SHORT LUMBER CONCEPT AND ACCEPTANCE

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ABSTRACT

The primary purpose of this study was to evaluate short length lumber (less than 8 feet long) utilization opportunities within the furniture and cabinet industries, If such a high-value market for short length lumber could be developed, the profit potential for many sawmills would increase and the forest resource management options in many areas would expand. Short length lumber furniture part yield and processing cost information were combined in a simulation model. An economic analysis of the model's output indicated that the production of rough furniture parts from short length lumber in a crosscut-first mill is economically feasible with careful matching of cutting bills and short length lumber input schedules.

INTRODUCTION

Procurement and production personnel associated with the eastern U.S. hardwood lumber industry frequently state that high quality logs of preferred species are much more difficult to obtain today than was the case a couple of decades ago. This is the prevailing opinion despite the fact that Forest Survey data indicates that hardwood quality is improving (Beltz 1991) and the inventory of select hardwood species is increasing (de Steiguer et al. 1989, Araman 1987). The perception that the availability of the more highly valued hardwood logs is decreasing is not unfounded, however. Supply constraints related to timber accessibility, timber stand operability, and stocking levels limit the effective availability of a significant proportion of the larger diameter trees and select species (Tansey 1988). Timberlands that are not subject to such constraints have been high-graded to the extent that the remaining hardwood stand is composed largely of smaller stems, lower grade timber, and less highly demanded species. The hardwood processing industry must address the problem of how best to adapt its timber conversion methods to better utilize the available resource.

The management prescription for returning these high-graded timberlands to productive forests requires that large quantities of small diameter and lower quality stems be cut to reduce overstocking and stagnation (Irland 1988). As cost effective practices are established to utilize this material, the incidence of high-grading-type harvest activities will diminish, the volume and quality potential of many of these stands will improve, and the timber supply concerns of primary processors will be reduced (Wengert et al. 1986, Irland 1988, Tansey 1988).

One of the proposed methods for converting the lower grade hardwood resource into a high value product involves cutting high quality short length lumber (less than 8 feet long) or dimension parts out of short hardwood bolts (Ringer 1975, North Carolina Division of Forest Resources 1979, Rosen et al. 1980). Wengert et al. (1986) discussed short length lumber processing problems that exist in five manufacturing areas: (1) log grading, (2) log breakdown, (3) lumber drying, (4) lumber grading, and (5) manufacturing. When asked about the problems they associated with short length lumber, several hardwood lumber producers stated that their inability to find markets for short lumber was a much greater deterrent to the production of short length lumber than was any technological aspect of short lumber production.

The major high value markets for hardwood lumber produced in the U.S. are the domestic furniture, cabinet, and dimension industries, and the export industry. Hardwood lumber utilization by the U.S. furniture, cabinet, and dimension industries equaled approximately 27 percent of total U.S. hardwood lumber consumption in 1987 (Luppold 1991). These are the market segments on which the largest number of lumber producers focus their marketing attentions. Hardwood sawmills will be more likely to adopt procurement and processing methodologies for short length lumber if a high value, high volume, end-user market (such as the furniture market) can be established.

At present, most eastern hardwood sawmills produce very little lumber shorter than eight feet in length. Short length lumber that is generated in the process of sawing longer logs is most often converted into relatively low value hardwood chips (~$25/ton). Modifications to present sawmilling practices, such as recovering lumber from logs with swollen butts or end-trimming a longer length No 2A Common board to produce a shorter length No. 1 Common or Selects board could produce additional volumes of short length lumber. When chips are produced from material that has the potential to yield short, high quality lumber, a mill's value recovery goes down.

Before the furniture industry will accept short length hardwood lumber, several obstacles must be overcome. These obstacles include: cutting yield uncertainties, handling problems and costs, and the furniture industry's lack of experience with short lumber (Wengert et al. 1986). If short length lumber yield and processing cost estimates were available, the potential value of short length lumber to the furniture industry could be estimated. This information could then be used by lumber manufacturers to help them design a short length lumber manufacturing and marketing strategy.

The three main points that I will be making during this presentation are: 1) short lumber is worth more to a sawmiller than are chips, 2) short lumber can be generated and managed, and 3) opportunities exist for developing high value and volume markets for short lumber.

SHORT LUMBER IS WORTH MORE TO A SAWMILLER THAN CHIPS

The first point that I want to emphasize is that short lumber is worth more to a sawmiller than are chips. Despite this, many sawmills chip lumber that is shorter than 6 feet long. They do this because they have not been able to identify or develop a consistent market for short lumber, or, because they don’t want to deal with handling short lumber.

