



United States
Department of
Agriculture

Forest Service

Pacific Northwest
Research Station

General Technical
Report
PNW-GTR-544
April 2002



Lumber Recovery Studies of Alaska Sawmills, 1997 to 1999

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Abstract

Kilborn, Kenneth A. 2002. Lumber recovery studies of Alaska sawmills, 1997 to 1999. Gen. Tech. Rep. PNW-GTR-544. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 15 p.

This report looks at solid wood product recovery based on the results of 23 studies conducted from April 1997 to July 1999 of 22 sawmills in Alaska (during these years, these mills represented over 90 percent of the State's annual lumber production). Results for all mills studied within the State were reviewed for differences (1) in recovery by regions of the State, (2) in recovery by size of operation, or (3) by type of breakdown machinery. Two outstanding areas of opportunity to improve product recovery for nearly every sawmill within the State were reducing target thickness to eliminate oversizing and reducing sawing variation. There were no significant differences in product recovery when comparing studies by region, production level, or equipment type. Requirements of markets during these years were definite factors in sawmills producing oversized products. There was less thickness variation with bandsaw breakdown equipment than with circular saw breakdown equipment. Followup studies conducted at sawmills where improvements have been made would document the value of the improvements.

Keywords: Alaska, sawmill, lumber, product recovery, forest products.

Introduction

The sawmill industry in Alaska faces many economic barriers that act together to reduce its competitiveness. Several of these barriers (such as the high costs of utilities, road building, transportation, and labor) are beyond the control of the sawmill industry. There are, however, at least three areas of production and operation in which the sawmill industry can improve its competitive position: (1) delivered log costs, (2) recovery of saleable products per unit of log volume purchased, and (3) production of higher valued products from the delivered logs.

The emphasis of this report is recovery of saleable solid wood products per unit of log volume. The report has four goals: (1) Summarize statewide recovery study results; (2) Determine whether localized conditions across defined geographical areas of Alaska affect the recovery of saleable products. The major differences across regions of Alaska (southeast, interior, south central) that may influence recovery are availability, quality and quantity of timber resources, and size of and distance to markets; (3) Determine whether size of the sawmill operation has an effect on recovery—Does recovery increase with size and complexity of the operation? and (4) Determine the effect of different breakdown machines on recovery. Does a sawmill using bandsaws for both primary and secondary breakdown have the highest recovery, and does a sawmill using circular saws for both primary and secondary breakdown have the lowest recovery, or does a combination of types of saws work best for recovery?

Lumber Recovery Study

This type of lumber recovery study provides the sawmill with a measure of products that could be produced compared to those products that are being produced from a selected supply of straight, sound sawlogs with available equipment (Carino 1986, Dramm 1994). Recovery studies provide sawmill operators with excellent data to set up their own quality control programs (Dramm 1991) and are done in many sawmills outside of Alaska. There are also opportunities to set up log and log-handling quality control programs that should result in increased recovery of additional useful products from the timber harvested (Lunstrum 1981). Because dimension (nominal 2-inch) lumber was a major component of products produced in all studies, this was the thickness used for the comparison of the mills.

Twenty-three lumber recovery studies were conducted in Alaska at 22 sawmills from 1997 to 1999.¹ There are about 70 working sawmills in Alaska, but the 22 mills studied represent over 90 percent of the volume of the State's lumber production. The criteria for selecting sawmills to be studied were (1) an operation producing 250,000 board feet (MBF) of lumber or more per year, (2) interest in producing lumber for the Alaska market, and (3) interest in expanding or improving the operation. The names and locations of the individual mills will not be disclosed because confidentiality was assured when the studies were conducted.

¹ One sawmill operation included in the study replaced equipment with more efficient and automated machinery; therefore, a second study was conducted to address the improved efficiency and was considered a separate study.

The analysis showed that the average amount of usable products produced per unit of log in Alaska is lower than in most other areas of this country (Moore 1990, Wilcox 1976). Two reasons seem to account for this reduced recovery: (1) sawmills are producing products that are oversized when compared to standard products on the market, and (2) sawmills have more product-size variation in producing the products (Stern 1979). Oversizing consists of more thickness or width of product being allowed than is needed to compensate for reductions from shrinkage, variation, or planing. The oversized material usually ends up as planer shaving (White 1978). In some parts of the world, planer shaving has a high market value, but not currently so in Alaska. Product-size variation should be 0.030 inch or less, because more than 0.030-inch variation is indicative of problems in machine alignment, maintenance, or operation.

Procedures

A sample of logs was selected at each sawmill. The number of logs at each mill depended on several factors such as the size of logs, type of sawmill, and willingness of logyard personnel to sort and lay out logs to be safely measured. The total number of logs used in the 23 analyses was 1,666. The number of logs by region was 740 logs in southeast Alaska, 566 logs in interior Alaska, and 360 logs in south-central Alaska. Straightness and soundness of logs were important selection criteria, because the main purpose of the studies was to look at the ability of the sawmill to maximize production when the abilities of the machinery and operator were the principal factors. Logs with noticeable crook, sweep, and decay were not included in the studies because they add too many uncontrollable variables to the data being analyzed and can skew the realistic capabilities of the machinery.

