategic issues that have been identified based on the industry analysis and internal analysis presented in the first two sections.

Recommendations and considerations for moving forward with an initiative to extract more value from the aspen resource are presented in the final section of the report. With consideration of the identified strategic issues and by comparing a similar value extraction model from another wood product region in British Columbia, two potential business opportunity options are explored.

Industry Analysis

Current Aspen Solid Wood Producers

The current aspen solid wood products industry in Canada can be described as small and fragmented. While there are a number of companies that work with this abundant hardwood species, very few could be found that promote aspen as their core product line.

Most of the companies that produce small volumes of aspen lumber in western Canada do so opportunistically, taking advantage of small scale logging activity in particular regions. With log volume adequate to run aspen in a small sawmill for one or more shifts, operators match their aspen lumber output to specific local market opportunities. These small-scale sawmills often produce rough green timbers to be used in the industrial resource sector such as crane matting or heavy equipment transport blocking in the oil or mining industry. Log quality in these instances can vary significantly from one sawmill run to the next, but product prices are relatively insensitive to this quality fluctuation and are instead driven by spot demand at local industrial sites.

Along with these small scale sawmills there are number of companies that promote aspen lumber on their websites and appear to produce regular volumes in a relatively wide product mix.

Aspen Valley Lumber of La Crete in northern Alberta produces SPF and aspen lumber. A range of aspen lumber products such as pallet stock material, pipeline blocking and timber mats is promoted on their website. This company is reported to have built up a steady customer base in the US and Mexico through its sales agreement with Marathon Wholesales of Richmond, BC. Pipeline blocking and timber mats are sold to the local resource industries.

La Crete Sawmills, another company producing aspen solid wood products from the same area promotes aspen studs for use in the residential framing market. These studs are graded to NLGA rules but are promoted as having a proprietary enhancement of no wane, which would be attractive to many end users. The studs are offered in both 2 x 4 and 2 x 6 in two precision end trimmed lengths. Along with studs, this company also promotes 1 x 4 and 1 x 6 wane free lumber. All products are kiln dried, planed and paper wrapped for truck or rail shipment.

Eastern Canadian producers such as Ben Hokum & Son Limited of Killaloe, Ontario specializes in value cutting of local Pines and Oak but also promote aspen lumber as one of its regular products. 4/4 and 5/4 sizes are graded to NHLA standards including #1 Common and Select and better grades are offered on their website at prices as high as \$930 per thousand board feet.

In Quebec Rosario Poirier Inc. a third generation family enterprise has developed a full range of aspen lumber products and is able to produce custom cut orders.

Another eastern specialty lumber company that offers aspen as one of its main product lines is Adventure Lumber. This company is headquartered in Michigan with production originating in Quebec. The company strives to add value to aspen lumber by producing pre-cut components and has recently introduced a thermally modified aspen product line.

In the USA, aspen solid wood production appears to be similarly small in scale and fragmented. The US producer's advantage of being located closer to the large markets of major urban centers provides them with the ability to focus on a higher percentage of finished products. In most cases these products are manufactured and distributed through the traditional hardwood supply chain made up of many small scale regional sawmills and a large network of secondary manufacturing and wholesale distribution that supports manufacturers of high value interior finished products. Companies producing aspen lumber products usually offer aspen along with a full range of other complimentary hardwood species.

Readers are encouraged to access the company websites of aspen producers that are mentioned above for detailed information on their companies and product lines. (See Appendix #1)

Aspen Technical Properties, Lumber Grades and Outturns

This subsection of the report presents a description of the working properties of aspen solid wood, technical data, and information on lumber recovery and grade outturn of sawn lumber.

Working Properties

Aspen doesn't contain resin, and has toughness as well as exceptional stiffness. The wood resists splitting when nailing or screwing, yet you can work it easily with hand tools because of its softness. It also glues

well. Due to the tendency for aspen's wood fibers to fuzz when worked, you need to use tools with sharp blades and cutters. While this wood takes paint readily, it blotches when stained unless you first apply a sealer. Aspen is a stable wood that wears without splintering. However, in conditions favoring decay, it deteriorates. For carving, aspen makes a first-rate substitute for basswood. You also can fashion it into light-duty furniture, solid paneling, and millwork. Aspen has no odor and imparts no taste to food-stuffs, so it's ideal for baskets, bowls, and containers. Children's toys made from aspen remain splinter-free. Aspen lumber may be hard to find. Where sold, however, the boards will be high quality, but generally neither unusually wide nor thicker than 1 inch. (Wood Magazine.com)

Technical Data

The following technical information has been compiled by FPInnovations from internal and external scientific sources.

TREMBLING ASPEN

Botanical Name: Populus tremuloides Michx.

The tree often appears in pure stands and grows in many soil conditions from sea level to 3000 metres. This tree grows up to 25 metres tall and 25 cm in diameter, but has a shorter lifespan than most trees due to its susceptibility to decay.

Aspen is the most commonly used wood species for oriented strand board (OSB). It is suitable for the production of high quality laminated veneer lumber (LVL) for use as headers, joists, beams and planks. Aspen lumber has gained moderate acceptance in the construction market as studs. There is interest in marketing aspen for appearance applications due to its bright white colour.

Aspen lumber is dried according to end-use and customer specifications. Kiln drying inhibits natural staining of the wood, improves its strength and stiffness, enhances its appearance, and increases its resistance to decay and attack by insects.

Aspen is currently sawn into studs for construction lumber under National Lumber Grades Authority (NLGA) rules. However, the main interest is to increase the production of aspen for millwork applications. Appearance and millworking grades can be produced according to National Hardwood Lumber Association (NHLA) rules.

ASPEN VISUAL PROPERTIES	
COLOUR	
Heartwood	Varies from off-white to creamy to light greyish-brown.
Sapwood	Nearly white.
Latewood /Earlywood recognition difficult.	The diffuse porous nature of this species makes growth ring Contrast
GRAIN	
Straight-grained, fine and even-textured.	
FIGURE	
Plainsawn lumber or rotary-cut veneer: Faint growth rings. Quartersawn lumber or quarter-sliced veneer: None.	
KNOTS	
Discolouration above and below knots form and a “comet-tail” or “keyhole”.	
OTHER	
It has a characteristic disagreeable odour when wet, but is odourless when dry. Wood is soft and light. It weathers to a light grey with a pronounced silky lustre.	

ASPEN WORKING PROPERTIES		
Process	Performance	Comments
MACHINING		
Planing	Good planing quality	Recommended planer settings: 12° or 20° hook angle and 16 or 20 kmpi (knife marks per inch).
Turning	Good surface quality	Common defects: torn out grain and, less severe, fuzzy grain. Sanding usually eliminate these defects.
Sawing	Resistance to sawing varies widely	Moderately good when compared to other lower-density wood species but poor when compared to higher-density hardwoods (e.g. maple).
Boring	Moderate quality	Recommended settings: use brad point bit.
Mortising	Very good	Very good mortising quality when using a hollow chisel mortise.