The fact that short lumber can be worth more than chips where consistent markets can be identified, is borne out by the number of flatbed trucks that we now see on the highways carrying 4, 6, and 8 foot long cherry lumber.

The breakeven short lumber sales price versus hardwood chips gives an indication of the potential value of short length lumber to a sawmill. Lumber sold at the breakeven sale price would be of equal value to the sawmiller as would be hardwood chips. Thus, this is the absolute minimum price that short lumber should ever be sold for.

The breakeven sale price for short length red oak lumber ranges between $263 and $339 per green thousand board feet (mbf; Table 1). The breakeven price increases as the chip price increases. In other words, the relative value of short lumber compared to chips goes down as chip prices increase. Short lumber has to be sold at a higher price to maintain its value relative to chips. In contrast, the breakeven lumber sales price goes down as log prices increase.

The difference between the breakeven price and the going market rate for a given species of lumber indicates the maximum amount of money that can be spent to market short lumber. For red oak lumber, this gap is approximately $450 per mbf (based on April 1993 prices for green, 4/4, 1 Common lumber).

This gap can be thought of in several ways. First, and most optimistically, you can think of it in these terms: if you could sell short lumber for the going market rate without incurring any additional production costs in the process, this amount, ~$450/mbf is value-added over the chipping option. A second interpretation is: if a market can be established by offering short lumber for some amount less than the going market price for longer lumber, the difference between $450/mbf and the price discount, say $200/mbf, is the value-added over the chipping option. A third interpretation is: if the market demands that short lumber be sorted and packaged in a special, more costly way, or if normal handling of short lumber costs more per mbf in the sawmill, the additional costs can be justified so long as they are less than $450/mbf.

Table 1. Calculations of breakeven short length lumber sales prices for different log cost and chip price levels.

ANALYSIS:	Chips: $25/ton Log Price: $250/MBF	Chips: $25/ton Log Price: $200/MBF	Chips: $25/ton Log Price: $150/MBF	Chips: $30/ton Log Price: $150/MBF
CHIP ANALYSIS				
Chip Yield per MBF-Doyle Logs (tons)[1]	6.05	6.05	6.05	6.05
X Chip Price per Ton	$25	$25	$25	$30
= Chip Revenue/MBF Logs	**$151**	**$151**	**$151**	**$182**
- Chipping Cost per MBF-Doyle	$18	$18	$18	$18
- Log Cost per MBF-Doyle	$250	$200	$150	$150
= Chip Profit/MBF-Doyle Logs	**-$117**	**-$67**	**$17**	**$14**
LUMBER ANALYSIS				
Log Cost per MBF-Doyle	$250	$200	$150	$150
+ Lumber Manufact. Cost/MBF-D	$130	$150	$170	$175
= Total Cost per MBF-Doyle	**$380**	**$350**	**$320**	**$325**
BREAKEVEN PRICE				
Lumber Cost/MBF-Doyle Logs	$380	$350	$320	$325
+ Chip Profit/MBF-Doyle Logs	-$117	-$67	-$17	$14
Breakeven Lumber Price/MBF	**$263**	**$283**	**$303**	**$339**

Adapted from: Barrett 1989.

1- Chip yield per mbf-Doyle logs is based on the following assumptions: 1) there are 2.2 cords per mbf-Doyle logs, 2) a cord of red oak wood (excluding bark) weighs 5500 lbs.

SHORT LUMBER CAN BE GENERATED AND MANAGED

The second point that I want to emphasize is that lumber can be generated and managed. However, many sawmill and dimension mill handling systems will require some modifications to be able to handle lumber shorter than 6 feet long.

Most conventional, long-log oriented hardwood sawmills, have the potential to produce more lumber shorter than 8 feet than they are presently producing. In fact, many sawmill operators will tell you that they used to produce more short lumber but they reduced their output as furniture companies became less willing to buy the short material. At the majority of eastern hardwood sawmills, material that could be cut into short lumber is being converted to chips instead.

Four of the most likely sources of increased volumes of short lumber are:

1. Slabs that are currently being chipped . . . short boards could be recovered from butt logs in many cases, by slabbing the log less heavily and then sawing a short board with the second pass of the log through the saw.

