UBC Social Ecological Economic Development Studies (SEEDS) Student Report

The Utilization of Small Diameter Douglas Fir: The Viability of the Log Furniture Market

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University of British Columbia

WOOD 465

April 8, 2003

Project Proposal for Wood 465

The Utilization of Small Diameter Douglas Fir

The Viability of the Log Furniture Market

Faculty of Forestry
UBC
ALEX FRASER RESEARCH FOREST

Submitted by:

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The University of British Columbia
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Introduction

The Alex Fraser Research Forest (AFRF) has approached us with the problem of creating a marketing strategy that will deal with an overabundance of small diameter Douglas fir sourced from their forest. This report will discuss some of the issues related with the fibre source, issues with potential product lines, and suggest what we feel is the most viable product to produce given the parameters of the problem.

As described by Ken Day, manager of the AFRF, there are several key issues that must be taken into account when developing this specific marketing plan. The reason for the harvesting process is to thin the existing forest, which is thickly overrun with small diameter Douglas fir. The area being harvested is part of the Cariboo Forest Region's 275,000 ha of mule deer winter habitat. The plan is to selectively harvest, therefore thinning the forest allowing for increased mobility of the mule deer. Other benefits of this forest activity include increased diameter and quality of the remaining trees, more sunlight penetration onto the forest floor, promoting increased growth of food sources for deer and other wildlife. Removal of fibre from the forest can also decrease the potential for catastrophic forest fires in the area as the fuel source is reduced. The harvested logs are typically very small, ranging from 4" to 6" diameter on average. The log supply is expected to be available for the long term, and is of high density, being quite small in height and diameter for their age. It should be noted that a large percentage of the logs may have excessive knots and have considerable warp or sweep. Due to the small average diameter and thick stands, the harvesting costs are substantial, approximately $200/m^3 delivered to the processing site.

In developing a strategy for the production and marketing of a product with the fibre sourced it was crucial to take all of the factors as well as the main goals of the AFRF into account. The main goals of the AFRF are as follows:

- *Improve the mule deer habitat within the AFRF*
- *Improve the quality of the remaining Douglas fir timber*
- *Reduce potential of catastrophic forest fire within the AFRF*
- *Create a financially viable product line that will be self sustaining and profitable as a destination for the timber harvested in this project*
- *Create employment opportunities in the Cariboo region*

The following is a discussion of the proposed production and marketing strategy.

Marketing Strategy

Alternative Solutions

The following section will suggest and discuss several use options for the timber harvested from the AFRF. The first option is to thin the timber, but do not extract the fibre from the forest. Under this scenario, logs would be cut, but left to decay on the forest floor. This would meet the objective of creating improved mule deer habitat; however this option has several negative implications. The large volumes of fibre left in the forest floor could potentially increase the risk of a catastrophic forest fire in the area. In a fire started, spreading through the area, the addition of large volumes of wood fibre to the forest floor could create a source of fuel, increasing the intensity, scope and duration of the fire. This option would not be a money making venture. The thinning process would require financial investment to perform, with no return on that investment within the short term, as no product would be processed and sold from the timber. Over the long term, through increased volume and resulting value of the remaining timber, the commercial viability of the forested area in question would be increased. The long term increase in timber value discussed above would occur regardless of the processing decisions made with respect to the harvested timber. For the above reasons, this option is not recommended. If no commercially viable product can be produced from the harvested timber, this option may allow for the lowest degree of financial loss while still achieving the goal of improving mule deer habitat.

A second option is to sell the extracted timber to a primary wood processor, such as a sawmill. With increases in technology with respect to small log processing, ie cant optimization and single pass high speed processors, sawmills are presently better equipped that ever before to deal with small diameter timber (Central Oregon Intergovernmental Council, 2002). The result of these technological advancements is an increase in fibre recovery and a reduction in processing costs over previously used techniques. This alternative would provide some value return for the fibre, making it preferable over the previous option. It is difficult to know what the exact lumber recovery and product mix would be if processed into lumber, but due to the typically small diameter logs it is thought that low grade, 2x3 and 2x4 products would dominate. The following calculation of the value potential of lumber production is based on a “framing lumber composite price” as of October 2002 of $282 US$/mFBM (www.randomlengths.com):

$$\frac{282 USD}{Mfbm} \cdot \frac{Mfbm}{2.36 m^3} \approx \frac{\$119 USD}{m^3}$$

The resulting value in this calculation clearly shows that with the cost of extraction at $\$200/m^3$, it would not possible to be profitable even with 100% lumber recovery, no processing costs, and US/Canadian currency exchange taken into account. Obviously this is not possible, therefore, this option is not recommended.

