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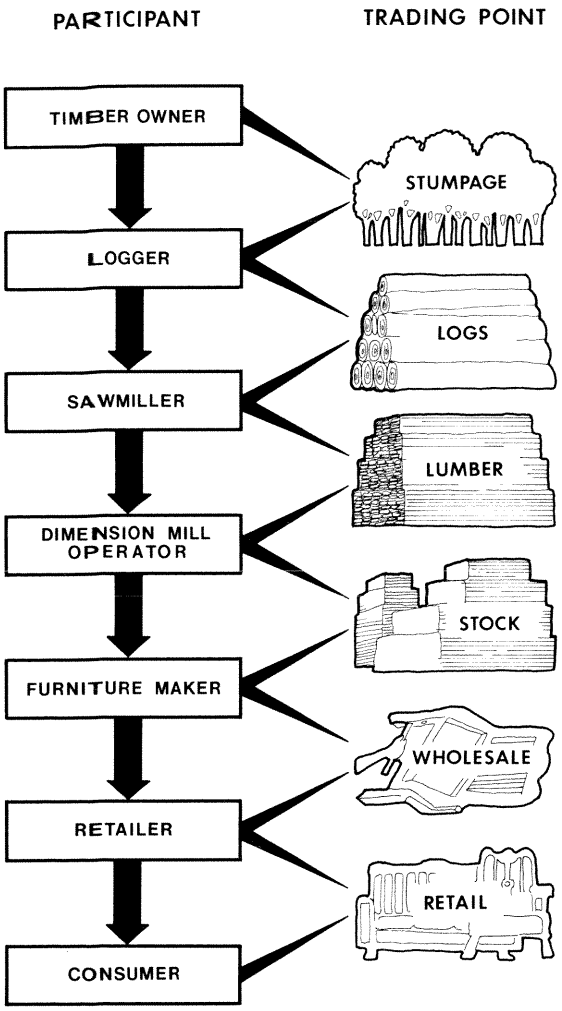


# MARKETING LOW-GRADE HARDWOODS FOR FURNITURE STOCK — A NEW APPROACH

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## Abstract

A hardwood shortage of high-grade lumber exists while there is a surplus of low-grade hardwood timber. Two things are needed for the surplus to correct the shortage: a new manufacturing system and a new marketing technique. Utilization research at the Princeton Forestry Sciences Laboratory has developed the new system for converting low-grade hardwood for furniture use. The manufacturing steps can be integrated with the existing marketing system from the timber grower to the logger to the sawmiller to the dimension maker to the furniture producer.

## INTRODUCTION

FURNITURE PRODUCTION is increasing. Standard hardwood lumber shipments are not. Hardwood lumber prices are rising. Furniture prices are not rising as fast as lumber prices. These four facts suggest to even the most casual observer contradictions that the furniture industry cannot absorb indefinitely. However, consider a fifth fact: while there is a shortage of the highest grades, there is no shortage of hardwood timber in general. Hardwood growth is greater than hardwood harvest.

What is the problem, then? The problem of furniture makers is how to use abundant low-grade hardwood to supplement the scarce high grades. And, they must do this in a way that will be of value to the timber grower, the logger, and the sawmiller as well. We believe that this report suggests a viable solution to the problem of how to use low grades in furniture.

## MARKETING HARDWOODS FOR FURNITURE TODAY—A BRIEF GENERALIZATION

There is a lot of buying and selling going on as high-grade hardwood timber is converted into furniture and sold to the final consumer (Fig. 1). We identify six major trading points:

1. "Stumpage"—A timber owner sells standing timber to a logger for a stumpage fee.
2. "Logs"—The logger sells logs from the timber he has cut to a sawmiller.
3. "Lumber"—The sawmiller sells lumber to the dimension mill owner or a furniture maker. In some places brokers assist in moving lumber from the sawmill to the user.
4. "Stock"—The lumber is dried, processed into rough part sizes, and sold to the furniture maker by the dimension mill owner. When the lumber is sold directly from the sawmill to the furniture maker, the "stock trading point" becomes an internal bookkeeping function of the furniture plant.
5. "Wholesale"—The furniture maker sells his product to a retail store.
6. "Retail"—The retailer sells furniture to the ultimate consumer.