2. Value-added trimming of lower grade lumber . . . I studied this option using the Northeastern Forest Experiment Station's red oak lumber data bank (Gatchell et al. 1992). Fifteen percent of the 8 and 9 foot, 1 Common boards that I studied could be remanufactured to a higher value short board (6 or 7 foot long Selects). More notably, 49 percent of the 8 and 9 foot long, 2A Common boards had the potential to yield a higher value short board.

3. Bucking a crooked log into two shorter, straight logs before sawing.

4. Short log processing.

Initially, our research emphasis has been on the first two short lumber sources listed here. These represent opportunities to improve present sawmill operations and profit. The increased processing costs required to make short lumber rather than chips from 8 foot and longer logs, are not as daunting to the sawmiller as are the costs associated with sawing short logs.

OPPORTUNITIES EXIST FOR DEVELOPING HIGH VALUE AND VOLUME MARKETS FOR SHORT LUMBER

The third point that I want to emphasize is that opportunities exist for developing high value and volume markets for short lumber. These markets can be developed by those primary producers who are willing to incur additional marketing costs. The breakeven lumber sales price calculations discussed previously (Table 1) give an indication of the additional marketing costs that can be economically justified by a sawmiller when producing short red oak lumber from material that would otherwise be chipped.

In order to obtain credible estimates of the value of short lumber to the furniture and cabinet industries, dimension part yield estimates and processing cost estimates were combined. The combination was examined using the systems simulation modeling approach. The short lumber yield results obtained from both the cut-up simulation experiments and mill study experiments along with processing rate data, comprised the major inputs to two systems simulation models. The layouts of the two rough mills modeled in this study are shown in Figure 1.

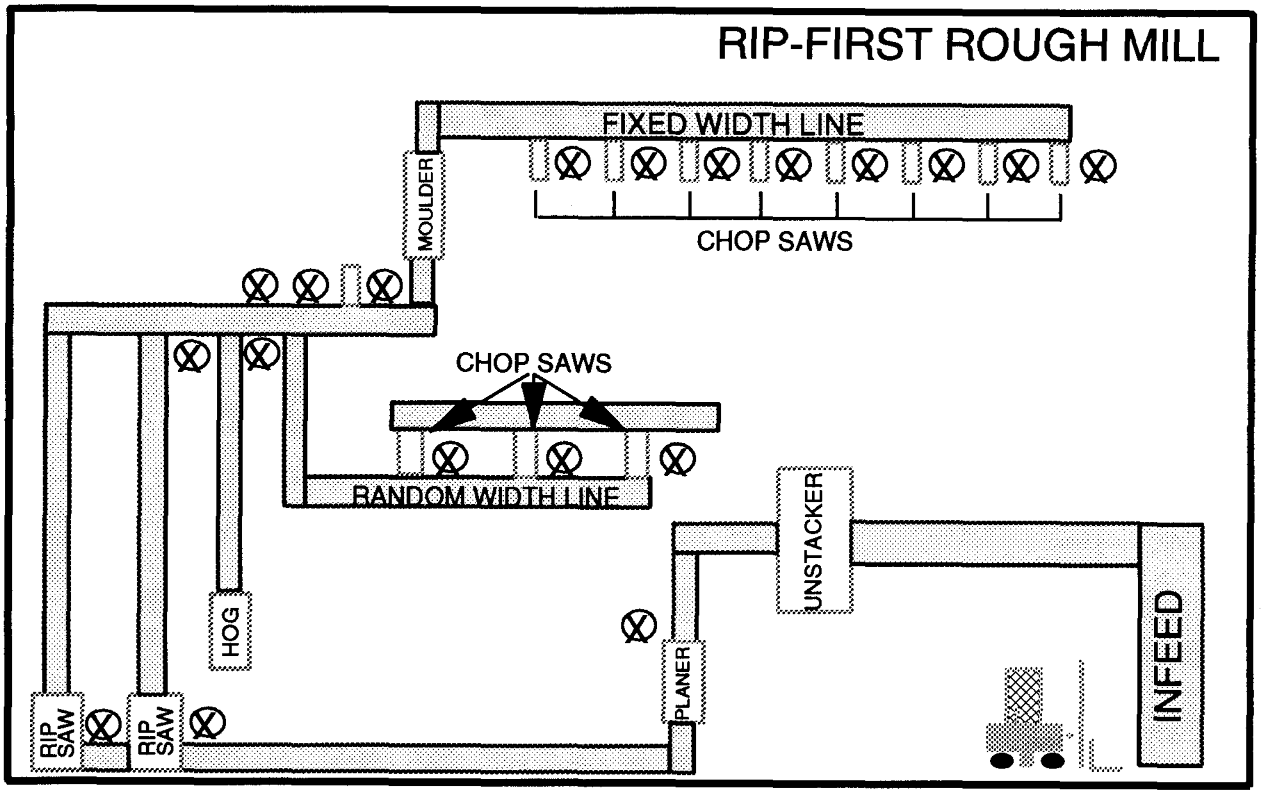
The output from these models was entered into a series of rough part production alternatives which incorporated variable production, part value, and cost assumptions. The net present worth of after-tax cash flows and the breakeven short length lumber purchase price (for secondary manufacturers) of these alternatives were calculated and compared.