The high extraction cost leads us to believe that a corresponding high value product must be produced to offset the cost of harvesting and create a potentially profitable production and marketing strategy. Relatively high value product options include, but are not limited to: wood flooring, kitchen/bathroom cabinetry, door and window stock, and log-home timbers.

The high density of the fibre could prove to make a high quality flooring product. However, due to the competitive nature of the flooring industry, resulting in competitive pricing levels, and inexpensive alternatives such as bamboo flooring and veneer laminated flooring, this option may not result in the highest possible value for the fibre source. Kitchen/bathroom cabinets are also a high value option for the harvested fibre. Similar to the flooring industry, cabinet constriction is subject to high levels of competition and less expensive alternative products. Door and window stock could also be a potential product for production, but is subject to the same competitive factors as listed above. The three options discussed above all required a high quality, clear (ie, no knots or other natural defects) wood fibre to achieve the highest possible value necessary. For this reason, the high quality wood may be of sufficiently tight grain and density, but may have too many knots, and due to the small average diameter, too low recovery during the sawing of the above products. Another issue related to the high density of the wood is the easy of drying to target moisture content. High density wood, with tight growth rings can be very difficult to dry effectively and ultimately cost more per unit volume to dry than other woods. The last high value option listed above is log home construction logs. Log home logs typically are of higher value than sawmilling logs, and are of considerably higher quality. Since the logs are used in construction applications, they are straight, with little taper and are consistent in diameter between logs. The logs from AFRF may be too small in diameter and too crooked to be suitable for log home construction.

Another option not included in the list above is log furniture material. There are several advantages to choosing such an application for the wood fibre. Firstly, the variability inherent in the logs could add to their appeal as log furniture stock. The sweep, crook, knots and other natural deformations present in many of the logs could be taken advantage of as design features, creating unique, curved, furniture pieces. The varying log diameters present in the distribution of harvested

timber could be well suited to a wide line of log furniture. Processing advantages of log furniture include the fact that construction requires relatively low cost of processing (compared to other furniture types), potential for air drying rather than kiln drying of logs, and a very high recovery can be achieved due use of round logs in the construction process. Any logs that are deemed not suitable as log components for the type of furniture suggested could be processed into boards. These boards could be used in the construction process where flat pieces are required such as seats, seat backs, or slats for beds. This would further increase the overall fibre recovery of the process. The resulting product is one that required relativity little processing, is visually appealing, structurally sound, and can potentially demand high retail value if marketed correctly.

Negatives of such a product line could include that fact that the bark must be removed from the log without damaging the log itself. This process is typically performed by hand, with a small blade called a draw-knife, and is therefore labor intensive. The variability inherent in the logs may make an interesting piece of furniture, but could also increase the complexity of the manufacturing process. Another potential negative with log furniture is the fact that only select consumers would be prone to purchasing this type of furniture. This fact may limit the size, and number of the potential markets and may make it necessary to be selective in the market segments that are targeted for product promotion.

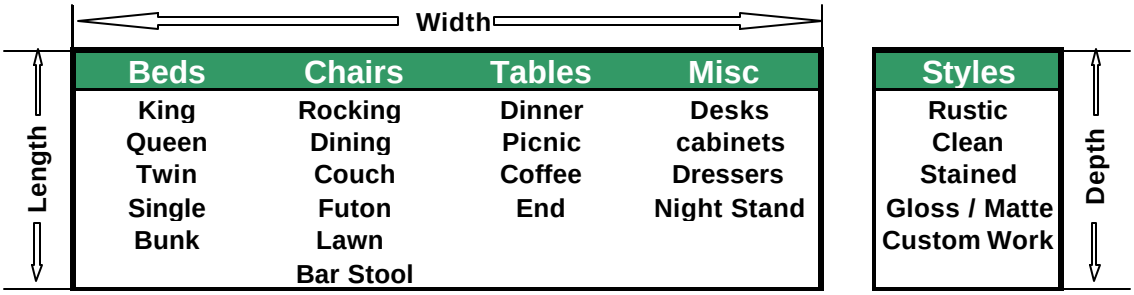
Product

The logs which are available are very adequate for the purpose of log furniture. Since we are utilizing the entire log, other than trimming to length, we are able to take advantage of its symmetrical properties. Where lumber may warp as it dries, the logs will remain relatively unchanged. Given that we are using the full cross-section of the log, we are maintaining its maximum strength potential, which will render knots and deformities far less detrimental than if the same log was used for lumber. Also because of such a tight grain, the density is relatively high compared to normal softwoods. This high density will aid in more uniform machinability, and leave the end grain much easier to finish. Also the sizes of the logs are ideal for furniture construction.