ASPEN WORKING PROPERTIES		
Process	Performance	Comments
Shaping	Very good	
Veneering	Easy	
Sanding	Good	Heavily affected by fuzzy grain. Recommended settings: finer sandpaper after the initial sanding to eliminate fuzzy grain and the sandpaper frequently changed.
FASTENING		
Screwing	Good	Good holding. Good resistance to splitting. Average screw retention: 482 lb.
Nailing	Satisfactory	Good resistance to splitting.
Gluing	Moderately easy	Good adhesion.
FINISHING		
Staining	Good	Finishes well. Blotches appear as the stains become darker. Recommended: light to medium stains.
Painting	Good	
Lacquering	Good	Performed well in the tape test.
Waxing	Satisfactory	Best when using light-coloured waxes (e.g. Mellow Pine).
HEARTWOOD DURABILITY		
Natural Decay	Low	Low decay resistance limits age of trees. Resistance
Treatability	Very good	Very permeable wood.

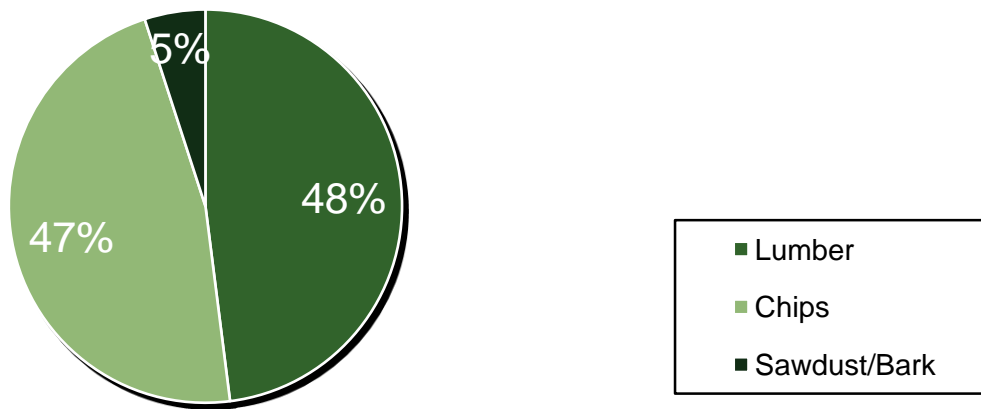
Lumber Recovery and Grade Outturn

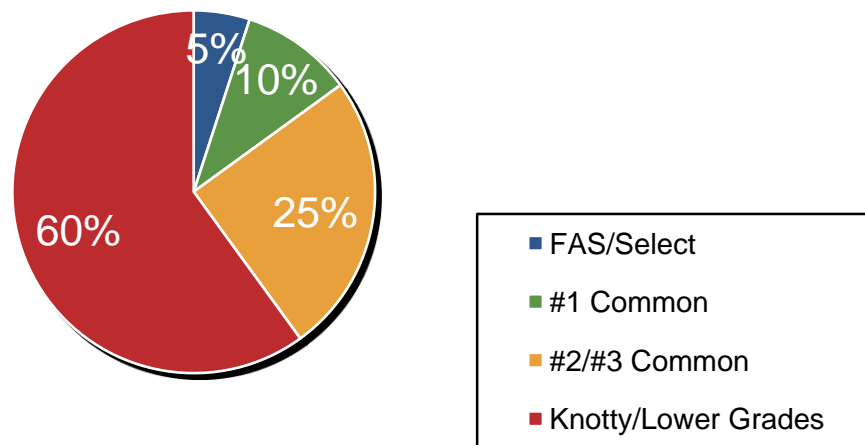
The majority of aspen sawlog breakdown is based on maximizing the higher grades and recovery of the remaining wood in lower grade lumber. The balance of the sawlog that is not sawn into lumber ends up as chips and sawdust. The following chart illustrates typical sawmill outturn from an aspen sawlog sort.

Approximately 48% of the fibre from a sawlog is converted into rough green lumber. The remaining 52% is recovered as a byproduct in chips and a combination of bark and sawdust.

When the rough green aspen lumber is further processed into marketable lumber, a range of grades are produced. Higher grades, #1 Common, Select and FAS grades of lumber make up approximately 15% of the typical lumber output. These grades can be sold at prices that are well above the average cost of production. Previous interviews conducted by FPInnovations have reported aspen sawmill operators having no trouble selling their #1 Common and better grades consistently at profitable prices. “The problem is selling the rest of the pile without giving it away” commented one sawmill operator. An estimated 85% of sawmill production is made up of #2, #3 Common and knotty lower grades, this portion is “the rest of the pile”.

Log Breakdown



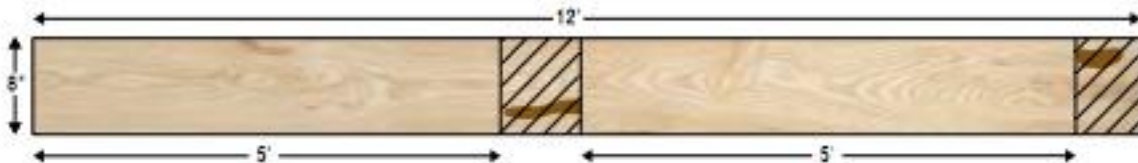


The grade outturn above is based on the NHLA (US National Hardwood Lumber Association) grade rules. This association provides information on all species of hardwood found in North America. The association’s website information center describes aspen lumber availability as “ limited” and “rarely available in thick stock”. The following grade descriptions are presented in their literature.

The FAS grade, which derives from an original grade "First And Seconds", will provide the user with long, clear cuttings best suited for high quality furniture, interior joinery and solid wood mouldings. Minimum board size is 6" and wider and 8' and longer. The FAS grade includes a range of boards that yield from 83 1/3% (10/12ths) to 100% clear-wood cuttings over the entire surface of the board. The clear cuttings must be a minimum size of 3" wide by 7' long or 4" wide by 5' long. The number of these cuttings permitted depends on the size of the board with most boards permitting one to two. The minimum width and length will vary, depending on species and whether the board is green or kiln dried. Both faces of the board must meet the minimum requirement for FAS.