The crosscut-first simulation study indicated that the volume and value of parts cut from short lumber in a crosscut-first rough mill compares favorably with the volume and value recovery obtained from longer length lumber (Table 2). In the "worst case" crosscut-first production alternative the breakeven short lumber price was only $129 less per thousand board feet than the going market price for dry, 1 Common, red oak lumber (Table 3).

Table 2. Crosscut-first rough mill simulation results - average values for 10 simulation runs.

SIMULATION OUTPUT VARIABLE	SHORT LUMBER	MEDIUM LUMBER	LONG LUMBER
Time in System (secs)	485	853	1072
Input Vol (bf/hr)	2226	2200	2240
Production Vol (bf/hr)	1709	1686	1716
Part Value ($/hr)	4139	3876	3948
Unstacker Op. Utilization	23.1%	15.3%	11.7%
Crosscut Saw Utilization	93.2%	93.3%	94.1%
Rip Saw Utilization	60.7%	66.1%	68.1%
Pieces Waiting for Rip Saw	9	61	73

Figure 1. Crosscut-first and rip-first mill layouts of mills in which yield and timing studies were conducted. Simulation/animation models of these mills were programmed and then used for experimentation.



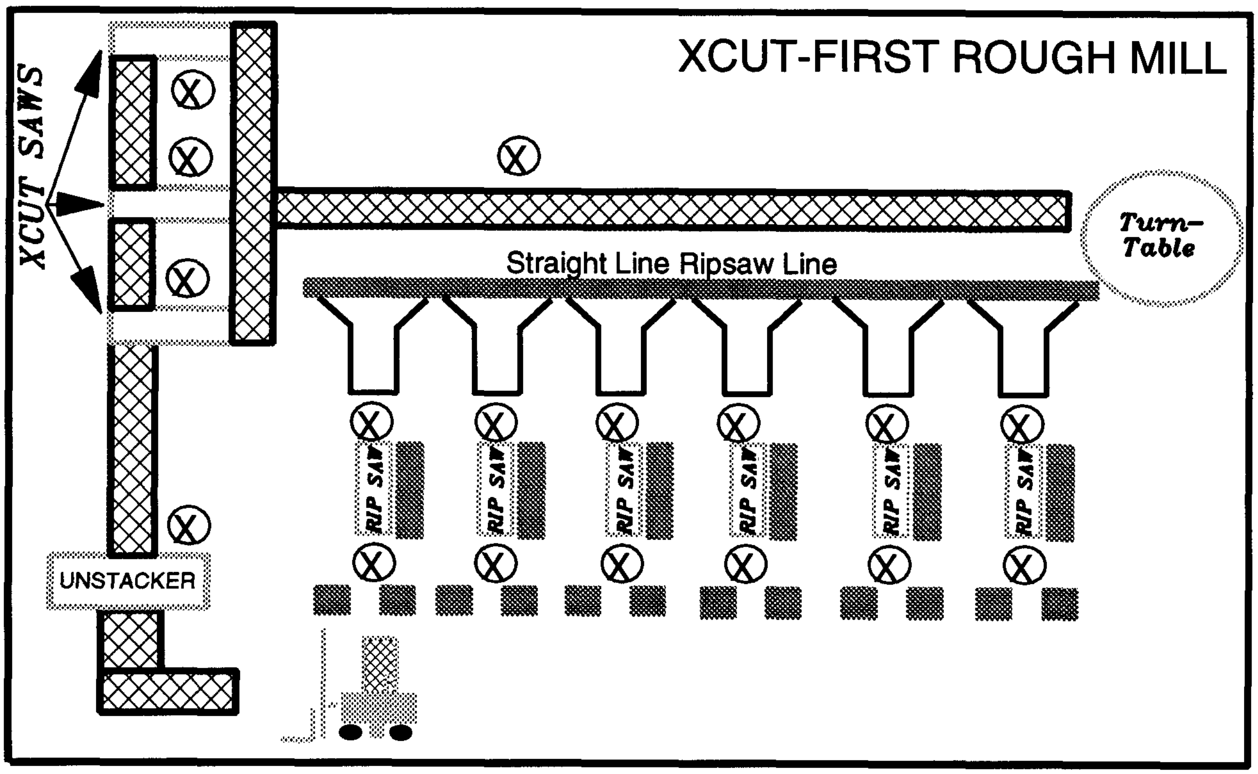


Table 3. Comparison of breakeven short length lumber purchase prices for the best and worst-case short length lumber cut-up scenarios for each mill model. Prices were compared to a going market price of $800 per dry mbf from the first quarter of 1992.

	ALTERNATIVE	Breakeven Short Lumber Price
		$/mbf dry lumber
CROSSCUT-FIRST BEST CASE	No conversion costs.	$800 or Current Market Price
CROSSCUT-FIRST WORST CASE	Extreme conversion costs, pessimistic short lumber yields, low mbf annual output from short lumber.	$671 or $129 below Current Market Price
RIP-FIRST BEST CASE	No conversion costs, 20% overhead rate.	$653 or $147 below Current Market Price
RIP-FIRST WORST CASE	Extreme conversion costs, 30% overhead rate, pessimistic short lumber yields, low mbf annual output from short lumber.	$373 or $427 below Current Market Price

The breakeven short lumber purchase price calculated using this pessimistic yield figure is 84 percent of market price. It is 1.3 to 1.7 times higher than the estimated breakeven lumber sales price for short lumber generated from material that would otherwise be chipped ($200/mbf adjustment made for dry lumber).