Product Levels

As the table below shows, we have there virtually hundreds of items that can be built given the log supply.

Table 1 Habitat Wood Co. - Product Mix



Product Width

All the products have one underlying theme, full log construction. Shown on the next page are the four main product lines. These images shown show just one representative from each line, and other products within the line can differ greatly.

Figure 1: Base models for product lines.
Ian M. Grady, March 23, 2003

The reason we recommend this product mix was to diversify risk by making a variety of different products, 19 in all. This will allow you to focus on higher demanded product, and pay less attention to the lower demanded items depending on market conditions. Different products require different sizes of logs, therefore this product mix width allows for better utilization of the variability of logs extracted from the forest. The product line of the beds will use the longer, straighter, larger diameter logs. The miscellaneous furniture will make use of the smaller diameter stock. Logs that are bent, or severally warped should be kept for some of the custom work, or "one-off's".

Some of the logs should be used for square stock, which would be used for such things as the seat platforms, slats for bed, drawers, cabinets, or anywhere small panels need to be made. These logs will be pre-selected as the preference will be to use clear, sound wood.

Product Length

Within the product mix, there are short product lines. These lines are aimed toward the functionality of the product item. The size of an item or its robustness is incorporated into the design to suit specific functional needs. An example would be the chair line. There are different chairs for different intended usages. Smaller upright chairs for sitting at the dinner table, compared with wider, lower, relaxed chair, that of the lawn chair. Also indoor/outdoor will make a difference on how it is constructed and finished.

Product Depth

To make the product line even more diverse it is recommended that there be variations within a single product item. The two basic type of style is the "Rustic", and "Clean" look. One of the biggest benefits of the product's depth is that it allows the attraction of buyers with different preferences.

Rustic

By use of the '*skip-peel*' method of debarking, the rustic style is a result of leaving the cambium layer partially intact prior to finishing of the log. Figure #2. The cambium layer brings a warmer feel to the furniture. This style of finishing would fit well into an existing home that has been build around the same feel. A person may also want to keep the entire bark on.

Figure 2 Example of Rustic Finishing

Clean

Figure #3 below shows an example of the clean style of log used in the furniture. All bark, and cambium layer of the log is removed. Most timber designed chalets are constructed with exposed timbers that have a consistent color range, and therefore the uniqueness of the Rustic look would not fair well with most. Therefore the clean style will work best for these buyers. This look is also better for the buyer likes to know exactly what he/she is getting. Unlike the rustic style where

one item can look quite different from the second item, the clean style do not differ much between successive items built.

Figure 3 Example of Clean Finishing
Ian M. Grady, March 23, 2003

Finishing

With 19 items, and two main styles of construction, there are nearly 40 unique items offered. Taking it one step further, the different types of finishes increases the number of possibilities considerably. Figure #4.

Figure 4
Ian M. Grady, March 23, 2003

Custom Work

This level of depth is intended to take base model items within each line, and work with a customer to suite his/her wants or needs. There is the possibly of using extremely defective logs such as; burled, bow/crook, forked, or extremely twisted grain. A customer may also want to incorporate a piece of his/her wood within an item such as a headboard.

Total Product

All this furniture would have to be designed withstand years of usage. There will be a life-time guarantee on the structural integrity of each item. Also all items will display the forest certification symbol signifying that each and every item has been processed from a certified forest,

Price

To establish a selling price we took into account three factors; Costs (Variable and Fixed), profit margins, and competitions prices. In order to establish the costs for each item we have had to make quite a few assumptions. For fixed costs we had made the following assumptions, elaborated more clearly in Appendix A :

- *10 workers ($13/hr)*
- *1 Manager ($60,000/Year)*
- *Rent, Power, Electricity, Misc ($240/day)*

The variable costs are basically the material costs. The cost to get the wood to the processing facility has been set at $200/m^3. Because we are primarily dealing with the round log as a whole, with little breakdown, we have assumed recovery to be 70%. This equates to a cost of every m^3 that is to be made into furniture to be $286. For each product item, we estimated the volume of material in m^3 required to build them. This volume was multiplied by the $286/m^3 to give the material cost of the item. To each item we attached a $5 cost for miscellaneous parts and accessories. Also the time required to build each item was taken into account, to which the fixed cost was spread.