The log analysis routine computer program used in these studies was developed by the USDA Forest Service, State and Private Forestry, at the Forest Products Laboratory in Madison, Wisconsin, as part of the IMPROVE system log processing program. Smalian's, Huber's, or Newton's formulas are used to estimate output of log volume in cubic feet, and Doyle, Scribner, Bureau Scribner, or International $\frac{1}{4}$ -inch and $\frac{1}{8}$ -inch rules are used to estimate board-foot log scale. This program is designed to help sawmill owners and operators collect, organize, and store information about logs. For the 23 studies in Alaska, volumes were determined by using Smalian's formula for cubic measure and by Scribner log scale for board-foot measure. The logs were numbered on both ends with crayons or paint to track them. Log lengths were measured in feet and inches. If slant bucking (not perpendicular with log surface) was present, the shortest length was the measurement recorded. Both small- and large-end diameters were measured inside the bark in inches and tenths of inches. If there was considerable swell on butt logs, an estimate was made as to where the normal taper of the log would have surfaced without the swell. Two measurements were taken of each end, the smallest diameter and one at right angles to the first measurement. This information was recorded on appropriate forms.

The sample logs were usually processed as a batch, although at a few mills, nonstudy logs were inadvertently mixed with the study logs, increasing the difficulty in tracking the material intended for the study. In determining where variation problems occurred and what machines caused them, it was important to record for each log which end was sawn first and which cuts of the log were sawn by which machine. It was also important to tell which was the top of the board when sawn. This information is needed to determine top-to-bottom and end-to-end variation.

All products produced from the study logs were tallied by nominal sizes used by the mill (such as 1 x 4s, 2 x 4s, 2 x 6s, etc.). Products also were tallied by lumber grade where the sawmill operator had an interest in knowing recovery by grade. From this information, lumber recovery factor (LRF) and percentage of overrun were determined. Lumber recovery factor is a unit of measure that relates nominal volume of lumber products in board feet produced for each cubic foot of log processed; LRF was used to compare the sawmills studied. In addition (because this is a number more recognized by many in the industry), sawmills were given overrun of log-scale figures for each study. The average LRF from these studies for the State of Alaska or for each region will be of little use to land managers who are looking for a conversion factor from log scale to amount of saleable product primarily for use in appraising timber. Because the study logs contained a minimum of decay, crook, and sweep, they should not be considered as a representative sample of logs used in actual production. The purpose of these studies was to see the potential of existing machinery to produce products; therefore, logs with a minimum of defect were used. Lumber recovery factor gives the sawmill a measure that is not greatly influenced by log diameter, cutting procedures, or the potential of what products could be produced compared to what products are being produced with available equipment. It is a good measure for comparing sawmills because LRF is not as related to log diameter as are most log rules, especially Scribner, for estimating lumber production.

Freese (1973) presents information on 68 different log rules used in the United States and Canada. The Scribner rule, published in 1846 when finished lumber sizes were different than in today's market, is the log rule used most often by the wood products industry and land managers in the Western United States and Alaska. When using a log rule such as Scribner, the sawmill operator wants to know how the yield of products compares to the scale of the log rule. The relation of yield of products produced to net scale of log rule is called overrun or underrun and is expressed as a percentage of the log scale. It is not uncommon with today's technology, machinery, and reduced dimension of finished lumber to have an overrun of 100 percent (production of twice the volume of products that the log rule predicted).

The lumber product size analysis routine computer program used in these studies was developed by the USDA Forest Service, State and Private Forestry, at the Forest Products Laboratory as part of the IMPROVE system lumber manufacturing program. This program helps assess the performance of any breakdown system that determines size and dimension in a product. A sample of each product of each thickness and width produced was measured for each study and for each breakdown machine within each study to look for causes of variation. Fifteen measurements of each sample board were taken with dial calipers to the nearest 0.01 inch. Five measurements were taken on the top edge at 1 foot from lead end, at one-third length, at midlength, at two-thirds length, and at 1 foot from tail end. Five measurements were taken on the bottom edge at these same lengths, and five measurements were taken for widths at these same length locations. Analysis of these measurements gave a good indication of within-piece variation, between-piece variation, top-to-bottom variation, and end-to-end variation. This information is helpful in determining what machinery needs to be adjusted to minimize causes of variation.

Statewide Sawmill Recovery Analysis

Reports were provided to each sawmill, including measurements of all study logs, LRF, and overrun figures for the sawmill (figs. 1 and 2). Major parts of each report were the measurements for each board sampled and the analysis of variation between these measurements. Recommendations were made about problems found and what could be done to correct them. It is not uncommon for many sawmills with high production outputs to check for these problems on a daily or weekly basis.

The size of the 22 sawmills studied differed greatly from annual production of about 250 MBF per year to about 15 million board feet (MMBF) per year. The number of logs per study ranged (in relation to the size of operation) from 23 to over 300 logs. The logs for each study ranged in average size from 8 to 27 inches small-end diameter with average lengths of 8 to 20 feet. Lumber recovery factor for the 23 studies ranged from 4.8 to 10.05 board feet of production per cubic-foot log input. The average LRF for the total volume processed was 6.38. This is below the average of mills studied in the rest of the United States (Lunstrum 1981). Overrun of the Alaska studies ranged from negative 12 percent to 110.5 percent, and the average overrun for the total volume processed was 18 percent.

The analysis shows that the average amount of usable products produced per unit of log volume in Alaska is lower than in most other areas of this country. Two reasons seem to account for this reduced recovery: (1) sawmills are producing products that are oversized when compared to standard products on the market, and (2) sawmills have a greater amount of product-size variation in producing the products. Oversizing consists of more thickness or width of product being allowed than is needed to compensate for reductions from shrinkage, sawing variation, or planing. The oversized material usually ends up as planer shaving. In some parts of the world, planer shaving can have a high market value, but not currently so in Alaska. Product-size variation should be 0.030 inch or less, because variation of more than 0.030 inch indicates problems in machine alignment, maintenance, or operation.