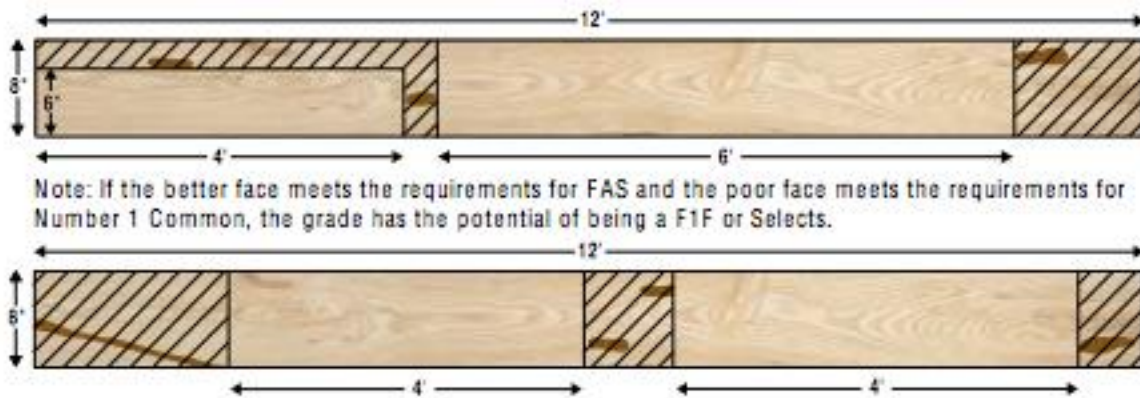


Note: Minimum yield 83 1/3% clear wood cuttings on the poor face of the board.



The Select grade is virtually the same as the FAS graded one face, except for the minimum board size required.

The #1 Common grade is often referred to as the Cabinet grade in the USA because of its adaptability to the standard sizes of kitchen cabinet doors used throughout the United States. #1 Common is widely used in the manufacture of furniture parts as well for this reason. The Number 1 Common grades includes boards that are a minimum of 3" wide and 4' long and will yield clear face cuttings from 66 $\frac{2}{3}$ % (8/12ths) up to, but not including, the minimum requirement for FAS (83 $\frac{1}{3}$ %). The smallest clear cuttings allowed are 3" by 3' and 4" by 2'. The number of these clear cuttings is determined by the size of the board. Both faces of the board must meet the minimum requirement for #1 Common.



Aspen Products, Markets and Competition

This subsection of the report examines current domestic and offshore markets for aspen solid wood products and discusses competition in these product segments and market regions.

Much of the information in this section is based on the findings of the 2002 FPInnovations work titled; An Assessment of Market Opportunities for Western Canadian Aspen in the United States, Japan and Europe. This work provides a very thorough investigation of aspen products in these specific markets as well as recommendations for pursuing aspen solid wood product business opportunities in Western Canada.

The following charts summarizes aspen solid wood product markets and products found in this report and has been updated through internet research that was focused on current aspen solid wood product manufacturers and products.

Category	Raw Material	Finished Products	Markets
High Value Interior Finished Products	Lumber FAS/Select/#1 Common	<ul style="list-style-type: none"> - Furniture/Components - Cabinetry/Joinery/Millwork - Finger-jointed Edge glued panels - Finger-jointed and Solid-wood Moldings/Interior Trim/Door and Window Casing - Interior Paneling/Doors and Door Cores - Sauna Panels and Components - Wooden Toys 	<ul style="list-style-type: none"> - USA - Europe - Canada - Japan - Other Asia
Lower Value Industrial and Construction	Lumber #2/#3/ Common Knotty and Lower Grades	<ul style="list-style-type: none"> - Pre-cut Pallet Kits - Pallet and Crating Lumber - Timber Mats - Pipeline Blocking - Dimension Lumber and Studs - Pressure Treated Exterior and Landscaping Lumber 	<ul style="list-style-type: none"> - Canada - USA - Mexico

Products

Aspen solid wood products can be divided into two distinct categories. The first category is high value interior finished products. High value interior finished products are used in a wide variety of applications and the demand for lumber suited to manufacturing these products is relatively strong.

Most of the aspen that is sold in high value interior finished wood product markets is produced by companies that manufacture and promote a wide range of hardwood species and products. In some cases aspen is used in limited applications because of its specific wood properties; in sauna parts because of its low thermal conductivity or for cabinet side panels because of its light weight, ease of workability and splinter resistance. In other products aspen lumber can be used as the main raw material, as in the case of wooden toys, again for its splinter resistance properties. Companies that feature aspen products lines such as in solid wood furniture or cabinets often do so because of preferential access to local high grade aspen lumber supplies in their region.

The second aspen solid wood product category consists of lower value industrial and construction products. Lower value industrial products include; crating and packaging material, precut pallet stock, timber mats, pipeline blocking, and Stud grade framing lumber.

Markets

The 2002 FPInnovations market assessment mentioned above reports that the North American market for Aspen lumber is relatively mature. The species, its working properties and attributes are relatively well known throughout the hardwood lumber community. In the high value interior finished product category the number of large scale industrial users was however determined to be quite small due in part to the limited supply of higher grades of aspen available in the market.

Lower value aspen industrial and construction grade products were found to face strong competition. Construction grades of aspen have inferior strength ratings which results in a limited market for structural applications. In packaging and crating markets, large volumes of low grade lumber are used. The majority of this lumber is produced as fall down grades from softwood dimension lumber mills. This supply of low grade softwood lumber combined with hardwood sawmill fall-down were found to offer the industrial packaging industry abundant supply options.

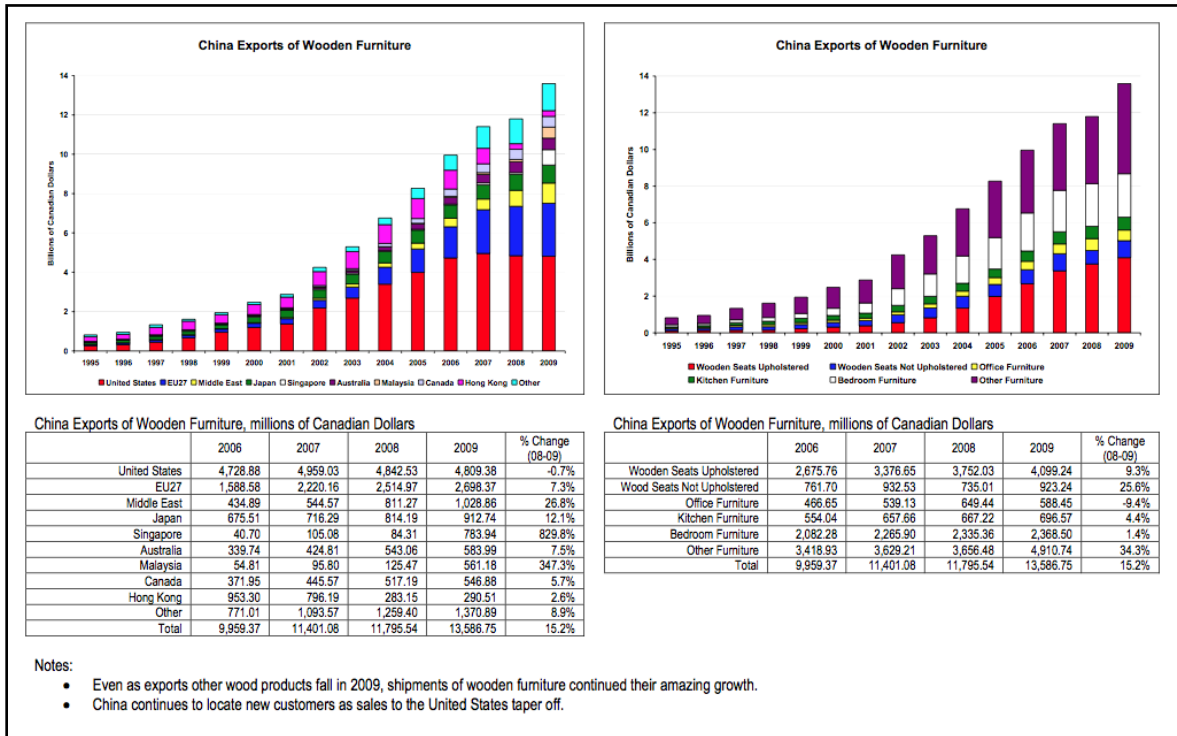
In Japan and to some extent in Europe, aspen is considered to be a new entry into the existing hardwood lumber market. Results from an initial market introduction of aspen in Japan conducted by FPInnovations were reported to be very favorable. These markets did not however show interest in the lower grades of aspen lumber.