To figure the price that should be charged, we examined six other log furniture companies, and gauged from that, what would be acceptable. The figure below shows the base prices that we feel should be charged for each item. See Appendix A for a more detailed examination of price determination. Once the price range for each item was determined, we examined the profit margin, and fine-tuned the selling prices accordingly. The aim is to have a profit margin between 20% and 30%.

BEDS				
Single	Twin	Queen	King	Bunk
$490	$565	$605	$640	$1,200
21%	*21%*	*21%*	*21%*	*21%*

CHAIRS			
Rocking	Lawn	Bar	Dinner
$350	$325	$275	$305
29%	*23%*	*20%*	*20%*

TABLES			
Night	Coffee	Picnic	Dinner
$320	$560	$1,200	$1,400
23%	*22%*	*28%*	*22%*

MISC
Dresser
$1,100
23%

Figure 5 Product Price Table Summary
Ian M. Grady, March 23, 2003

Distribution

There is very little documented research for the distribution of log furniture. We therefore sent out seven inquirers to the larger log furniture companies, and received three back with regard to distribution channels. The three responses we received all used different means of distribution. The first company strictly sold everything from their website, and only had a showroom at their local shop. (Bob Gitter, 2003) The second company was exclusively an intermediary, who took orders in, and passed these orders on to the furniture makers, who then sent it straight to the customer. (Fred Van Houten, 2003) The third respondent had diversified channels of distribution. There sales came from; 50% retail, 35% out of their showroom, and the remaining 15% from direct internet sales. (Delbet Kaufmann, 2003) A portion of the retail sales came from companies like the third company, who act as sales agents.

We believe the aim for Habitat Furniture Co. would be somewhat like the last company mentioned in the sense of diversification of the channels of distribution. The easiest channel is to set up a showroom right on the facilities premises. Secondly, a website displaying all product items, and variations, should be built. The third step would be to sell items through internet intermediaries, such as "Log Cabin Furnishings", mentioned above. To gain access to the customers who want to physically touch the product prior to buying, it is recommended selling the product through dealers.

Positioning

Environmental Certification

In order to maximize the profitability of the proposed product line, it may be possible to market the line as a certified wood product. Achieving environmental certification could serve several purposes. Firstly, certification could attract environmentally conscious consumers. Those who are conscious of environmental issues, and therefore wish to direct their purchases toward products that make a minimal negative (or even a positive) impact on the environment could be attracted to such a certified product line. An environmentally certified product could also achieve a higher retail price compared to similar, non-certified products, further adding to the financial viability of the proposed product line. An option for achieving third party certification that could be beneficial to the AFRF is to combine the certification of the forest and the wood products derived from it with an academic research project through the University of British Columbia. Such a strategy could integrate research into the improvements to mule deer habitat, the required forest practices that must be undertaken, the bureaucracy of a third party certifying body that must be dealt with, and the potential economic viability of a move towards certified wood products. This strategy could potentially bring in funding as a research project, helping with the costs associated with third part environmental certification. Such a strategy could also increase the profile of the project and the product line associated with it, through publications and talks on the topic.

Habitat Improvement

Regardless of whether environmental certification of the proposed product line is pursued, another environmental issue that could benefit the project is the fact the improvements to mule deer habitat are occurring as a result of harvesting efforts. This fact if properly promoted could attract consumers to the product line. In order to receive the greatest reward from the habitat improvement effect of the harvesting it may be necessary to educate the consumer as to the origin of the wood used. This could be done through an education program such as point of purchase pamphlets, and explanation in advertising campaign undertaken. Consumers who are aware of the benefits created through the harvesting process may be more likely to purchase the products, or pay a premium for them. An option for ensuring that the product line is recognized as having benefit to mule deer is to market the line with a brand name, such as “Deer Furniture”, “Habitat Furniture” or some other name that allows the consumer to connect this product with environmental benefits.