Improvements in lumber recovery can be achieved by eliminating oversizing and reducing variation to standards that have been set by the industry, both of which can be accomplished without incurring great costs. Reducing variation can be accomplished by proper alignment of the sawmill and tightening up areas where adjustments are made. At 18 of the 23 mills studied, oversizing was a problem. In four of the studies, the lumber was sawn too thin, and when dried and surfaced, would not make the 1.5-inch minimum needed for grading as construction lumber. For every 0.030-inch reduction in product thickness, 2.5 percent of additional recovery can be produced. In 17 of the 23 sawmills, lumber variation exceeded 0.030 inch (which is a realistic industry goal). The three most efficient sawmills in Alaska had total variation at 0.020 inch or below (figs. 3, 4, and 5).

If the sawmills in Alaska could obtain an average LRF of 7.75 (the national average in 1979), there would be a 21.5-percent increase in product recovery or a reduction of 21.5 percent of log input to produce the same volume of products currently being produced. A conservative estimated LRF for modern sawmills in the Pacific Northwest in 2000 is 9.0 (Lunstrum 1981). If Alaska sawmills could become even more efficient, achieving an LRF of 9.0 would mean an increase of 41 percent of additional products or 41 percent fewer logs harvested to maintain the same level of production.

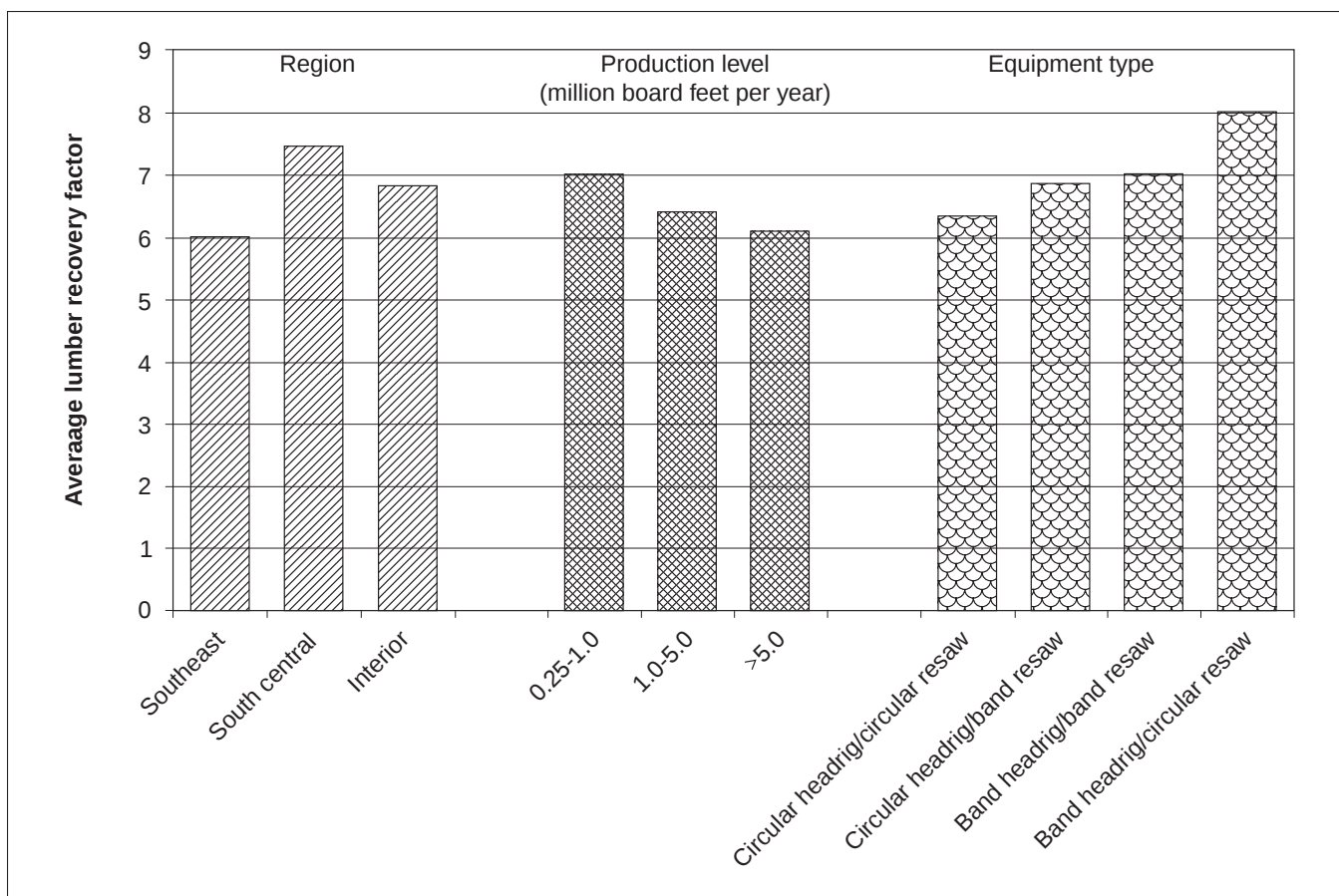


Figure 1—Lumber recovery factor for Alaska sawmills by size of mill, region of state, and equipment type.

Regional Sawmill Recovery Analysis

The region referred to as southeast Alaska consists of lands near the Tongass National Forest from Yakutat to Metlakatla. The region referred to as south-central Alaska is the area south and east of the Alaska Range ending at Icy Bay on the east side. The region referred to as interior Alaska includes those lands north and west of the Alaska Range.

Southeast Region

Seven sawmills were analyzed in this region. The size of these operations ranged from about 250 MBF per year to about 15 MMBF per year. The number of sawlogs per study ranged from 23 to over 300 logs. The average size of logs for each study ranged from 8 to 27 inches small-end diameter with average lengths of 13 to 20 feet. Lumber recovery factor for the seven studies ranged from 5.5 to 7.02. The average LRF for this region was 6.02. For this region, the range of overrun, with Scribner scale, was from negative 12 to 55 percent, with an average overrun of 12 percent.