Since the FPInnovations 2002 assessment of aspen market opportunities, China has continued to play an increasingly stronger role in global furniture and finished wood product markets. Much of the hardwood furniture and finished interior wood products manufacturing that was once done in the US has now been moved offshore to China.

China with a significant advantage in labour costs has proven that they are able to buy raw material from North America in both logs and lumber, manufacture a wide range of finished products and export these products back to North America, profitably.

Where the US was once considered one of the most developed markets for higher grades of hardwood lumber, China may now have replaced a significant portion of this demand, particularly in the middle range of the high grades. The number of US furniture and other finished wood product factories has decreased significantly over the past ten years.

The US continues to be a large market for finished interior wood products. The charts below illustrate the increase in China's exports of wooden furniture over the past ten years.



Markets such as Europe, Japan, Australia and the Middle East also consider China to be an important supplier of wooden furniture.

Veneer Based Products

With the majority of value added opportunities for aspen found in the solid wood sector, much of this report is devoted to lumber. There are however a number of veneer based valued added opportunities that are worthy of mention. The chart below lists a number of finished products and their markets.

Category	Raw Material	Finished Products	Markets
Veneer Based	Peeled Veneer	- Decorative Plywood Paneling - Plywood Core Material - Laminated Veneer Lumber, Decorative and Structural	- USA - Canada

One company that promotes a wide range of aspen plywood products is Bessemer Plywood Corp. of Michigan. Details of their product offering can be viewed on their website. (See Appendix #1)

Competition

Many other hardwood species compete with aspen for the higher grades used in furniture and other interior mill work. American tulipwood is reported to be the closest species to aspen when comparing technical and workability attributes.

Canadian SPF competes with aspen in the North American crating and packaging market. Many customers in this segment can use lower grades of almost any specie including aspen and other hardwoods and a range of softwoods such as Southern Yellow Pine and Pacific Northwest species such as Hemlock and Douglas-fir. Price is often the deciding factor in material supply choices.

Aspen competes with SPF in the North American dimension lumber market but SPF has a superior strength rating and a dominant market share position. NLGA grading rules for studs and structural lumber classify aspen as a “Northern Specie” which is somewhat of a catch-all specie category with a minimal structural rating for span and strength.

Internal Analysis

Timber Supply

Saskatchewan has a current Sustainable Harvest Level (HVS) of about 3.35 million M3 of hardwood, most of which is aspen. The chart below lists the license holders and volume assignments.

License	Hardwood HVS	Hardwood Allocation	Potential Available	Comment
Prince Albert FMA	948,000	947,000	253,000	Pot. avail. volume is held by independent allocation holders who do not own processing facilities or have long term supply agreements with manufacturers
Pasquia Porc. FMA	838,288	838,288	0	Volume assigned to OSB, in production
L&M FMA	44,620		0	Company is sawing some hardwood at this time for industrial use.
Mistik FMA	911,400	911,400	0	All hardwood is assigned to Mistik Mgt. on behalf of shareholder manufacturers.
Mee-Toos TSL	55,000	55,000	55,000	Conservative HVS estimate, not currently utilized
Kitsaki-Zelensky TSL	132,000	132,000	132,000	Conservative HVS estimate, not currently utilized

License	Hardwood HVS	Hardwood Allocation	Potential Available	Comment
NWC TSL	100,400	100,400	100,400	Conservative HVS estimate, not currently utilized
MLOSBS TSL	160,310	160,310	0	Volume assigned to OSB, in production
Island Forests	60,374	0	60,000	Some of this volume may be assigned through recurring volume allocations
Turnors	100,314	0	100,000	Unassigned
Total	3,350,706	3,144,398	700,400	

The sustainable harvest for hardwood in the Prince Albert, Pasquia-Porcupine, L&M, and Mistik Forest Management Agreement Areas (FMAs) and the Meadow Lake OSB Term Supply License (TSL), totals about 2.9 million M3 – all of which is fully assigned through tenure arrangements to license holders.

Most of the remaining volume (about 0.45 million M3) in the provincial sustainable harvest for hardwood is assigned through Term Supply Licenses along the northern fringe of Saskatchewan’s commercial forest zone but is not currently being harvested.

Current Consumption

The majority of aspen harvested in Saskatchewan today is delivered to one of three primary processing facilities. The chart below lists these facilities and their annual consumption volumes.

Primary Processing Facilities	Annual Aspen Consumption	Comment
Meadow Lake Mechanical Pulp	0.6 to 0.9 million M3	Volume depends on their blend of hardwood and softwood fibre
Meadow Lake OSB	1 million M3	Hardwood (primarily aspen)
Weyerhaeuser OSB Hudson Bay	0.8 million M3	Hardwood (primarily aspen)
Total Consumption	2.4 to 2.7 million M3	Supplying licenses of 2.9 million M3 suggest that up to 0.5 million M3 of hardwood could be available for new developments

Meadow Lake Mechanical Pulp consumes between 0.6 million and 0.9 million M3 of hardwood annually, depending on their blend of hardwood and softwood fibre. Meadow Lake OSB consumes about 1 million M3 of hardwood (primarily aspen). The Weyerhaeuser OSB mill in Hudson Bay consumes about 0.8 million M3 of hardwood annually (primarily aspen). Total consumption from active license areas is between 2.4 and 2.7 million M3.

The overall consumption requirement of the three hardwood consumers in the province is between 2.4 and 2.7 million M3 compared to the available supply in the associated FMAs and TSLs of about 2.9 million M3. This would suggest that up to 0.5 million M3 of hardwood could be available for new developments. Another 0.4 million M3 of hardwood timber could be available in more distant (northerly) license areas.

