

What Have We Learned From The Sawmill Improvement Program After Nine Years

By **STANLEY LUNSTRUM**

The Sawmill Improvement Program, better known as SIP, was launched in July of 1973 to help extend the Nation's timber resources through more efficient sawmilling of logs. Administered by the U.S. Forest Service, the SIP increases a log's breakdown efficiency and thereby helps sawmillers to recover more of their lumber. This means that more of the log resource becomes high-value lumber and less becomes lower-value products such as sawdust and chips. While it's true that most of the fiber content of the logs going into our sawmills is used in one way or another, usually less than half of the fiber content becomes dressed lumber. Since it's not uncommon for logs to represent up to 80% or more of the cost of the lumber on the green chain, mill owners can ill afford to convert less than 50% of the log into dressed lumber. Today, technology has made it possible to convert 70% or more of the log into dressed lumber, thus minimizing the remaining low-value products. The Sawmill Improvement Program helps mills to increase their conversion efficiency and thereby conserve the resource.

An adequate timber supply that is wisely and prudently used is critically important to the economic welfare of the Nation. With current levels of forest management, timber supplies are already beginning to fall short of projected demands in some areas. Our Nation does not have unlimited forest resources on unlimited acres of land. At the current level of land conversion activity, it is estimated that approximately five million acres of forest-base land is lost to nonforest use per decade. As this happens, it becomes clear that (1) more and better timber must be grown on fewer acres and (2) we must continue total utilization of the forest resource. This may mean using the entire wood fiber content of the tree, including the roots which has already been proven feasible. More complete utilization of the fiber content of the tree is the primary goal of the tightening-up procedures and the application of current technology in the SIP program.

In the early 70's, approximately 160 cubic feet of logs were required, on the average, to produce 1,000 board

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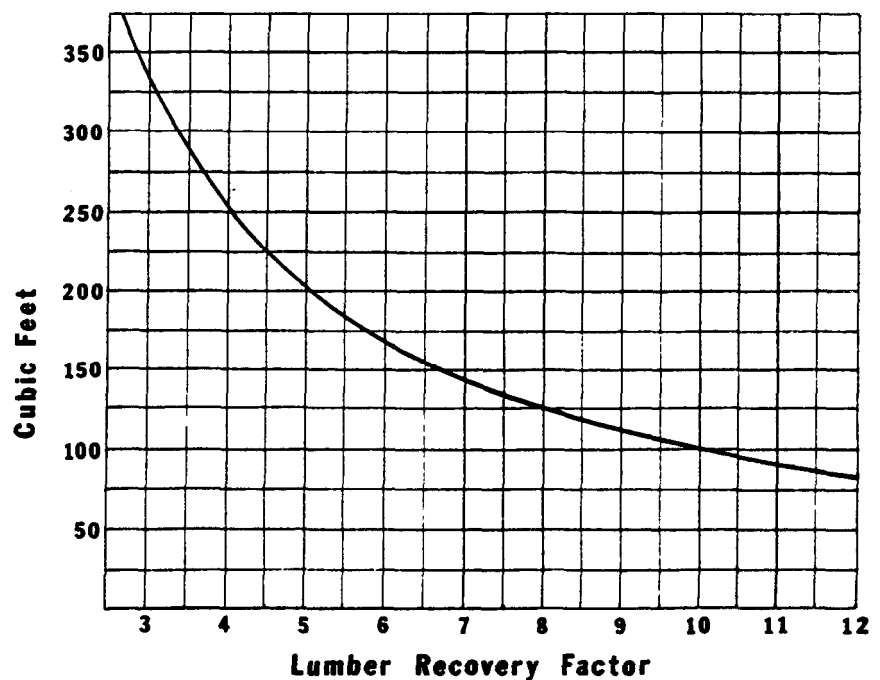
feet of dressed lumber. Today approximately 135 cubic feet of logs, on the average, are required. Therefore, in nine years, we have seen approximately a 15% reduction in log requirements to produce a given amount of lumber. The SIP program has helped to achieve this improvement in lumber recovery. Improving a mill's lumber conversion efficiency can have a dramatic effect on the amount of logs required. For example, 24% less log volume is required to produce 1,000 board feet of lumber at Lumber Recovery Factor (LRP) 8 than at LRF 6 (graph #1). With the continued adoption of available technology, it's possible that only 100 cubic feet of logs or less will be required to produce 1,000 board feet of dressed lumber in the near future.

Approximately 1,000 first-time studies have been conducted in softwood dimension mills across the Nation since

1973. Approximately 325 second-time, or followup studies, have been conducted to confirm improvements made in lumber recovery. The average size softwood dimension mill studied in the SIP program produces about 22 million board feet of lumber per year. The average improvement where tightening-up procedures have been implemented is about 4%. Thus, the average improvement in recovery per mill is about 800,000 additional board feet of lumber without increasing log input. This results in approximately 80 million board feet of additional softwood dimension lumber each year which translates into approximately 640 million board feet of additional lumber that has been produced since SIP began about 9 years ago. It should be remembered that this 640 million board feet of lumber was produced without cutting additional stumpage. Without improving the conversion efficiency, this additional lumber would have been lost to planer shavings or chips.