Oversizing of thickness of boards could be greatly reduced at three of the mills if dried, planed, and graded construction lumber was the final product. There seems to be at least three reasons why oversizing is occurring: (1) the present market is requesting oversized material although it may not need the extra wood and usually is not paying a premium for the oversized product, (2) Shop and millwork buyers often

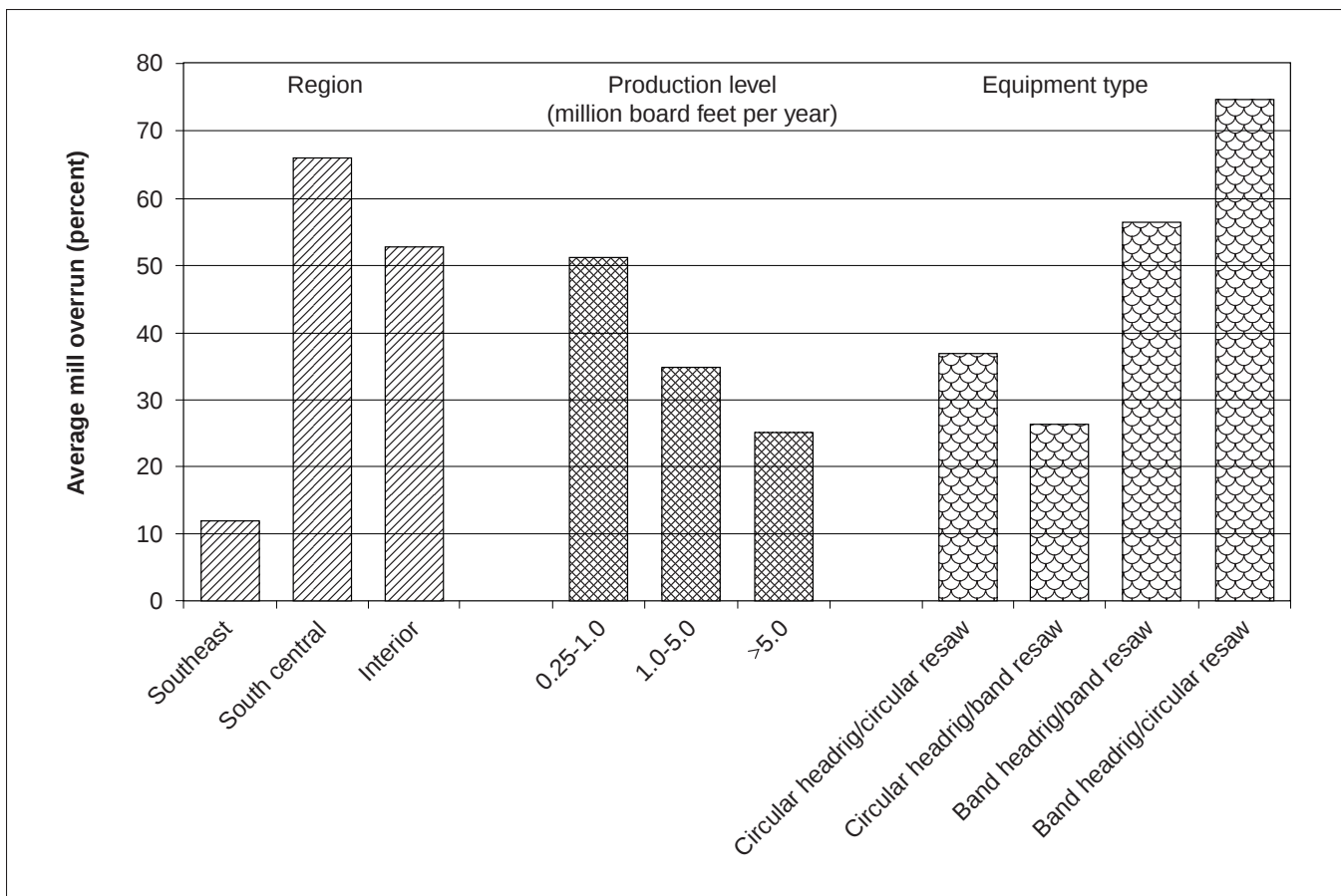


Figure 2—Mill overrun for Alaska sawmills by size of mill, region of state, and equipment type.

need oversized material and are willing to pay a premium price, and (3) some sawmill operators believe that it is best to produce thicker products because operators have been criticized in the past for lumber that did not plane to standard thickness without skip. Planer skip on the surfaces of lumber can reduce this piece to a lower lumber grade. Total thickness variation exceeded the industry standard of 0.030 inch at five of the seven mills with the regional average at 0.051 inch and a range from 0.020 to 0.079 inch. This variation can be lowered with proper alignment and maintenance of machinery.

If sawmills in the southeast region could obtain an average LRF of 7.75, there would be an increase of 28.7 percent in product recovery or a reduction of 28.7 percent log input to produce the same volume of products. If southeast Alaska sawmills could achieve the Pacific Northwest LRF of 9.0, this would be an increase in recovery of 49.5 percent. Given the current shortage of sawlogs, getting an additional 49.5 percent of saleable products without increasing log supply or meeting the current production with a reduced log input should be of interest to the industry.