Not all hardwood timber from the Forest Management Areas and Term Supply Licenses used by the primary hardwood consumers in the province is assigned or allocated to companies with manufacturing facilities. Within the Prince Albert FMA there is approximately 0.25 million M3 of hardwood allocation assigned to forestry companies who are logging and selling hardwood timber under short term agreements. It is very likely that a manufacturer offering a price premium above what is paid for pulp or OSB logs could have access to hardwood sawlogs available from these allocations.

Of the hardwood volume that is currently allocated and could be available over what is required by the mills on their respective land bases, most of this volume is likely to be found in the central and western parts of the province. Mid-Term spatial harvest distributions show hardwood distributed more or less evenly throughout the Prince Albert and Mistik FMAs. (See map in Appendix #2)

On the more distant Term Supply Licenses on the northern fringe of Saskatchewan's commercial forest zone, there is little or no harvesting taking place at this time. While there is the potential for a hardwood sawlog harvest in these areas, the distance from Prince Albert (300 to 600 kms) and the inability to integrate forest operations with other forest products users makes this a less viable opportunity at this time.

Potential for Solid Wood Products Manufacturing

This subsection of the report is based solely on the findings of the 2003 Forintek report *Potential for Hardwood Merchandizing in Saskatchewan*, written by Derek Goudie. The objective of this report was to explore the potential of sorting and merchandizing logs in a central location for the purposes of supplying a solid wood products manufacturing facility. Sections of this report are presented below and have been minimally edited to provide more current information specific to the log quality of Saskatchewan's aspen:

In spite of the wide distribution of large volumes of aspen in Saskatchewan, only a small proportion is presently being utilized for conversion to solid wood products. One of the major constraints to enhanced utilization is the inherent inconsistency in log quality between stands, as well as between and even within trees. This variability in log quality makes it very difficult for hardwood sawmillers to predict product yields and typically results in less than optimal grade and volume recoveries. It is clearly in the interests of solid wood manufacturers to ensure that, as far as possible only logs suitable for their targeted products are received at the sawmill.

The ability to minimize the variability of quality in logs that are processed at the mill represents a significant challenge for a business utilizing hardwood species. Many solid wood manufacturers have indicated that they are not able to adequately source logs that can be matched with their targeted products.

The work plan for this investigation began with reliance on local expertise to identify fiber sources that could be expected to supply a log sort yard in the Prince Albert area. The source regions for aspen are Anglin Lake, Candle Lake and Chitek Lake. Samples from each of the source regions were evaluated in order to determine log grade distributions. The samples were deemed to be representative of fiber that would continue to come from the region on an ongoing basis. A log grader certified by the National Hardwood Lumber Association assigned a log grade to each of the logs in each of the samples.

All of the logs were graded according to a system developed by the US Forest Service. This system, the rules facilitates the selection of logs that are suitable for manufacture to factory grade lumber by placing them into one of three grades, F1, F2, or F3, based on their expected yield of NHLA graded lumber. The system is used to segregate a given lot of cut logs that will be used to produce lumber that is to be remanufactured to remove defects and obtain the highest yield of clear, sound cutting.

The percentage of all sawlogs that were graded as F1 ranged from 30% from the sample from Chitek Lake, to 39% from the sample from Candle Lake; more than 75% of the sample sawlogs were determined to be either F1 or F2 logs. The higher log grades, F1 and F2 also represented nearly 80% of sawlog volume.

In general, F1 logs are best suited for the extraction of higher grades of factory lumber. Using such logs to manufacture pulp chips does not result in optimal value extraction. The log grade yields from aspen measured as part of this investigation strongly suggest that a significant proportion of the fiber in the Prince Albert region can be utilized for lumber manufacture. Assuming that the sample loads tested are in fact representative of the quality of logs from the regions in question, there are significant opportunities available to utilize aspen in order to develop local industries that produce high value grades of factory lumber.

Strategic Issues

The purpose of this section is to discuss the key strategic factors linked to establishing an aspen solid wood manufacturing business in Saskatchewan. The information used to develop these issues has been introduced in the two previous sections; Aspen Industry Analysis and Internal Saskatchewan Fibre and Manufacturing Analysis. Considerations for addressing these strategic issues will be presented in the final recommendations section of the report.

Key strategic issues discussed below are: Log Sorting, Handling and Hauling; Product Mix; Current Global Fibre Flows and Logistics; Understanding the Added Value Potential and Establishing a Starting Point.

Log Sorting, Handling and Hauling

Log sorting, handling and hauling represents a significant portion of the production costs of aspen solid wood products. Only a small percentage of the total harvest of aspen logs meets the standards of a sawlog grade. OSB and Pulp mills accept “bush-run” logs that do not require grading or sorting. For this reason the extra costs that are required to inspect a large volume of logs will be attributed to the small portion of the sawlogs that are sorted from the total.

Another factor that adds cost to the log sorting, handling and hauling of aspen for solid wood products is the location of the suitable sawlog grade fibre. Sawlog quality timber is mixed throughout vast timber

areas. If log sorting is done in multiple harvest locations, employees with proper training will also be required at each site.

Lumber recovery of aspen sawlogs is estimated to be approximately 48%. The remaining 52% of the log volume delivered to a sawmill is recovered in chips, sawdust and bark. These byproducts would likely be sold and delivered to a local pulp mill.

Past studies have also found that even after log sorting and grading, lumber recovery from sawlog grade aspen logs is still very unpredictable. The visual sawlog grade does not always guarantee an acceptable final lumber outturn. Often logs that show minimal outer defect are found to be unsound once the log is opened up in the sawmill. This variable log quality would be averaged out over time and could fit within our above mentioned estimation of 48% lumber recovery overall. It does however warrant consideration and add to the complexity of the aspen solid wood value added equation. Hauling logs to a sawmill site, adding sawmill production cost to this resource only to discover that a portion of the fibre is not suitable for lumber, and then hauling the resulting chips to the pulp mill would result in significantly increased costs.

Chips that are produced at the sawmill and then sold to the pulp mill will have significant additional transportation costs. It is unlikely that the pulp mill would pay more for chips that come from a sawmill than its internal costs of producing chips at its own facilities. Because the pulp mill produces chips from aspen logs that are delivered directly to the mill, transportation costs are minimal. The costs of hauling the 52% by-product volume from the harvest site to the sawmill and the cost of hauling it again from the sawmill site to the pulp mill will need to be absorbed by the sawmill company.

Product Mix

Market demand for aspen lumber in the grades of #1 Common and Better is relatively strong. These grades are sought after by manufacturers of furniture and other interior finished wood products. Grades with a large percentage of clear fibre, such as FAS and Select, command the highest prices. Prices for grades with smaller percentages of clear fibre are lower. At some point finished wood product manufacturers, weighing the relative costs of recovering clear fibre from each piece against price paid for the lumber, decide on the optimum grade input for their facilities. #1 Common appears to be the lowest grade of aspen lumber that many North American interior finished wood product manufacturers are able to accept. The balance of grade versus price is slightly different for each hardwood species. Higher valued species such as Oak can be sold in lower grades to manufacturers who are able to extract further value from the smaller clear pieces.