Consider the first three trading points. While each has a serious effect on the fourth or "stock" trading point, each is usually independent. Neither the timber owner nor the logger knows or is concerned about the final use of the wood. Although the logger's bucking decisions affect the maximum length of a rough part, his major concern is maximizing his profit when he sells his logs to the sawmill. The sawmiller, in turn, wants to saw as precisely as possible and produce as much high-grade lumber as possible. How the lumber is to be used is beyond his area of interest. When the woods were full of large high-quality trees, these procedures and objectives were adequate.

The wholesale and retail trading points need not be considered further here. Furniture stock sawed from high-grade timber and furniture stock sawed from low-grade timber to the same quality standard will look and behave the same.

## MARKETING LOW-GRADE TREES FOR FURNITURE USE—A NEW APPROACH

Low-grade timber is not what the forester sets out to grow. He wants high-grade timber. Unfortunately, most of the hardwood acres have not been managed by foresters. Instead, most of the hardwood stands are the result of nature's growing technique followed by indiscriminate cutting. An area is saturated with a tremendous number of seedlings. As these miniature trees grow to saplings, to poletim-

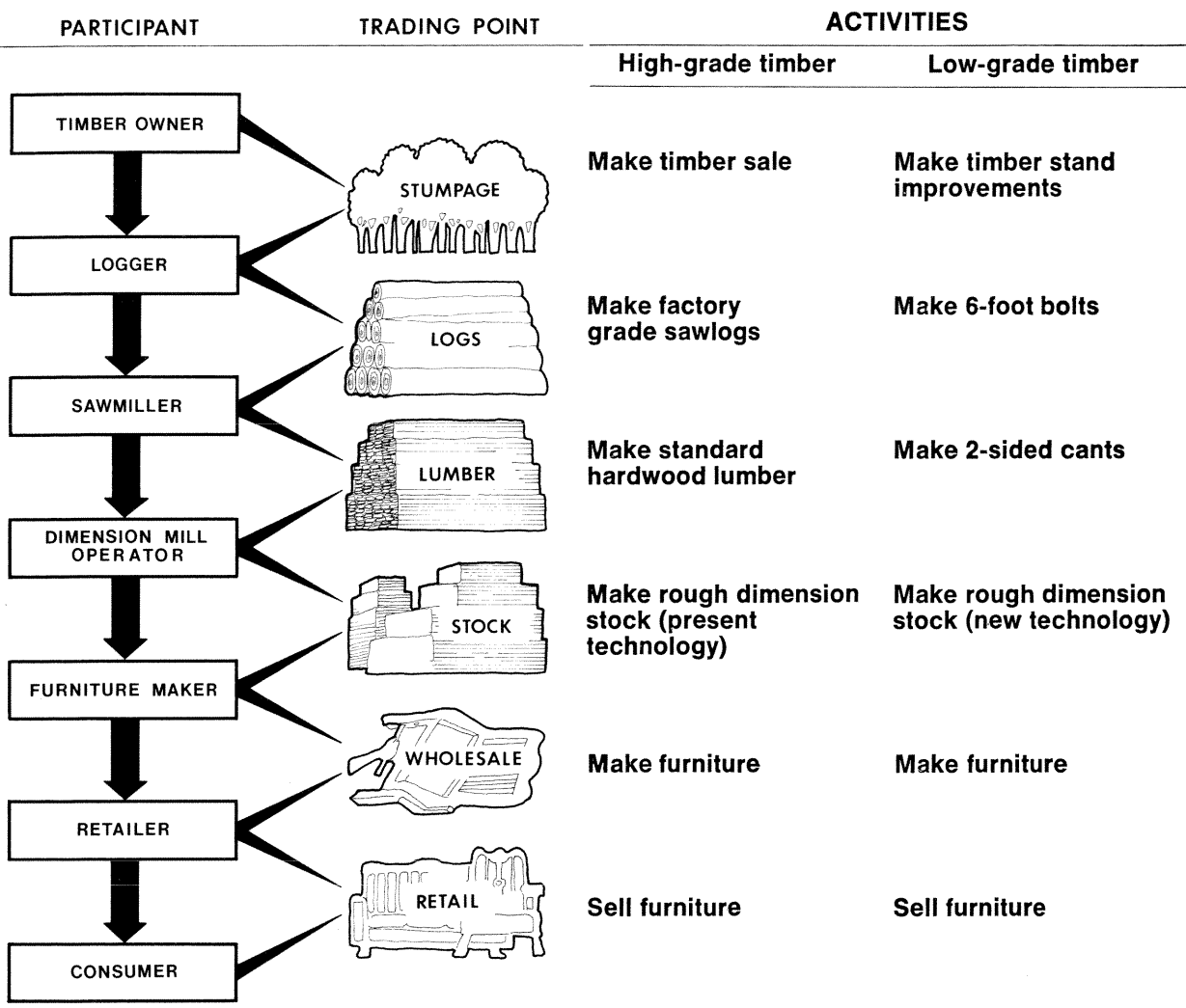


**Figure 1.—Marketing hardwoods: trading points from hardwood timber to furniture.**

ber, and finally to sawtimber size, most of the trees must die as there is room for only a few. In this way the "best" trees compete and survive. But this way is not very efficient. Often we find acres of small trees in a stagnant situation with no forester's attention being applied. Conventional hardwood markets do not provide enough economic incentive to remove the excess small low-grade timber so that the best forestry practices can be applied.

We feel that the low-quality, small-diameter hardwood forest can best produce pulp, pallets, and parts for furniture. If we include the residue from sawing operations, there is an important fourth product: energy. In any event, it is not what is in the forest that is most important; rather, it is how to get the products out of the small-diameter, low-grade trees. Years of research at the Forestry Sciences Laboratory lead us to recommend a new way.

The key to our low-grade hardwood marketing method is to use the best of the low-grade trees for furniture parts, with the remainder going to pallets, pulp chips, and/or energy. The low-grade trees will be harvested as bolts. The bolts will be sawed to cants instead of to