Potential Markets

The product line that has been suggested is rustic looking, log construction furniture. This style of furniture has the potential to be marketed to several distinct market segments as follows:

- **Residential Markets**
  - *Log/timber frame homeowners (primary residence)*
  - *Private vacation cabin owners (not primary residence)*
  - *Other residential markets (those who find the rustic design and style of the furniture appealing) Japan (or Asia in general), NA, Europe.*
- **Commercial Markets**
  - *Ski-hill, guest ranch, fishing/hunting, eco-tourism lodge developments*
  - *The potential 2010 Vancouver Winter Olympics*
  - *Industrial log home producers*

Due to the limited fibre production capacity of the AFRF, it is suggested that the North American market, and the Western States and provinces in particular should be targeted. The figure below indicates exports levels from BC and Canada of Bedroom and Kitchen furniture. The blue indicates Bedroom furniture, and the red indicates Kitchen furniture. Our product targets bed furniture more so than kitchen.

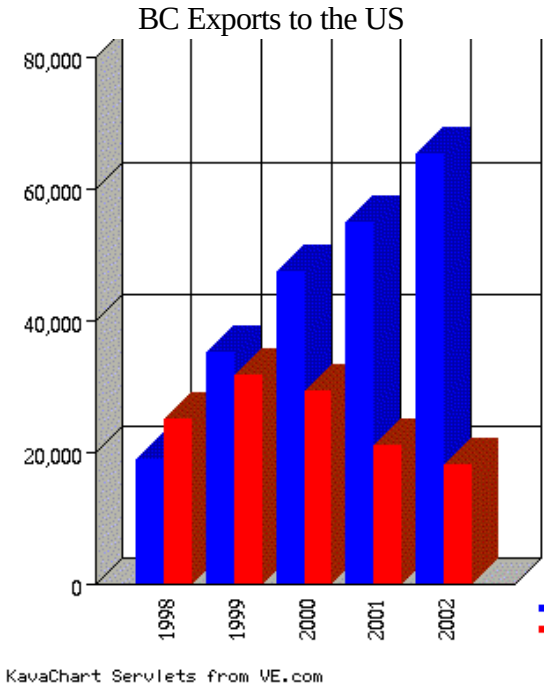


Figure 6 BC Exports to US
http://strategis.ic.gc.ca

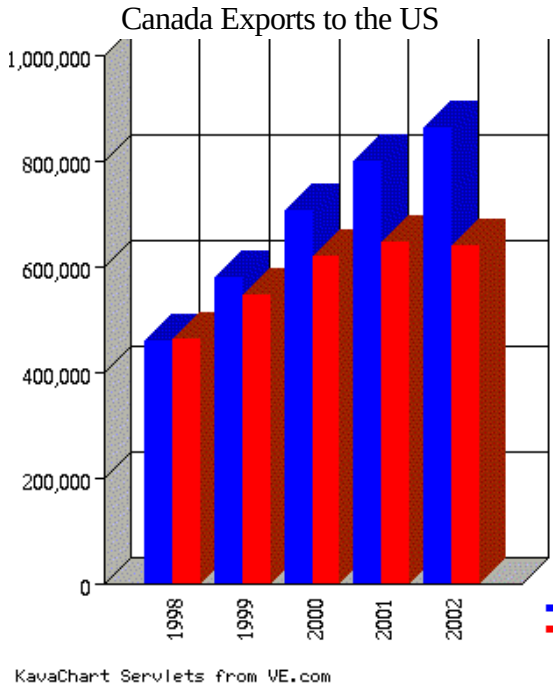


Figure 7 Canada Exports to US
http://strategis.ic.gc.ca

Log/Timber Frame Homeowners

The style of furniture that will be constructed as part of the proposed product line could suit the look and feel of log and timber frame construction homes and the taste of their owners. The rustic look of the furniture is similar to that of the exposed wood in the interior of log and timber frame homes. There may be potential in this area since the taste in interior decor of those who live in log/timber homes could include rustic looking furniture, including log furniture.

Private Vacation Cabin Owners

Private vacation home owners are those who own a home for the primary purpose of personal recreational activity. Private cabins can tend to be rustic looking and feeling, similar to log and timber frame homes, and therefore could be well suited to the rustic design of log furniture. Owners of private vacation cabins are typically financially stable, and may have disposable income that could be spent on this type of furniture.