The demand for lower grade aspen lumber is very price competitive. Packaging and crating material and pre-cut pallet stock is the largest market for aspen lumber in these lower grades. Lumber used in these applications can have relatively large knots, some amount of unsound wood, manufacturing defects and wane. Low grade structural softwood lumber, that is produced as a fall-down grade in sawmills, is sold into these markets. Hardwood mills that produce lumber in a range of species also target these markets with their fall-down grades.

Timber mats and pipeline blocking are other uses for lower grade aspen lumber. These markets are limited, sometimes to only specific projects. Other hardwood and softwood low grade lumber and timbers compete in this market with spot price and availability often being the determining factor in securing business.

Stud grade framing lumber is a very large market and aspen lumber can be used in this application. Prices for this commodity lumber product fluctuate considerably and demand is linked directly to the level of residential construction activity. Currently this level of activity is near the bottom of historic demand cycles. This market is dominated by softwood lumber producers. Aspen lumber, while technically suitable for this application, is not generally accepted as a direct substitute.

The above mentioned product mix is a strategic issue for aspen sawmills. The upper grade portion is marketable at relatively high prices. The lower grade portion is much more difficult to sell and prices are low. The issue becomes one of economics as an aspen sawmill is typically only capable of producing approximately 15% of its lumber output in upper grades. The remaining 85% of its production competes in markets where other sawmills sell their fall-down lumber products. In contrast a typical softwood sawmill product mix can be made up of 80% higher value structural grades and only 20% that is considered to be fall-down grades. Hardwood mills cutting species that are more valuable than aspen can often capture as much as 60% of output in grades that can be sold to interior finished products manufacturers with only 40% fall-down.

Current Global Fibre Flows and Logistics

China has become an increasingly important customer for upper grades of hardwood lumber that are used in furniture and other interior finishing applications. This development has an impact for potential hardwood producers of Saskatchewan for two reasons. First, China has not been a market for lumber producers of Saskatchewan in the past and a great deal of development work would be required to refine logistics and explore market opportunities. Second, China as a relatively new market for large quantities of North American lumber is for the most part unfamiliar with the specific specie attributes of aspen lumber from North America.

The issue becomes one of assessing the extent to which this shift in furniture and interior finished wood products manufacturing activity, from North America to China, affects potential markets for producers in Saskatchewan. Where it was once relatively easy for producers to understand and estimate their costs of serving customers in North America with direct truckload shipments, it is now more difficult for them to quote prices to Chinese customers. Factors such as container loading, ocean freight and export documentation will all require consideration.

Understanding the Added Value Potential and Establishing a Starting Point

A successful aspen solid wood business depends on the ability to capture and market the relatively small portion of upper grade lumber from the vast aspen fibre resource.

Potential customers need to know the delivered price, product quality, potential quantities and have assurance of steady supply before they can seriously consider buying and working with a new lumber product offering. Sawmills, on the other hand, need to know what products to make, the price of each product in the mix and have assurances of steady customers that will support the investment before they can begin operation.

Recommendations

The purpose of this section is to put forward proposals that can be considered for adding value to the aspen resource found in Saskatchewan. Extracting the higher grade aspen fibre from the mixed quality,

widespread timber base, and manufacturing value added solid wood products within the province is the intent of these options.

Two options for moving forward with an aspen value added solid wood product initiative are presented below.

Option #1

One option for a value added aspen solid wood product initiative is to further explore opportunities for creating a traditional sawmill supply chain for aspen solid wood products. Successful aspen sawmill businesses exist in other regions of Canada. Aspen has also been incorporated into a number of sawmill operations that cut a range of both hardwood and softwood species. Saskatchewan appears to have the timber resources to support this type of industry development. The traditional supply chain consists of the following stages:

- Sorting sawlog quality aspen at or near the harvest areas and transporting these logs to a sawmill.
- Primary breakdown of logs to maximize the volume of the highest value products.
- Further processing a portion of the lumber output by kiln drying, precutting, trimming grading and packaging.
- Marketing the full range of the lumber product mix.
- Selling and hauling chips, bark and sawdust to pulp mills.

Sawlog quality aspen can be sorted onsite or near the harvesting area. Logging contractors who handle bush run aspen logs, can inspect and select logs that are suitable for sawing. To produce adequate volume for a full time sawmill operation this harvest area sorting activity would need to take place at several logging site locations. Training logging contractor employees to identify and select the proper quality of log would be essential. It is estimated that a volume of approximately 50,000 M3 of sawlog quality aspen could be produced annually in the regions surrounding Prince Albert.

An aspen sawmill could be located in the Prince Albert region. This sawmill would need to be designed for high grade clear fibre recovery. A small head-rig followed by shifting board edgers and ample re-saw capacity is a suggested mill configuration for extracting the higher grade lumber. The mill would also require the ability to handle larger timbers that would be sold “as is” rough green to local industrial customers.

After the primary sawmill breakdown a portion of the lumber output would require further processing. Kiln drying would be required for some of the higher grade lumber to maximize the product value and to reduce costs of trucking finished products to market. A planer, trimmer and sorting line would also be required for final processing before packaging.

The product mix of a typical aspen sawmill can be estimated as follows:

- 15% #1 Common, Select, FAS grades in sizes of 1”, 1.25” & 2”
- 60% Packaging and Crating lumber. Products range from low-grade 1” boards to pre-cut pallet kits.
- 15% Industrial lumber and timbers for use in the local resource sector.
- 10% Economy low-grade sold locally for a range of domestic end uses.

As previous FPInnovations reports have suggested, detailed economic analysis of all costs and product prices would be required as the first stage of moving forward with this type of initiative.

Two significant challenges of pursuing the traditional sawmill supply chain option have also been identified in this report. (Strategic Issues, pages 17 - 18)

All additional costs of sorting logs and transporting byproducts from the sawmill site will need to be absorbed by the sawmill business. Approximately 52% of the fibre volume will be byproducts. This volume would essentially incur double hauling costs when compared to the current practice of hauling bush-run logs directly to the pulp mill where they are converted to chips.

Another significant challenge for an aspen sawmill is developing markets for the lower grade portion of the lumber outturn. This lower grade portion represents the majority of the traditional aspen sawmill's production. Strong supply relationship would need to be developed with customers in the crating and packaging market segment. Adding as much value as possible to these lower grade products at the sawmill site, by way of precutting and supplying a full range of pallet and packaging components would need to be pursued. It is unlikely that a sawmill could operate profitably by selling 60% of its production simply as commodity low-grade lumber.

In response to these challenges, a second option for establishing an aspen solid wood business is presented below.