conventional lumber. Cants will be sawed to short boards which will be made into rough dimension stock. Let us look at this in greater detail.

### The "stumpage" trading point

About half of the hardwood volume is in tree stems 12 inches or less in diameter. A program geared to process logs up to 12 inches in diameter provides an excellent opportunity for timber stand improvement (TSI)—the removal of excess trees. Traditionally, the forester has a logger remove these trees, gives him the wood he removes, and pays him in addition. This work is done on the theory that the remaining forest will ultimately pay this cost. Contrast this with high-grade timber sales, in which the logger pays the forester "stumpage" for everything he cuts.

With our new approach to processing, we believe the value of the low-grade timber will be high enough overall to eliminate the need to pay the logger for TSI work. While we do not envisage a lucrative stumpage for the timber owner, improving his forest at no cost or even a small profit should be attractive.

Our approach to stumpage is to set the value of the best of the low-grade hardwood timber equal to the cost of the remaining TSI work. In this way, the forester (seller) will get the TSI that is required to grow high-grade hardwood timber without an out-of-pocket investment. The logger (buyer) will have low-grade timber to sell at a price that will allow him a reasonable profit.

### The "logs" trading point

Sawmill machinery is inflexible. Its main purpose is to generate a flat surface parallel to another flat surface. To this machinery we feed round or somewhat round logs that may be crooked, heavily tapered, or otherwise less than perfect cylinders. Some "tailoring" of the tree-length stem must be done to accommodate the sawmill's requirement for straightness.

With low-grade hardwoods, a compromise between log length and log quality must be made. By cutting out the poorest sections, higher grade bolts can usually be bucked from low-grade trees. However, there is a limit to how much grade improvement can be expected. Low-grade hardwood trees are not only knotted and of indifferent quality, they are often crooked, too.

Making very short bolts, 4 to 5 feet long, takes a lot of work and requires a lot of handling. There does not appear to be enough yield to justify using such short initial lengths. On the other hand, bucking to 8-foot lengths that are fairly straight is less work and the quality level is good. The only problem is that there are not many of these 8-foot lengths available.

