Technology developments in solid wood products manufacturing are enabling mills to economically process smaller logs. Species once considered to have little commercial value are now commonly used by mills for the manufacture of structural panels. Logs once considered suitable only for pulping are now being processed into plywood. Technological advances are redefining the concept of peelable and sawable timber. With size becoming a less important criterion, values for older and bigger categories of timber appear to be losing some of their premiums over smaller sized logs. Strategies for future timber management should consider the probable narrowing of price differentials between large and small logs.

INTRODUCTION

Harvested timber is sorted and sold according to various grades. Historically, the bigger and more defect free a log was, the higher would be its grade and hence its value per board foot. This continues to be the case today, although forces in individual markets cause premiums for higher grades to fluctuate. In particular, over the last 12 years, a noticeable trend has significantly reduced premiums for higher graded logs in two large volume species, Douglas-fir and southern pine.

Many factors account for changes in relative prices. Bigger, higher grade logs are used primarily for solid wood products, while smaller logs are used mostly for pulp. Therefore, strength in solid wood markets relative to pulp markets tends to increase values for higher grade logs relative to pulp grade logs, and vice versa. This factor, however, exerts a cyclical influence and is not a likely explanation for the prolonged trend that has been evidenced the past dozen years.

Another possible cause is decline in quality. Log grades are an inexact measure of value, because they cover a range of size and quality characteristics. For example, in the Pacific Northwest, a necessary (though not sufficient) requirement for a log to be graded as a #1 sawlog is a minimum diameter of 30 inches. The diameter range of a #2 sawlog is between 12 and 30 inches. For a log to make it into the #3 grade, its diameter must be at least 6 inches. It is possible that batches of #1 or #2 sawlogs in the past were, on the average, bigger and clearer than current batches, and the decline in their premiums relative to small logs reflected this.

A third potential contributing factor to lower values for high grade logs is technology. Processing developments in the last 10 years have enabled structural panels and lumber to be made from small logs. I would like to briefly review these developments, in particular timber processing technologies that have occurred in structural panel manufacturing. But first, let’s review in more detail trends in timber prices by grade.

TRENDS IN LOG PRICES BY GRADE

Traditionally higher grade, large diameter logs have sold at a premium on a board foot basis, relative to lower grade, small diameter logs. This premium reflected, in part, the superior quality products that could be obtained from such logs, and the processing efficiencies that result from the large size.

Figure 1 charts some of these premiums for Douglas-fir sawlogs. These prices reflect harvesting and delivery costs as well as stumpage. The solid line depicts #1 sawlog premiums relative to #3 sawlogs over the period 1975 to 1985. These premiums are displayed in percentages. The dashed line shows #2 grade sawlogs premiums over #3 grade. The flat line at zero represents the #3 sawlog base.

Let us next consider how technological developments that made small log processing feasible may have contributed to this relative drop in higher grade timber values. Plywood and structural panel manufacturing, in particular, have changed due to advances in processing technology.

**PLYWOOD AND STRUCTURAL PANEL DEVELOPMENTS**

Until the early sixties, plywood manufactured mostly in the Pacific Northwest was the dominant structural panel. The raw material was largely old growth Douglas-fir, and the product mix was heavily weighted to high-value sanded specialty items like concrete forms. In those days, blocks were centered manually and loaded into the lathe by means of overhead cranes. Lathe charging times were long, but since the logs were large the lathe downtime was small in percentage terms. Multi-layered tiers of trays ahead of the clipper were required to store veneer as it came from the lathe. Peeling was interrupted frequently by defects in the old logs, and a surge capability was needed to store veneer during the periods when the lathe was peeling continuously. The slow clipper speeds enabled the clipped veneer to be stacked manually by pullers who sorted veneer by grade and heartwood/sapwood categories.

In the early sixties, the plywood industry began in the South. The southern timber resource was smaller and less defective, so charging time of the lathe and clipper speed became more critical. Faster chargers were developed and automation arrived on the green chain as full sheet stackers began to appear. The product mix was mainly commodity, unsanded items for the growing construction related markets.

As the supply of old growth timber declined, plywood mills in the West and Canada evolved similar to southern pine mills. Gradually, the focus changed from specialty and sanded items to sheathing and commodity grades. Technical advances were increasing lathe charging rates, clipper speeds, and automatic stacking capabilities.

The wave of investment in waferboard mills in the late seventies brought new realities into structural panel markets. Waferboard mills were utilizing aspen and other hardwood species that had few commercial uses other than firewood or pulp. As a result, waferboard mills enjoyed wood costs that were a fraction of those in a plywood mill using traditionally large timber.