Residential Markets

Residential markets other than log and timber frame homes could be targeted. This segment may not be as inclined to purchase log home furniture as those who own a rustic style home. Since this segment consists of consumers that reside in a wide variety of housing types and may have widely varying tastes with respect to furniture, there may be less potential for penetration as a percentage of total market share. However, since the majority of consumers live in dwellings other that log and timber frame homes, this segment option could account for a significant percentage of AFRF's total sales.

Commercial Accommodation

Commercial tourist accommodations such as those found in ski resorts, fishing/hunting guide operations, or eco-tourism destinations could represent a significant potential market. Each of these tourist facilities may try to provide a rustic looking facility to add to the "wilderness" experience of their clientele. If the tourist outfits are targeting an elite clientele for their business, the rustic look may be just that, a look. For this reason, they may want high quality, high end furniture in order to create a certain level of comfort for their patrons but still retain the rustic look. This furniture requirement could fit well with the products that would be produced by Habitat Furniture Co., high

end rustic looking furniture made from wood from an environmentally friendly source. If the wood products are to be certified, this could further increase the product appeal to eco-tourism outfits.

Vancouver's 2010 Olympic bid

Although a final decision has net been made on which candidate city will host the 2010 Winter Olympics, Vancouver is one of three finalist cities. Two fundamental concepts of the Vancouver 2010 Olympic bid platform are environmental stewardship and "showcasing domestic product innovation and expertise". The 2010 Olympic Bid Corporation holds the following thought: "environmental stewardship affirms that in every activity, the 2010 Bid Corporation will conserve resources, prevent pollution, and protect and enhance natural systems." (Olympic Bid Web Site). Both the idea of protecting and enhancing natural systems and promoting local products and innovation could position the products being suggested in this report well with Olympic organizers. If the Vancouver bid is awarded the 2010 Winter Olympics, a tremendous amount of investment will flow into BC in the form of government funding and private capital. Government funding would be used for, among other things, to build Olympic facilities, including accommodations for athletes. Private capital would most likely be directed in a large part towards service related businesses, such as hotels and restaurants. This investment in accommodation facilities, restaurants and other service industries could be targeted as major consumers of AFRF's log furniture line.

Commercial Log and Timber Frame Home Producers

There may be potential to enter into strategic alliances with log and/or timber frame home manufacturers. In the Williams Lake area of BC there are several log home manufacturers. These businesses may, in an attempt to be more vertically integrated, and supply a more complete product to their customers, wish to offer homes with optional furnishings. Homes could be sold with complete bedroom or living room sets, provided by Habitat Furniture Co. and included in the package price. Or operations could educate customers about Habitat Furniture Co. products in exchange for the odd house log that might come out of the AFRF.

Promotion

Several promotion options will be discussed at this point. Typically, log furniture similar to that marketed by Habitat Furniture Co. can be promoted through several avenues including the following;

- *Company website*
- *Advertisements in magazines (such as furniture, log home, or "cottage life" magazines)*
- *Word of mouth*
- *Trade shows targeted towards homeowners ("home shows")*

Due to the unique positioning strategy of environmentally beneficial, or even environmentally certified, it is recommended that in additional to the "traditional" promotional strategies listed above, the following strategies could also be implemented at no, or relatively low cost to Habit Furniture Co.;

- *Publicity surrounding environmental benefits of the harvesting – get the word out to reporters about the situation, it could make for a good news story showing BC forest practices in a positive light*
- *Publicity around the certified product (if this avenue is perused) – this could lead to articles in magazines*
- *Exposure and publicity through research into the project (if the research strategy is feasible), such as publications in academic journals*
- *Sales team*
    - *Promote the product line to log home builders who see value in offering customers options for furniture purchases that would fit the style of the home they are purchasing*
    - *Promote the line to potential corporate customers, such as Vancouver Olympic campaign, various resort developments mentioned above*
    - *Canvass retail furniture outlets that would potentially carry such a product, in particular, those that have a corporate philosophy of promoting sustainability through the products they sell – a point of purchase display could be set up at a retailer describing the positive impact the products have on the environment, and the fact that the fibre originates from the AFRC*

- *Product endorsement – environmental groups such as the David Suzuki Foundation, may be interested in endorsing such a product in their efforts to promote environmental consciousness*

All of these options are potentially costly. Since the Habitat Furniture Co. is building from the ground up, and will have financial limitations, it is not recommended that these options be

Other options for promotion include:

- *Promoting the product line though show rooms in major centers*
- *Advertisements on radio or television*

Additional forms of print advertisement – newspapers, billboards

Recommendations

Given that this project is just a preliminary report, our first recommendation is to conduct a thorough market study. For the amount of time given for this project, we were unable to carry out any in depth market research. Our report indicates the main areas of focus, but there are no concrete numbers to back this proposal.