We have found the best compromise of bolt length and parts quality and quantity (or yield) to be reached when 6-foot-long bolts are bucked from tree length stems (Reynolds and Schroeder 1978). Fortunately, most furniture stock parts are short, so the 6-foot length is not a deterrent.

A compromise of bolt diameter limits is also required. Sawmill machinery that can saw very large bolts makes a wide, wasteful headrig kerf. And, bolts whose diameters are very small have a large percentage of juvenile wood which is weak and which causes sawing and drying problems. By limiting the bolt range to 7.5 through 12.5 inches in diameter, the juvenile wood problems are reduced and oversize sawmill equipment is not required. About half of all hardwood growing stock is in this diameter range.

In our new approach to marketing low-grade hardwood logs for furniture use, the logger will make and sell 6-foot-long bolts, 8 to 12 inches in diameter (small end), from the better low-grade hardwood tree length stems.

### The "lumber" trading point

It is a rule of thumb that hardwood sawmills make a profit on 1 Common and Better lumber but do well to break even on 2 Common and poorer lumber. When factory grade 3 logs up to 12 inches in diameter are sawed to lumber, very little 1 Common and Better lumber will be made. Therefore, very little if any profit will be made if only the best of the low-grade logs are sawed to lumber. It is easy to see that a different sawn product will have to be made if the sawmill is to make a profit.

Rather than lumber, we recommend that the sawmiller convert the bolts to cants. Bolts

can be sawed very efficiently to cants with specialized Scragg-type sawmills. The sawmiller can afford to sell the cants at a lower price per board foot than he would have to charge if he sawed the bolt into lumber. In addition, all of the cant will be sold at one time. The sawmiller will not have to grade, sort, and sell lumber by grade.

### The "stock" trading point

New rough mills to make rough furniture dimension stock from cants have been designed. The cants are resawed to boards and the boards are dried. Then the boards are crosscut to stock lengths, edged, and planed in one operation. At this point, many of the pieces are ready to be used directly. The other pieces will be further processed to remove defects. If some of these pieces will require too much manual processing, they will be discarded and used for fuel.

If parts are needed in longer lengths than are available, Serpentine end matching (Sem) (Gatchell, Coleman, and Reynolds 1977) may be used to glue short stock lengths to the required longer lengths. These long lengths may be edge-glued into wider parts or panels.

Once the rough dimension stock has been produced with these new approaches, it can be sold (or used) in direct competition with rough dimension made from standard hardwood lumber that has been processed with traditional technology. The two rough dimension stock products are made to the same quality standards. Only the raw material and the manufacturing process will be different. Because the dimension mill operator uses a relatively inexpensive raw material that has been specifically tailored to fit his new-technology process, he can match the price charged for conventionally produced stock and make a profit.

## THE NEW APPROACH—CAN IT WORK?

Whether the new marketing approach will be successful depends mainly on whether equal products can be delivered at prices similar to those of conventional products. An important question is whether each step in the marketing processing chain benefits people enough to make a change worthwhile. Let us illustrate the new approach with results from a black cherry study that was conducted as part of a TSI effort in West Virginia.[1] The end product was furniture that was commercially finished and appraised.

The end product must carry the costs and profits of all that goes before. Because the rough dimension stock produced conventionally and that produced by the new techniques are equal in all respects, we can start at the stock trading point and work back to the forest. In this example, we will consider only the value of the furniture parts and not other possible products such as chips or energy.

### Pricing at the stock trading point by the furniture maker

Most furniture makers have rough mills where standard hardwood lumber is manually converted to rough dimension parts. Determining the value of these parts is generally done with rules of thumb: Using 1 Common lumber, one-half of the raw material will end up in parts, and the value of rough parts is equal to twice the cost of the lumber input.

On a 4/4 basis, it will take 2,000 board feet of lumber to make 1,000 square feet of rough dimension parts. In mid-1978, the average price for 1 Common black cherry lumber was $575 per Mbf (thousand board feet). At a 50 percent yield, it will take $1,150 worth of lumber to make the 1,000 square feet of dimension stock. The value of these parts is twice the cost of the lumber input or $2,300 per thousand square feet.

The furniture maker will consider purchasing rough dimension parts if the price of these parts is equal to or less than the value of the parts made in his own rough mill. As the rough parts from the new procedures are equal in all respects to those produced with conventional technology, we set the price of the new method parts to the same $2,300 per thousand square feet.