Since the crosscut-first mill modeled is a very representative crosscut-first rough mill, the simulation and economic analysis results are applicable to a large percentage of crosscut-first operations. For crosscut-first mills that occasionally process "short" cutting bills, short length lumber should be part of the raw material mix. This is especially true if: 1- short lumber price discounts of $100 to $150 per thousand board feet can be obtained, or 2- in processing longer length lumber, stop-and-start flow develops due to rip saw bottlenecks, and 3- the materials handling system is already well-adapted to handle shorter lumber.

For the rip-first model the volume and value of parts produced from short lumber was only 60 percent that of the longer length lumber (Table 4). The breakeven short lumber prices calculated for this model ranged between $427 and $147 per mbf less than the going market price for longer lumber (>8 feet; Table 3).

Table 4. Rip-first rough mill simulation results - average values for 10 steady-state simulation runs.

SIMULATION OUTPUT VARIABLE	SHORT LUMBER	MEDIUM LUMBER	LONG LUMBER
Time in System (secs)	262	539	916
Unstacker Reload Utilization	15.0%	8.4%	5.9%
Forklift Utilization	16.1%	8.7%	6.3%
Input Vol (bf/hr)	3023	5142	4894
Production Vol (bf/hr)	1648	2802	2668
Part Value ($/hr)	2999	5347	5105
Rip Saw Utilization	84.1%	97.2%	90.5%
Rip Queue Entities	13	28	31
Planer Outfeed Entities	7	13	15
Fixed Width Strip Percent	74.9%	77.5%	79.9%
R/W Chop Saw Utilization	55.7%	46.2%	41.9%
F/W Chop Saw Utilization	68.7%	83.7%	86.3%
Moulder Queue Entities	5	38	42
Fixed Chop Line Entities	35	37	103

The “best case” rip-first alternative’s breakeven short lumber purchase price is still somewhat lower than the crosscut-first model’s “worst case”-based breakeven purchase price. Additional rip-first mill model’s should be built to determine if other rip-first mill configurations are more suited for running short lumber. Our observations of other rip-first rough mill systems lead us to believe that rip-first mills that have fixed saw settings or faster setworks on the rip saws could better utilize short lumber than was the case for this system that had fairly slow setworks on selective rip saws.

CONCLUSIONS

As rough mills expand their lumber input mix to include a higher percentage of 4-7 foot lumber, higher value material (short lumber rather than chips, or longer, lower grade lumber) can be produce by hardwood sawmills. Once a stronger market for short hardwood lumber exists, short log processing systems will become more viable and the timber management options available to the resource manager will increase.

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