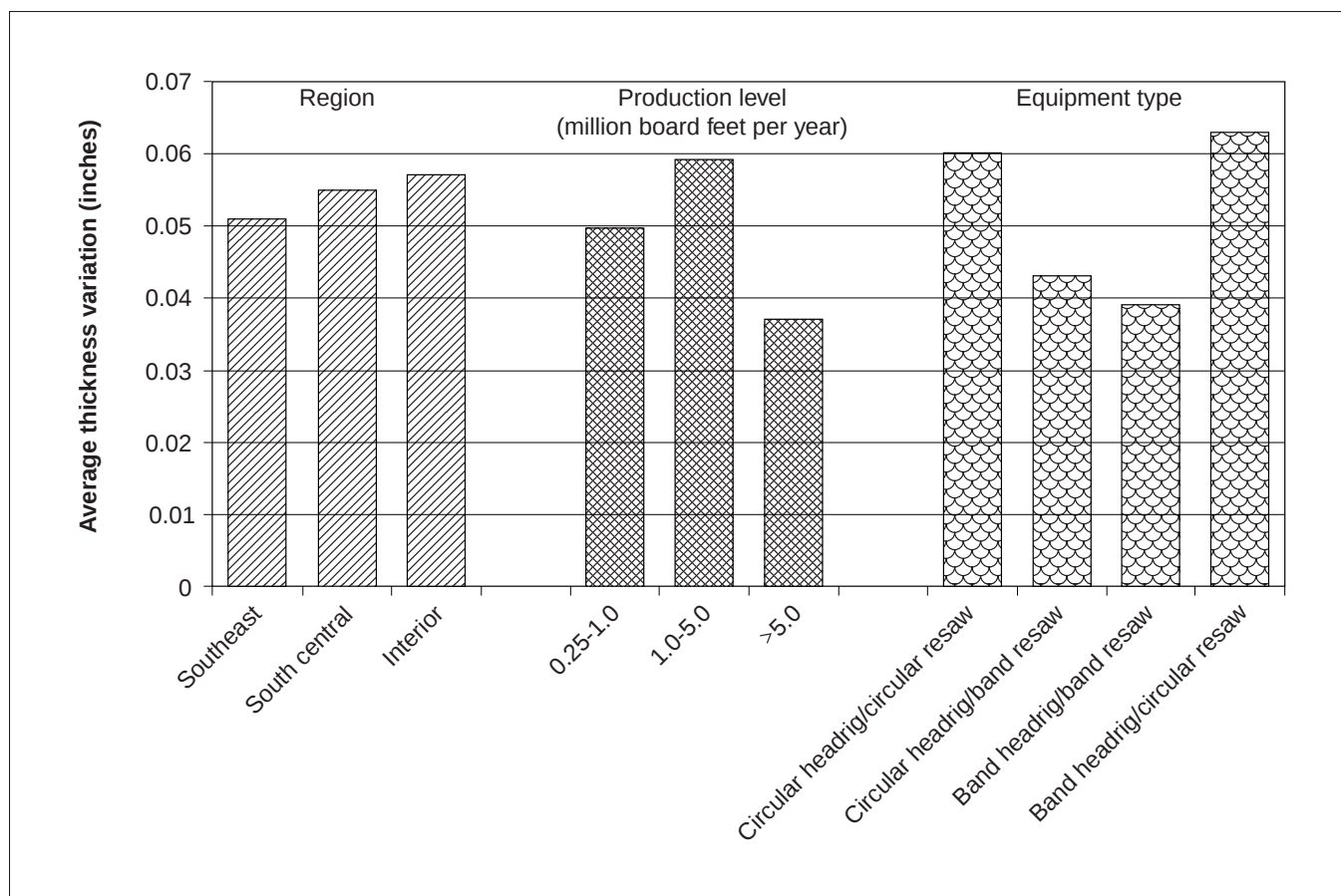


Figure 3—Thickness variation for Alaska sawmills by size of mill, region of state, and equipment type.

South-Central Region

Six sawmills were analyzed in this region. The size of these operations ranged from about 250 MBF to about 8 MMBF per year. The number of sawlogs per study ranged from 49 to 79. The average size of logs per study ranged from 8 to 11 inches small-end diameter, with average lengths of 8 to 15 feet. Lumber recovery factors for the six studies ranged from 6.56 to 10.01, and the average LRF for the region was 7.47. The overrun for Scribner scale for the region was from 42 to 110.5 percent, with an average overrun of 65.9 percent. The sawmill with the lowest overrun from Scribner scale did not have the lowest LRF. This points out the problem of comparing sawmills by using overrun calculations versus LRF. Lumber recovery factor is a more accurate measure to compare sawmills but is not readily used by the industry.

Oversizing of thickness of boards could be reduced at five of the mills because construction lumber was the final product. Total thickness variation exceeded the industry standard of 0.030 inch at three of the six mills. This region's average thickness variation was 0.055 inch with a range from 0.012 to 0.121 inch.

If sawmills in the south-central region could obtain an average LRF of 7.75, there would be a 3.7-percent increase in product recovery or a 3.7-percent reduction of log input to produce the same volume of products. Achieving the LRF of many sawmills