Option #2

The second option for establishing a value added aspen solid wood product business is to explore opportunities for implementing a new supply chain model for aspen solid wood products in Saskatchewan.

There are two fundamental strategic issues that need to be overcome to extract more value from the aspen resource of Saskatchewan. The first issue is the cost of log sorting and byproduct and hauling. The second issue is the current lack of demand for the lower grades of aspen lumber and the economics of producing the typical product mix. In response to these issues, another industry segment with similar challenges has been presented.

Examining a value extraction model from another region

Maximizing value of the old growth hemlock resource in British Columbia presents a number of challenges that are similar in many respects to the challenges of capturing the value of aspen the resources in Saskatchewan.

There is strong market demand for old growth hemlock in high grade lumber products. Stands of old growth BC coastal timber contain a wide range of hemlock log quality. Logs are therefore sorted into a number of different grades. The first two primary hemlock log sorts are sawlogs and pulp logs.

Hemlock sawlogs are further sorted according the percentage of high grade lumber each will produce. Logs that contain a large percentage of high grade clear fibre will be directed to mills that have equipment to extract maximum grade. Standard grade sawlogs will be cut into structural products and higher grades will be extracted whenever possible.

Pulp log sorts, the focus of this comparison, are sold to pulp mills for whole log chipping. These logs are deemed to be uneconomical to transport to, and process in, the local sawmills because of insufficient

lumber recovery. Some of these Hemlock pulp logs however contain significant amounts of recoverable high grade clear lumber.

In an attempt to maximize the value of this resource, some pulp mills in this region have incorporated primary breakdown activities to their "wood-rooms" or whole-log chipping facilities. This primary breakdown is achieved by adding equipment and skilled labour to their operations. The equipment additions usually consist of simple head-rig, re-saw and edger configurations. Logs that are identified as having recoverable high grade lumber are diverted to the head-rig line where rough green lumber is cut, onsite.

This rough green lumber is stacked, strapped and tallied before being transported to secondary remanufacturing facilities for kiln drying and further processing.

Lumber is usually recovered only from the outer portion of the log and sawn to a limited number of sizes. A large portion of the log, that is deemed unsuitable for sawing, is then returned to the wood-room in-feed line for whole log chipping after the high grade outer portion is extracted.

Adapting the British Columbia hemlock value extraction model to Saskatchewan aspen

The hemlock pulp log of BC can be compared to bush-run aspen of Saskatchewan. The pulp log sort of hemlock contains a portion of high value clear lumber. Similarly, a portion of the bush run aspen logs currently being consumed by the pulp and OSB mills contain a portion of high value clear lumber.

With modifications to the log in-feed operations of the pulp and OSB mills these logs could potentially be inspected inline. Logs identified as having clear lumber recovery could potentially be diverted to an onsite primary sawing facility. After cutting the identified higher grade sideboards from these selected logs, the remaining portion of the log could be returned to the facility's in-feed line for chipping or OSB processing.

Rough green lumber cut at the OSB and Pulp mill sites could be trucked to a central processing location for kiln drying, further processing, trimming and packaging.

The new supply chain model for aspen solid wood products in Saskatchewan would consist of the following stages:

- Transporting bush-run logs from the harvest areas to the OSB and Pulp mills.
- Identifying higher quality aspen logs at the in-feed log preparation area of the OSB and Pulp mills.
- Diverting these logs to a primary sawmill breakdown line.
- Extracting rough cut lumber and preparing it for shipment to a processing facility.
- Further processing the lumber by kiln drying, pre-cutting, trimming grading and packaging.
- Marketing of the high grade lumber products.

This new supply chain option could potentially overcome challenges faced by the traditional sawmill supply chain. The traditional sawmill supply chain requires logs to be hauled to the sawmill and byproducts to be hauled from the sawmill to the pulp mill. Because approximately 52% of the sawlog volume results in byproducts, this cost is significant and would need to be absorbed by the sawmill business.

The new supply chain eliminates the need to haul logs separately to a sawmill site. Logs are identified and sawn onsite at the pulp and OSB mills. The portion of the log that is not sawn into lumber is immediately returned to in-feed line of the pulp and OSB mills for chipping and OSB processing.

The new supply chain also provides the ability to extract only the higher grade portion of the aspen lumber. With proper training, operators should be able to quickly identify logs that have a high probability of producing clear lumber. Clear lumber is sawn from the outer portion of the larger diameter logs. A head-rig operator with proper training should be able to open the face of the clear portion of the log and execute a number of cuts before reaching the knotty or unsound portion of the log.

All rough lumber extracted at these facilities would require further processing such as kiln drying, planing, trimming, grading and packaging. Trucking costs for transporting this rough green lumber to a centrally located secondary processing facility would need to be considered.

By extracting only the outer portion of selected logs, the grade outturn of aspen lumber would be significantly improved over that of the traditional sawmill method. It is estimated that this extraction method, using a thin kerf band saw for maximum grade recovery, could produce the following grade outturn:

- 80% #1 Common, Select, FAS grades in sizes of 1", 1.25" & 2"
- 20% Packaging and Crating lumber, as falldown grades.

A product mix made up of a large percentage of higher grade products would be of immediate interest to customers in the furniture and interior finished product segments. The secondary processing facility, operating as a stand-alone business, would be able to focus on this market segment with targeted product and market development initiatives.

Potential added value estimates

The traditional sawmill supply chain presented as Option #1 above could consume an estimated volume of 50,000 M3 of aspen sawlogs annually. This is a conservative estimate based on sorting only 10% of the 500,000 M3 of aspen logs that could be made available from indirect allocations and excess supply from hardwood consumers. Assuming this business could overcome the strategic issues that have been identified, and generate a reasonable return-to-log profit of \$10/M3, total business profits of approximately \$500,000 per year are possible for this option.

The new supply chain presented as Option #2 above could extract value from approximately 2,900,000 M3 annually, which is the combined consumption volume of the current processing facilities. Considering current prices of 4/4 Select & Better grades of aspen lumber selling at approximately \$350/M3 and the current delivered log cost of \$40/M3 there appears to be significant margin available for solid wood products manufacturing. Assuming these facilities could extract 20,080 M3 annually and that this material could be extracted, transported and processed at a total cost of \$150/M3, operating profits of more than \$3 million dollars annually could be expected.

Suggestions for future activity

This report is a strategic analysis that presents information on the aspen solid wood product industry, the Saskatchewan aspen resource, strategic issues concerning the potential for aspen solid wood product manufacturing, and recommended options for exploring value added opportunities.

Much of the information in this report was gathered from past studies, although it is believed that the critical factors of this analysis still hold true today;

- a portion of the aspen resource may have higher value alternatives,
- markets show the strongest demand indications for the higher grades of aspen lumber,

information for detailed current financial calculations was not readily available. Pursuing option #2 of this report would require significant operational changes and investments in machinery at the pulp and OSB mills. The willingness for these facilities to entertain such changes, and estimates of the investment and additional operational costs would need to be explored further.