It is estimated that if all softwood-producing dimension mills in the U.S. would increase their conversion

CUBIC VOLUME OF LOGS REQUIRED TO PRODUCE 1000 B.F. OF LUMBER



efficiency, approximately 2 billion board feet of additional lumber could be realized annually without increasing the log input. Graph No. 2 shows the various amounts of products the log resource is being converted into. It is a composite picture from 1973 to 1979 and shows what dimension sawmills have been doing across the U.S. As LRF increases, proportionately less of the log volume is recovered as rough green lumber and more as dry dressed lumber.

What Factors Affect LRF?

The factors that affect LRF can be grouped into three categories, those related to: (1) raw material; (2) equipment and machining, and (3) processing.

Raw-Material-Related Factors

Since logs are the raw material, sawmills are naturally concerned with their size and form. Log size has to do with both diameter and length. Many mills today are cutting second and third growth timber which means that saw logs, for the most part, are smaller in size. Diameter affects LRF dramatically, especially as logs get smaller. LRF is also inherently less for small logs than for larger logs.

Log form also affects lumber recovery. It has to do with the shape or configuration of a log including taper, sweep, and natural or induced defects. Log form is influenced by species characteristics, site, aspect, injuries either natural or man-induced, and cultural practices applied during the growing process.

In general, sawmills must deal with smaller, lower-quality logs today

than in the past. Since smaller logs are a fact of life, it should be recognized that the LRF will be inherently less than for larger logs. These smaller logs, however, challenge sawmillers even more to realize maximum recovery.

Equipment and Machining-Related Factors

Kerf Width.—Lumber recovery can be improved by utilizing the minimum practical sawkerf. The impact this has on lumber recovery is the same as reducing sawing variation, eliminating oversizing, or reducing planing allowance. However, it is counterproductive to reduce sawkerf at the expense of increasing sawing variation.

The Sawmill Improvement Program has shown that high recovery mills invariably use narrower sawkerfs than low recovery mills. This results in less wood usage per line and therefore allows more boards to be cut from each log.

Sawing Variation.—Sawing variation is the uneven dimensioning of lumber in either thickness or width that results from a combination of saw wander, deviation of the log travel during sawing, and failure of the setworks to precisely position the log for a cut. It occurs in lumber basically because (1) a log or cant cannot be transported through the saw(s) in a straight line and single plane, and (2) saws do not always track in a straight line. As a result, boards vary in dimension, not only within a piece, but among pieces. To insure that lumber will not fall below a predetermined final size, an extra dimensioning allowance is made for variation in the

makeup of target set. Sawing variation is often expressed as a plus or minus value. For example, a board thickness can vary plus or minus 3/32nds inch with the assurance that the final size will always meet specifications. The minus side of the sawing variation allowance is of particular concern in analyzing the effect on lumber recovery.

There are several types of variation values that can be calculated to help describe what is happening during the sawing process. Within-board variation values indicate how well the saws track in a line. Between-board variation values indicate the consistency of the setworks as well as the ability of the log or cant transport mechanisms to transport the log past the saw in a straight line and single plane.

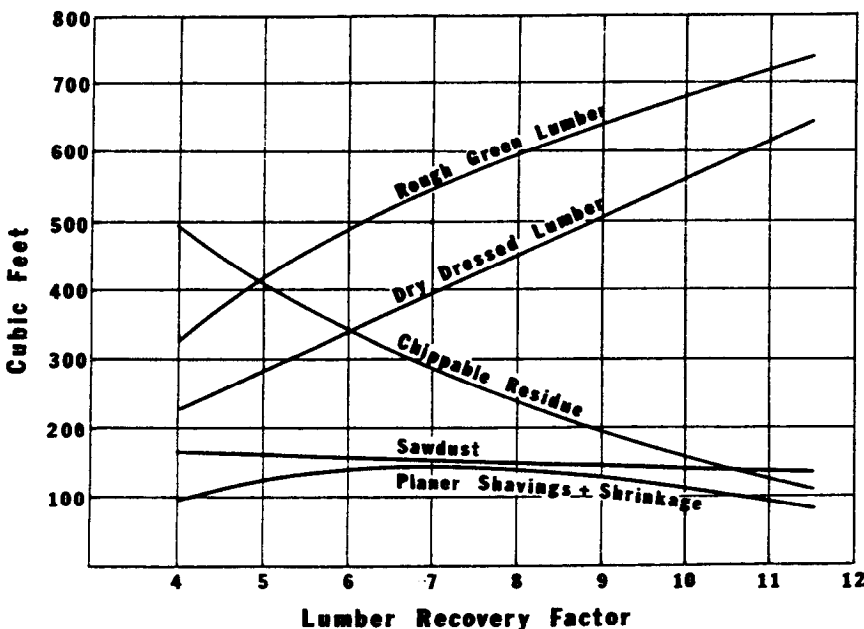
The Sawmill Improvement Program has shown that high-recovery mills have sawing variation values that are, on the average, 25% less than that of low-recovery mills. The best mills studied have sawing variation values that are 75% less than the average mills.