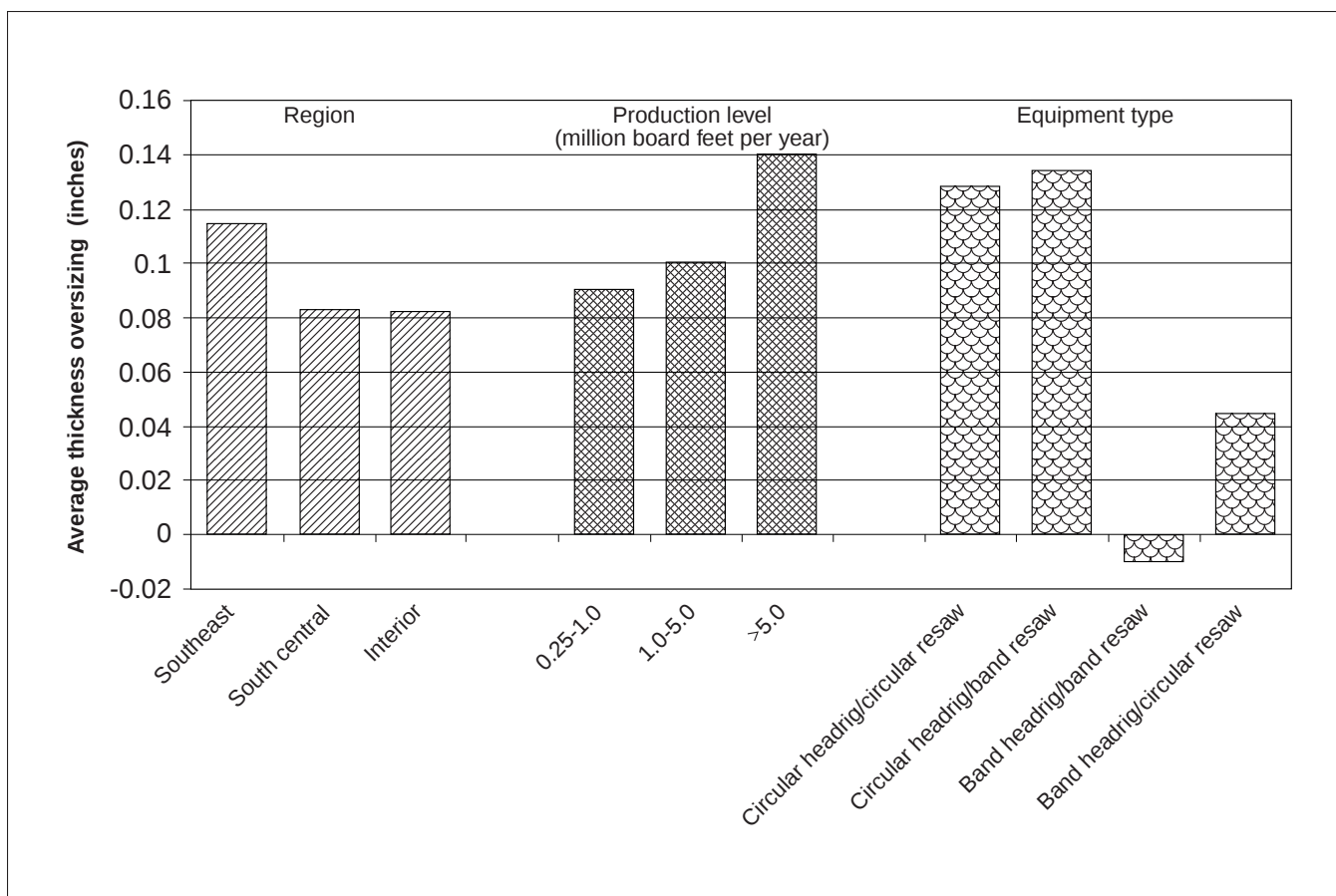


Figure 4—Oversizing of thickness in Alaska sawmills by size of mill, region of state, and equipment type.

in the Pacific Northwest, which is estimated to be near 9.0, would mean an increase in recovery of 20.5 percent. Reducing target sizes and total variation can gain much of the potential recovery, but this would require that alignment and adjustments be corrected and maintained on all machine centers.

Interior Region

Ten sawmills were analyzed in this region. The size of these operations ranged from about 250 MBF per year to nearly 2.5 MMBF per year. The number of sawlogs per study ranged from 26 to 100. The average size of logs for each study ranged from 8 to 12 inches small-end diameter, with average lengths of 10 to 18 feet. Lumber recovery factors for the 10 studies ranged from 4.8 to 10.05, and the average LRF for the region was 6.83. The range of overrun for this region, with Scribner scale, was from 25 to 103 percent, with an average overrun of 52.7 percent.

Oversizing of thickness of boards could be reduced at seven of the mills because construction lumber (dried, planed, and graded) was the final product. Total thickness variation exceeded the industry standard of 0.030 inch in 9 of the 10 studies. The region's average variation was 0.057 inch with a range from 0.025 to 0.121 inch. The mill with the total variation of 0.121 inch could increase its recovery by 7.5 percent by just reducing the variation to the industry standard.