[1]Reynolds, Hugh W. System 6: Black cherry lumber yield from thinnings. (Unpublished report on file at Forestry Sciences Laboratory, Princeton, WV.)
Reynolds, Hugh W. System 6: Cherry furniture panels from a gang rip single length rough mill. (Unpublished report on file at Forestry Sciences Laboratory, Princeton, WV.)

### Pricing at the lumber trading point by the dimension maker

With the new processing method, the dimension maker will gang rip two-sided, 6-foot cants to boards and dry and process these boards to rough parts. What can he afford to pay for these cants? Our studies on black cherry, red oak, white oak, and yellow-poplar from thinnings have shown that the new process should be very profitable if the cost of the cants is one-fourth the price of the dimension parts produced, rather than one-half as with the conventional lumber. Low grade hardwoods are, after all, low grade and yields are poorer. So the dimension maker will pay $575 (one-fourth of $2,300) for enough cants to make a thousand square feet of 4/4 dimension stock.

Measuring 6-foot, two-sided cants can present a problem or two. They are curved on two sides and often tapered (Fig. 2). Their volume cannot be determined as easily as can the volume of four-sided cants. And yet, a board foot volume is needed as a marketing tool. Our technique for measuring the volume of two-sided, 6-foot-long cants is simply this: Measure the widest face on the small end of the cant and multiply this width in inches by 1½ when measuring 3-inch-thick cants, 2 when measuring 4-inch-thick cants, and 3 when measuring 6-inch-thick cants.

The yield of rough dimension parts from two-sided cants, measured this way, is roughly 30 percent. So, 3⅓ Mbf of cants are needed to produce 1,000 square feet of 4/4 stock. Recalling that the dimension maker can make a profit if he pays about $575 for enough cants to make this 1,000 square feet of parts, the price for two-sided cants is $175 per Mbf.

### Pricing at the log trading point by the sawmiller

Can the sawmiller make a profit selling 6-foot-long, two-sided cants at $175 per Mbf? Yes! But before we show how, we must briefly discuss the term *board feet*. Or, more importantly, how different systems measure different volumes but still use the same label: Mbf.

Moving from surface feet of dimension parts to cant volume was rather straightforward. With cants, it was necessary to invent a technique because of the half round, half flat, tapered shape of the raw material. Going from there to the round bolt involves an even bigger variation in amount.

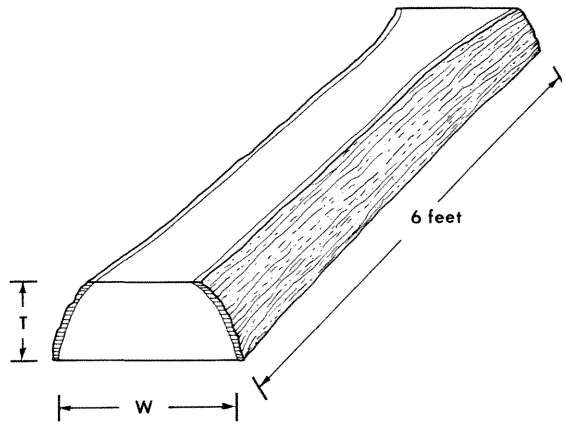


**Figure 2.—Measuring two-sided cants.**

**T: Thickness in inches: 3, 4, or 6**
**W: Width in inches**

$$\text{Board feet} = T \times \frac{W}{12} \times 6 \text{ feet}$$

$$= 3 \times \frac{W}{12} \times 6 = 1.5W$$

$$= 4 \times \frac{W}{12} \times 6 = 2.0W$$

$$= 6 \times \frac{W}{12} \times 6 = 3.0W$$

The commonly used measuring device for round logs or bolts is the International ¼-inch Rule. This device seriously underestimates the amount of material in small bolts. We have found that cants, measured our way, produce about 70 percent more board feet than the International ¼-inch Rule estimates. That is, 585 board feet of bolts—as measured by the International Rule—consistently produces 1,000 board feet of cants from bolts 8 to 12 inches in diameter. The 585 board feet of bolts that make 1,000 board feet of cants worth $175 have the same value as 1,000 board feet of bolts worth $300.