Oversizing.—Oversizing is the additional width or thickness dimension on the green target size that is not needed to satisfy other sizing allowances. It serves no useful purpose in meeting lumber specifications and is merely removed as planer shavings during planing.

Oversizing is quite often the largest single source of easily correctable loss in the milling process. A sawmiller will sometimes favor excessive dimensional allowances for subsequent shrinkage and planing, thinking that it will not affect recovery. It is this philosophy that often accounts for oversized lumber. Oversized lumber, by the very nature of the problem, is cut at a higher target size resulting in increased wood usage per line. Loss of lumber recovery can reach 10%. Approximately one-third of the sawmills studied in the SIP program have problems with oversizing.

Planing Allowance.—Provisions must be made for planer allowance in the makeup of the green target size. During planing, the planing allowance, as well as sawing variation and oversizing, are all removed as planer shavings. In dimension lumber, planing is usually done to size the lumber rather than for good appearance although it accomplishes both. Therefore the shadow of sawtooth marks on the lumber does not degrade it. Our Sawmill Improvement Program has shown that 5 to 16% of the green log volume is lost to planer shavings with the average about 10%. High-recovery mills invariably use smaller planer allowances and some of the highest recovery mills studied

AVERAGE NATIONAL VOLUMETRIC RECOVERY FROM DIMENSION MILLS FROM 1000 FT³ OF LOGS



lose less than 3% of the green log volume as planer shavings.

Processing-Related Factors

Bucking Practices.—Controlling log length is a problem in most sawmills. Incorrect log length may originate either at the mill or in the woods. In any case, the process of log making begins in the woods and any errors made there are carried through the milling process. When long logs are cut in the woods, the mill takes on the additional responsibility of further bucking them into shorter lengths.

Many reasons are given for bucking logs to incorrect lengths. For example: slanted cuts, insufficient trim allowance on long logs, bucking several logs simultaneously, bounce-back when log hits stop, failure to use equipment properly because of constant push to maximize production, lack of bucking schedules, lackadaisical attitude in checking equipment performance, etc.

Especially detrimental are logs that just fall short of their intended length by an inch or two. In such cases the lumber must be trimmed back to the next nominal length which may be up to 1.9 feet.

Another concern of improper log length is decreased production capacity. A survey conducted in Texas showed that 8 inches of log overlength cost 1.67 seconds of additional processing time. With mill production costs of \$7.80 per minute, this 1.67 seconds of production time cost the mill 21.7 cents. After figuring residue cost, a net loss of 16 cents resulted. Since

this mill cut 500 logs per day, its net loss was \$80.

The SIP program has shown that because of improper log lengths, on the average mills sustain a loss in recovery of 3-8% with the average about 4%.

Sawing Patterns.—Sawing lumber is basically a problem in geometry—that is, attempting to change circular or elliptical log shapes into primarily rectangular shapes. In all sawing processes, the location of the slabbing or opening face on both the log and the cant is the key to maximum lumber yield. Since the position of the first face establishes the position of all remaining faces, it has a major impact on the anticipated lumber yield. The smaller the log size, the greater the problem of finding the best pattern. Computerized control of the sawing process is one means by which the correct positioning of saw lines can be reliably accomplished.

Most computer programs for determining saw line positions take into account dry lumber size, planing allowance, shrinkage, sawing variation, wane, log taper, and sawkerf. It is humanly impossible to determine the best log breakdown pattern by mere observation. With the aid of a computer, many thousands of calculations can be made almost instantaneously and the best solution for lumber recovery determined.

For a computer to determine the best log breakdown pattern, it must be fed accurate information about the log.

For example, the diameter and length of the log, and in some cases, its shape. The advent of log scanners a number of years ago made this possible. The log scanner must be interfaced with a computer which can then accumulate, calculate, and store all pertinent log data until the operator calls for it. Once computations have been made, the log can then be positioned and the sawing process consummated.

Two things become apparent in applying computer technology to the sawing process. First, the system must have the ability to quickly and accurately compute or retrieve correct sawing solutions; and second, the system must be able to accurately carry out that solution. In sawing small logs, a mistake in saw line placement can be very costly. For example, missing one board in four (which is all some small logs contain), could mean a 25% loss in lumber recovery.

Summary

In general, sawmillers must deal with smaller and lower quality logs today than in the past. In the South there has been -approximately a 7% reduction in log size over the last nine years according to SIP study results. The SIP program has dramatically shown that making correct breakdown decisions can increase lumber recovery up to 30% or more with 15% being possible in many sawmills.

Reprinted from

SOUTHERN LUMBERMAN

issue of December, 1982.