The recommendations also call for appropriate solid wood manufacturing facilities which may entail either a combined sawmill and secondary processing facility or a standalone secondary processing facility. Investment estimates, mill configurations, operational costs and a thorough investigation of current facility capability will also need to be explored further.

Ultimately, aspen solid wood products will need to be marketed and sold. A more detailed investigation of current market opportunities, product prices, and transportation options will also need to be completed.

Appendix 1

North American Aspen Company Websites and Product Information

Canada

- 1) Adventure Lumber
<http://www.adventurelumber.com/>
- 2) Ben Hokum & Son Limited
<http://www.benhokum.com/> (Current Aspen Lumber Prices and Availability; See the “Current Offering” Tab)
- 3) La Crete Sawmills
http://www.lacretesawmills.com/frameaset_aspenlumber.htm
- 4) Aspen Valley Lumber
http://www.rigmatsab.com/itoolkit.asp?pg=LUMBER_DIVISION
- 5) Proulx Forest Products
<http://www.palletenterprise.com/articledatabase/view.asp?articleID=635>
- 6) Rosario Poirier Inc.
<http://www.rosariopoirier.com/en/>

USA

Teton West Lumber specializes in western softwoods, including Lodgepole Pine, Engelmann Spruce and Aspen.

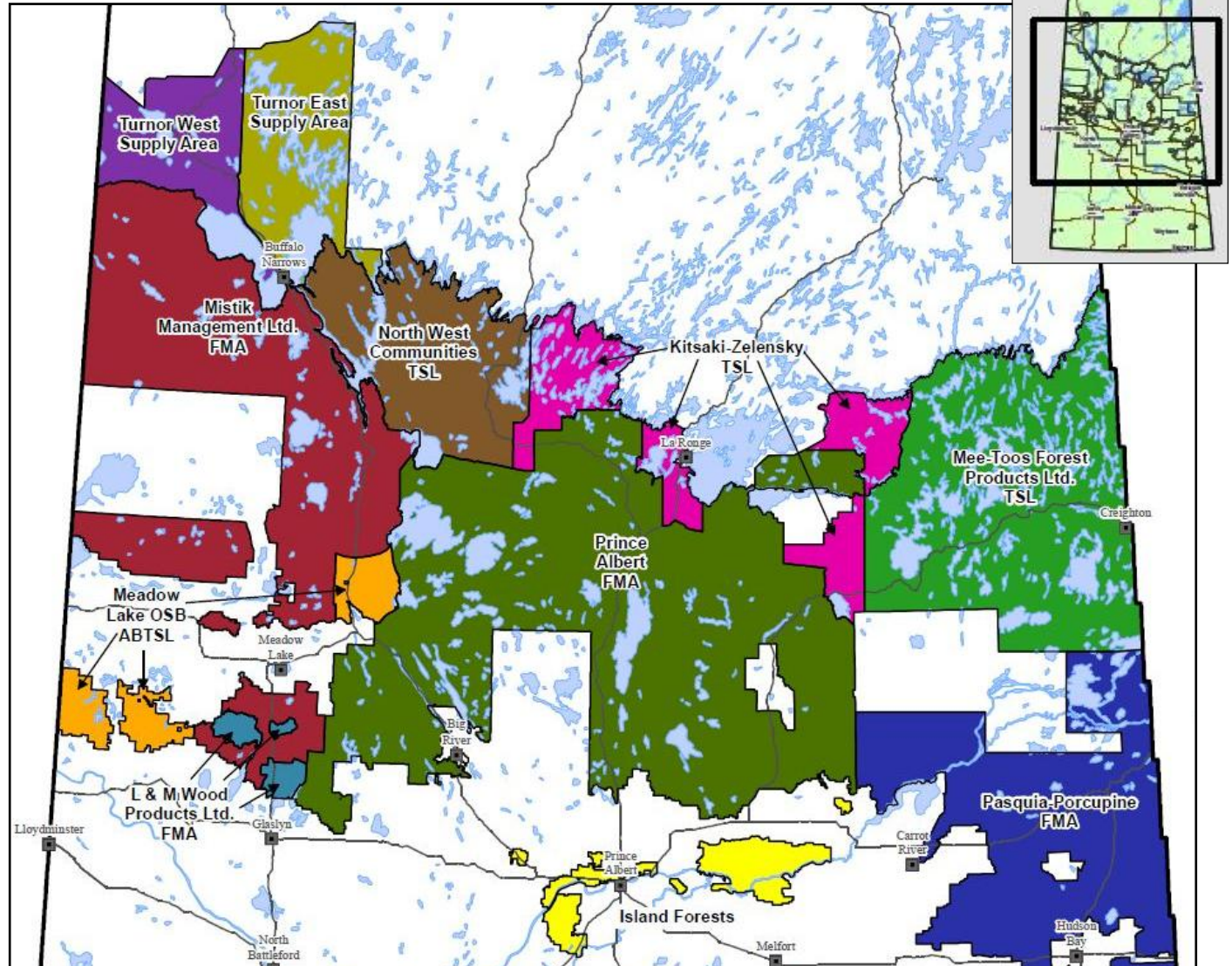
<http://www.tetonwest.com/sawmills.html>

Bessemer Plywood Corp. of Michigan offers a wide range of aspen plywood products.

<http://www.bessemerplywood.com/default.html>

Appendix 2

Saskatchewan Forestry Map and Hardwood Volumes



HARDWOOD Timber Supply Zone	HVS* m ³ /year	Estimated Accrued Biomass (ODT/year)**			
		Top	Branch	Foliage	Bark
Island Forests	60,374	1,843	4,261	857	6,046
Kitsaki-Zelenski TSL	132,000	6,136	10,387	2,329	13,858
L&M Wood Products Ltd. FMA	44,620	774	2,937	680	4,319
Meadow Lake OSB ABTSL	160,310	3,322	10,428	2,569	15,663
Mee-Toos Forest Products Ltd. TSL	55,000	2,547	4,698	1,045	5,815
Mistik Management Ltd. FMA	911,400	16,329	57,791	13,321	87,646
North West Communities TSL	100,400	5,610	7,283	1,749	10,699
Pasquia-Porcupine FMA	838,288	12,366	89,191	13,360	81,201
Prince Albert FMA	948,000	12,031	67,743	12,274	92,847
Turnor East Supply Area	53,431	2,288	3,994	868	5,529
Turnor West Supply Area	46,883	2,547	3,391	816	4,962
Total	3,350,706	65,793	262,103	49,868	328,585

MAP PRODUCED BY:
Inventory and Planning Unit
Forest Service Branch
Resource Management and
Compliance Division
Ministry of Environment
Government of Saskatchewan

PROJECTION:
Universal Transverse Mercator
North American Datum 83
CSRS98
GRS 1980 Spheroid
April 2, 2011



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