In order to process the wood, a facility will have to be acquired, that will be able to house the appropriate equipment, and space to process. The facility will also require a yard of sufficient size that will be able to hold enough log inventory during break-up. Also the facility itself should have enough room to accommodate a showroom. Once a facility is bought, approximately 10 people should be hired as labours, and a manager to look after the crew.

Once an in-depth market study can been finished, the data from it can be used to determine the steps to follow. The study will show which channels of distributions are best suited for this company. We feel that to start the business off, begin by distributing through the internet, and heavily promote the product where ever it is possible. The internet will be used for both selling to individual customers, as well as to retail dealers.

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Canada's Business and Consumer Site, Search for BC & Canada Exports of Furniture to the US, <http://strategis.ic.gc.ca> (April 8, 2003)

Prices														
Bed					Chair				Table				Misc	
Single	Twin	Queen	King	Bunk	Rocking	Lawn	Bar	Dinner	Night	Coffee	Picnic	Dinner	Dresser	
$460	$660	$700	$780	$1,000			$300	$400	$300		$800	$1,600	$1,100	Timberline Group
	$445	$600	$700		$300	$100		$249	$249	$55				Green Mill Log Furniture
$420	$487	$509	$512	$1,200	$165	$130	$262	$105	$270	$456	$1,500	$875		Lodge Craft
	$347	$416	$485	$1,248	$682		$230	$388	$388	$408		$1,366	$1,100	Kauffman Wood
$525	$630	$665	$770		$398		$245	$225		$315	$1,200			Pioneer Log Furniture
	$850	$1,850	$2,350			$600	$500	$600	$450	$450		$1,200	$1,600	Bob's Custom furniture
$625	$660	$1,860	$2,350	$1,248	$682	$600	$500	$600	$450	$456	$1,500	$1,600	$1,600	Max Price
$420	$347	$416	$485	$1,000	$165	$100	$230	$105	$249	$55	$600	$875	$1,100	Min Price
$490	**$665**	**$605**	**$640**	**$1,200**	**$360**	**$325**	**$275**	**$305**	**$320**	**$560**	**$1,200**	**$1,400**	**$1,100**	**Our Selling Price**
0.117	0.125	0.13	0.132	0.25	0.036	0.041	0.019	0.023	0.032	0.096	0.16	0.14	0.11	Cubic meters Per Item
0.15	0.175	0.189	0.2	0.375	0.1	0.1	0.09	0.1	0.1	0.175	0.35	0.45	0.35	Time Required to build one unit (Days)
$38	$41	$42	$43	$76	$15	$17	$10	$12	$14	$30	$51	$45	$36	**Cost of material per Item**
$348	$405	$438	$464	$670	$232	$232	$209	$232	$232	$405	$812	$1,044	$812	Processing Cost per Item
$386	$447	$481	$507	$946	$247	$249	$219	$244	$246	$436	$863	$1,089	$848	Total Cost per Item
$104	**$118**	**$124**	**$133**	**$254**	**$103**	**$76**	**$56**	**$61**	**$74**	**$124**	**$337**	**$311**	**$252**	**Profits**
21%	21%	21%	21%	21%	29%	23%	20%	20%	23%	22%	28%	22%	23%	**Profit Margin %**

FIXED

10	Number of people required to Process
$184	Average cost per employee ($13/hr pay, $10/hr benefits) @ 8hrs/day
$240	Manager based on ($60,000/year)
$2,080	Total Labour Cost per day
$144	Rent/day based on ($3,000/month)
$24	Power/day based on ($500/month)
$48	Heating/day based on ($1,000/month)
$24	Misc based on ($500/month)
$240	Total Building Costs per day
$2,320	**Total Cost to run per day**

VARIABLE

$200	Extraction Cost ($/m^3)
70%	Expected Recovery
$286	**True Cost of usable m3**