Is this $300 value realistic? Quite so! Let us say that the sawmiller pays $200 per Mbf for bolts. All he has to do is slab one side, turn the bolt 180°, slab the other side, and saw the bolt down the middle to make two cants. A small, circular headrig employing three men could saw two bolts per minute easily and a three-saw Scragg mill could saw three bolts per minute using only two men. For this small amount of work, the sawmiller will make $100 per Mbf of bolts over bolt costs.

### Pricing at the stumpage trading point by the forester

Is the $200 per Mbf the sawmiller pays the logger realistic? We believe so. But it really depends upon the stumpage the logger must pay the forester or timber owner. Stumpage may be high (attractive to the forester) if a pulpmill or a deep coal mine is nearby. Pallet mills use a great deal of low-grade hardwood timber and pay good stumpage rates. But, many areas having low-grade hardwood timber do not have these markets. In some of these areas, stumpage rates have been as low as $1.25 per Mbf.

Consider 10 percent of the bolt selling price to be a fair stumpage price. At $200 per Mbf, a $20 stumpage price would leave the logger $180 per Mbf to cover the costs of logging, hauling, and profit. This should be attractive to the logger.

And what of the forester (or timber owner)? He wants to get TSI work done without spending any money. If the best of the 8- to 12-inch diameter timber is used for 6-foot furniture bolts, most of the TSI work will already be done. In the thinning study from which we obtained our black cherry bolts, about one-third of the timber removed for TSI was available for furniture bolts. The yield was 2 Mbf per acre of these bolts, which produced $40 per acre of stumpage value that could be used to complete the remaining two-thirds of the TSI work; that two-thirds should also produce some palletwood, pulpwood, or fuelwood. So if the forester gives the logger all of the wood in exchange for the TSI work, he will, in reality, be paying the logger $40 per acre in addition to the value of the wood for pallets, pulp, or fuel.

## DISCUSSION

Having a new technology to make rough dimension stock is the first requirement for utilizing low-grade hardwood timber for furniture. A new market pricing technique is also needed that will permit the low-grade timber products to be bought and sold in the same way as products from high-grade timber. If it starts with the value of rough dimension stock produced conventionally from high-grade lumber, the new marketing technique will work.

The furniture maker sets the price he will pay for dimension stock based on the 1 Common hardwood lumber price. The dimension mill owner sells rough dimension stock at this price and determines the price of the cants he will use. The sawmiller sells at this cant price and determines the price he will pay for bolts. The logger sells at this bolt price and pays the forester (or owner) for the low-grade hardwood timber by performing TSI work.

These concepts were tested in a study of low-grade black cherry taken from a TSI cut. At the stock trading point, the selling price of rough dimension was $2.30 per square foot. At the lumber trading point, the selling price of cants was $175 per Mbf. At the logs trading point, the 6-foot bolt selling price was $200 per Mbf. The apparent discrepancy between the high bolt price and lower cant price is due to the 70 percent overrun in converting bolts to cants. At the stumpage trading point, the price was $20 per Mbf, bolt scale, which resulted in $40 per acre that the timber owner could pay, in addition to giving the smaller timber away, for the TSI work.

Is this little more than a numbers game? We hardly think so. The prices shown are conservative in comparison to those of dimension stock conventionally produced from lumber. As furniture demand increases and hardwood lumber production remains constant, the lumber prices rise rapidly; so do stumpage prices for high-quality logs. But this stumpage/lumber price pressure is not felt by the low-grade hardwood resource. So as the conventional trading point prices—stumpage, logs, lumber, stock—go up, the new-technology production using the low-grade resource will become more lucrative.

## CONCLUSION

If this new marketing concept is to succeed, we must do more than prepare wood products for the next trading point in the traditional manner. A small-diameter tree that needs to be weeded out might well be used for furniture parts if all processing steps were aimed at these parts. Such trees can profitably be converted in new, specialized, highly automated rough mills. The stumpage owner, the logger, and the sawmiller should recognize this. There appears to be plenty of economic incentive for a thorough commercial test of this approach.

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