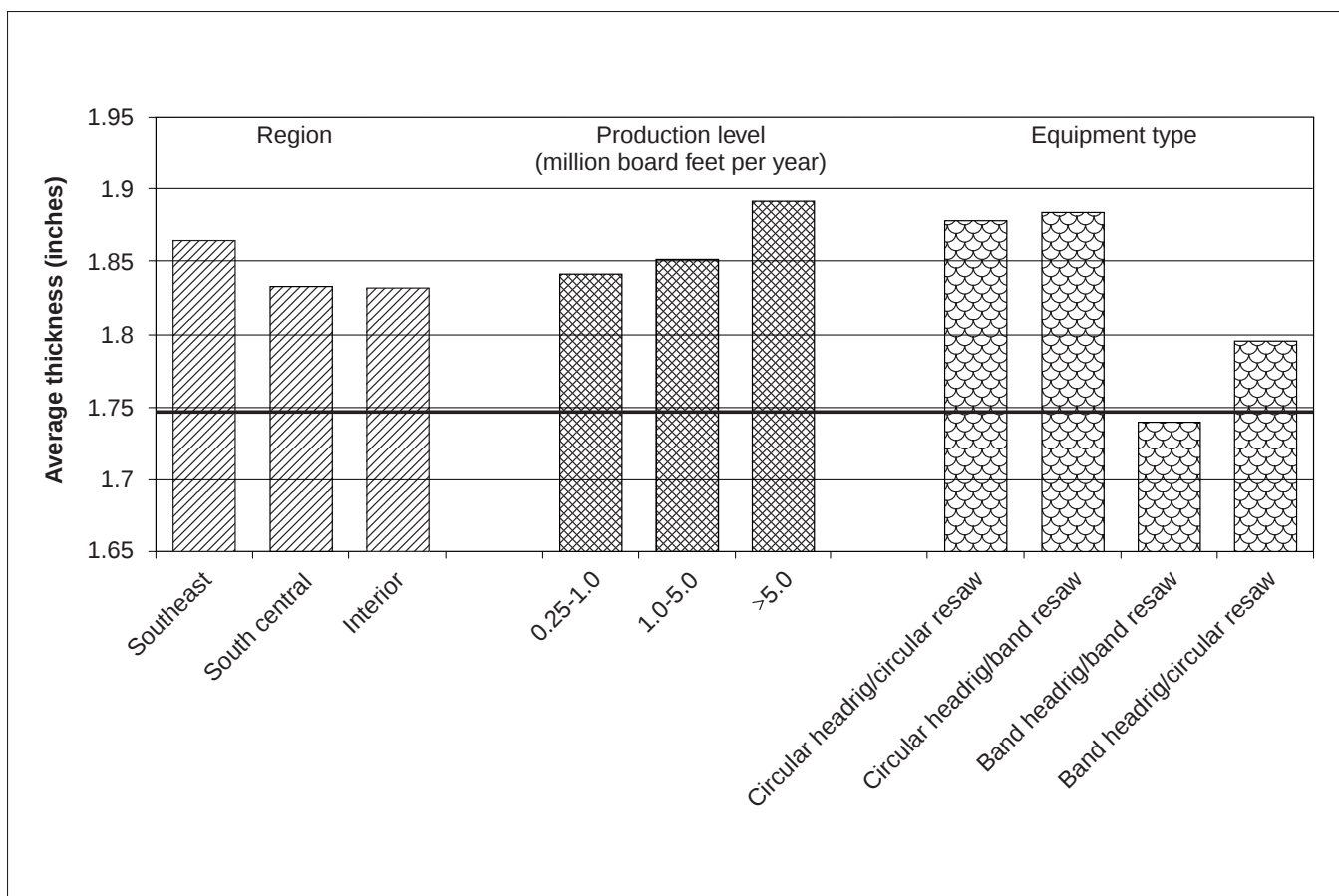


Figure 5—Average thickness of 2-inch lumber from Alaska sawmills by size of mill, region of state, and equipment type. Heavy line refers to maximum thickness needed to produce dimension lumber (nominal 2 inches).

If the interior region sawmills could obtain an average LRF of 7.75, there would be a 13.5-percent increase in product recovery or a 13.5-percent reduction of log input to produce the same volume of products. Reaching the LRF of many sawmills in the Pacific Northwest, which is estimated to be near 9.0, would result in an increase in recovery of 31.8 percent. Reducing target sizes and total variation, both of which can be reduced without substantial additional costs to the operation, can achieve much of the potential product recovery.

Recovery Analysis by Level of Sawmill Production

Alaska has many small sawmills that operate on a part-time or seasonal basis. No mills in this category were studied. Mills that are in business for most of the year and are trying to improve their output of products are usually producing 250 MBF or more per year. Sawmills that exceed the 1 MMBF production size usually have been in business for many years and have invested in higher quality equipment. The major markets for mills producing up to 5 MMBF per year are within the State of Alaska. Some higher grade materials are shipped to secondary processing mills in Washington and Oregon.

**Sawmills with Annual
Production Between
250 and 1,000 MBF**

Fifteen of the sawmills analyzed in Alaska were in the smallest of the three production classes. The number of sawlogs processed per study ranged from 23 to 100. The sawlogs for each study ranged in size from 8 to 16.5 inches small-end diameter, and lengths ranged from 10 to 20 feet. Lumber recovery factors for the 15 studies ranged from 4.8 to 10.05, and the average LRF for this size operation was 7.01. The range of overrun for this size operation was from zero to 110.5 percent with an average of 51 percent.

Oversizing of thickness of boards could be reduced at 10 of these sawmills, because dried, planed, and graded construction lumber was the final product. Total thickness variation exceeded the industry standard of 0.030 inch on 12 of the 15 studies. The average variation for this size of mill was 0.0495 inch with a range from 0.019 to 0.121 inch.

If this size of sawmill operation could obtain an average LRF of 7.75, there would be a 10.6-percent improvement in recovery, and if the Pacific Northwest LRF of 9.0 could be achieved, the improvement would be 28.4 percent. Technically, this is possible with the equipment in use.

**Sawmills with Annual
Production from 1 to 5
MMBF**

Four of the sawmills analyzed were in this size classification. The number of sawlogs per study ranged from 49 to 110. The sawlogs for each study ranged in average size from 8 to 27 inches small-end diameter and average lengths from 8 to 16 feet. Lumber recovery factors for the four studies ranged from 5.67 to 6.87, and the average LRF for this size of mill was 6.4. The range of overrun, with the Scribner scale, for this size of operation was from negative 12 to 65.7 percent with the average overrun per study at 34.7 percent.

Oversizing of thickness of boards could be reduced at three of these sawmills. One of these three is producing for a market that is requiring oversizing; unless this market can be convinced to accept a reduced target, this mill may be limited in how much it can reduce the thickness. Total thickness variation exceeded the industry standard of 0.030 inch on three of the four studies. The average variation for this size of mill was 0.059 inch with a range from 0.012 to 0.085 inch.

If this size of sawmill operation could obtain an average LRF of 7.75, there would be a 21-percent improvement in recovery, and if the Pacific Northwest LRF of 9.0 could be achieved, the improvement would be 40.6 percent.