The growing competition from waferboard and the other nonveneered structural panels began to take market share away from plywood. That competition, in combination with the recession of 1980-82, severely strained many plywood mills. In deciding about their futures, many companies concluded that for plywood, the future was limited and their mills closed. Others saw waferboard as the panel of the future and joined the rush to build waferboard mills. But a number of companies, looking at available technologies and costs, concluded that a modernized plywood mill could be
competitive. This resulted in the revitalization of the plywood industry in the past 5 years that saw capacity and output climb even in the face of widespread mill closures. Let's review the changes in plywood manufacturing that enabled this transformation.

First, consider automation. Waferboard mills are highly automated. Logs are flaked and the wafers are not separated according to grade. What little differentiation is needed among wafers is handled automatically by screens. From the flaker to the press, wafers are moved by conveyor belts without direct manual input.

Though not quite to the same extent, a modernized plywood mill is also highly automated. In a traditional mill, 4 or even 5 hours of labor were required to produce a 1,000 square feet of plywood. In a modern sheathing mill with automatic stacking, layup and press loading, that ratio can be as low as 2.

Next, consider gluing. Substantially greater amounts of adhesives are required per unit of waferboard than for plywood. Although application rates have been cut from the 3 to 3 1/2 percent range to about 2 percent of a panel's weight (using powdered resin), adhesive costs remain the largest item in waferboard production.

In plywood, glue can account for as little as 1.5 percent of the panel's weight. Because plywood is less dense, the amount of glue in a panel of equivalent thickness is less than half of that in a waferboard panel. A relatively new method of glue application, foamed extrusion, can reduce glue requirements by 25 percent relative to spray or spreader application systems. Many mills today are on a high moisture content gluing program, using veneers with double the normal moisture content going into the press. On such a program, glue requirements can be reduced further. All told, glue costs in a state-of-the-art plywood mill can be about a quarter of that in a waferboard mill.

Finally, consider wood. The main advantage of waferboard is that it can be made from very small, poorly shaped logs that have few alternative uses. As a consequence, their cost is extremely low. Even after losses due to fines, trim, and compression, which can reduce utilization to 60 percent or less, the low stumpage makes for very inexpensive wood, approximately $25 per thousand square feet of product, 3/8-inch basis.

To match such low costs, the modern plywood producer had to adopt essentially the same quality wood resource as his waferboard competitor, that is, bolts with diameters of a foot and less. To process such logs economically, a mill must be able to do several things.

First, since bolt peeling time is 4 seconds or less, depending on the diameter, the charge time, which is idle time from the production viewpoint, must be accomplished rapidly. With current swing chargers, a bolt can be loaded into a conventional lathe in about 2 seconds. This rapid charge rate is vital to economic small log processing.

Another imperative is to round up the bolt rapidly, since roundup time is also mostly idle time from the veneer production viewpoint. One lathe design today, the so-called spindleless lathe, involves two lathes, one to round up the bolt, the other to peel it. On conventional lines, rounding and peeling are accomplished on the same lathe, but with hydraulic carriage drives controlled by a microprocessor, there is split peel capability. This means the roundup thickness can be greater than the peel thickness. This accomplishes the roundup faster, cutting about a second off the idle time, to under 2 seconds for the roundup.

Second, since the log is so small, the core diameter must be reduced as much as possible to keep recovery rates high. With a core driver and powered nosebar, cores as little as 2-5/8 inches can be achieved as compared to 5 and 6 inches traditionally. Spinouts, another wood waster, are being minimized to low levels. When logs do spinout, they tend to do so at smaller cores, further increasing recovery.

Third, to keep up with the high-speed lathes, fast, accurate clippers are required. Clipping systems are available today which can accurately clip full-sheet veneer at speeds in excess of 500 FPM as compared to 350-400 with older systems.

Finally, to reap the benefits from the more productive green ends, dryers must be able to keep abreast of the increased output. Strategies for increasing dryer throughput include high moisture gluing, radio frequency redrying, and on-line dryer controls which adjust dryer speed to changes in veneer moistures.

The basic result is that today's panel producer, whether waferboard or plywood, is generally using small or low-grade timber. To be competitive, a commodity plywood mill simply cannot afford large diameter logs with their historic premiums. So large diameter logs are finding alternative markets, such a export markets, or are being priced lower relative to small, pulpwood-sized material.

SUMMARY AND CONCLUSIONS

Coat considerations have forced timber processors to utilize smaller, cheaper timber. Technology has made small log processing feasible in structural panel production as the physical and processing advantages of large diameter material are being reduced by modern equipment and processing techniques. Price differentials due to size and age in the main commodity species have narrowed and probably will continue to narrow in the future as these trends progress. Other species that have special end use niches, where appearance is a major consideration, may not be affected by these trends. But the forest manager growing timber for tomorrow's commodity markets should consider the changes occurring in processing technology and their implications on timber values.