**Sawmills with Annual
Production Over 5
MMBF**

Four of the sawmills analyzed were in this classification. The number of sawlogs per study ranged from 50 to over 300. The sawlogs ranged in average size from 8 to 24 inches small-end diameter and average length from 14 to 16 feet. Lumber recovery factors for the four studies ranged from 5.26 to 6.86, and the average for this size classification was 6.09. The range of overrun, with the Scribner scale, for this size classification was from negative 8 to 55 percent with the average overrun per study at 25 percent.

Oversizing of thickness of boards could be reduced at two of these mills. One mill is producing for a market that is requiring oversizing; this mill may be limited in thickness reduction. Total thickness variation exceeded the industry standard of 0.030 inch at two of the four studies. The average variation for this size classification of sawmills was 0.037 inch with a range from 0.020 to 0.055 inch.

Sawmill Recovery Analysis by Production Equipment Classifications

Sawmills with Circular Headrig and Circular Resaw

The improvement of product recovery in this size classification of sawmills would have the greatest overall effect for the State of Alaska because these mills represent 78.7 percent of production of the 23 sawmills studied. If this size classification could obtain an average LRF of 7.75 (U.S. industry average in 1979), there would be a 27-percent improvement in recovery. If a Pacific Northwest LRF, estimated to be 9.0, could be achieved, the improvement would be 48 percent. This would result in a reduction of 48 percent fewer sawlogs needed to achieve the same current production or 48 percent more products from the same volume of sawlogs (fig. 1).

The primary and secondary breakdown equipment of sawmills is either circular saws or bandsaws, or a combination of the two. This analysis was undertaken to see the results of these combinations as it affected lumber recovery.

Thirteen of the sawmills analyzed had this type of breakdown equipment. The regional distribution of this type of equipment was as follows: two in south-central Alaska, three in southeast Alaska, and eight in interior Alaska. The size of production of the sawmills in this classification ranged from 250 to 2,500 MBF. The number of sawlogs per study ranged from 23 to 100. The average size of sawlogs for each study ranged from 8 to 27 inches small-end diameter and average lengths from 8 to 18 feet. Lumber recovery factor for the 13 studies ranged from 4.8 to 7.27, and the average LRF for this classification was 6.34. The range of overrun for sawmills in this classification, with Scribner scale, was from negative 12 to 66 percent with the average at 36.7 percent.

Oversizing of thickness of boards could be reduced at 11 of these sawmills, as construction lumber to be dried, planed, and graded was the final product. Total thickness variation exceeded the industry standard of 0.030 inch in 11 of the 13 studies. The average variation for this classification of sawmills was 0.060 inch with a range from 0.012 to 0.121 inch.

If this classification of sawmill operation could obtain an average LRF of 7.75, there would be a 22-percent improvement in recovery. If the Pacific Northwest LRF, which is estimated to be 9.0, could be achieved, the improvement would be 42 percent in additional products or a 42-percent reduction in sawlogs to make the current volume of products.

Sawmills with Circular Headrig and Band Resaw

Three of the sawmills analyzed had this equipment configuration. The number of sawlogs ranged from 52 to 80. The study sawlogs ranged in average size from 8 to 24 inches small-end diameter, and average lengths ranged from 14 to 20 feet. Lumber recovery factor for the three studies ranged from 6.75 to 7.02; the average for this classification was 6.87. The range of overrun, with Scribner scale, was from negative 8 to 64 percent with the average overrun per study at 26.3 percent.

Oversizing was a problem at two of these mills, and total variation exceeded the sawmill industry standard of 0.030 inch at two of these mills. The average variation for this classification of sawmill was 0.043 inch with a range from 0.025 to 0.060 inch.

If this classification of sawmill could obtain an average LRF of 7.75, there would be a 12.8-percent improvement in recovery, and if the estimated average LRF for the Pacific Northwest of 9.0 could be achieved, the improvement would be 31 percent.

Sawmills with Band Headrigs and Band Resaws

Four of the sawmills analyzed had this equipment configuration. The number of sawlogs per study ranged from 50 to over 300. The study sawlogs ranged in average size from 8 to 13.7 inches small-end diameter and in average length from 10 to 14 feet. Lumber recovery factor for the four studies ranged from 5.5 to 10.01; the average for this classification was 7.02. The range of overrun, with Scribner scale, was from 12 to 110.5 percent with the average overrun per study at 56.4 percent.

Oversizing was a problem at only one of these mills, and variation in excess of the sawmill industry standard of 0.030 inch only occurred at two mills. The average variation for this classification of sawmill was 0.039 inch with a range from 0.019 to 0.064 inch.

If this classification of sawmill operation could obtain an average LRF of 7.75, there would be a 10.4-percent improvement in recovery. If the Pacific Northwest average LRF (9.0) could be achieved, the increase in recovery would be 28.2 percent.

Sawmills with Band Headrig and Circular Resaw

Three of the sawmills analyzed were in this classification. The number of sawlogs ranged from 50 to 79. The study sawlogs ranged in average size from 8 to 10.6 inches small-end diameter and in average length from 10 to 15 feet. Lumber recovery factor for the three studies ranged from 6.86 to 10.05; the average LRF for this classification was 8.02, which is greater than the U.S. sawmill industry average in 1979. The range of overrun, with Scribner scale, was from 42 to 103 percent with the average for the three studies at 74.7 percent.

Oversizing and total variation were problems at two of these mills. The average total variation of the three mills was 0.063 inch with a range from 0.028 to 0.121 inch. It seems possible these three mills could achieve the estimated LRF average of the Pacific Northwest sawmills of 9.0. This accomplishment would be an improvement of 12 percent in additional products from the same log volume, or the current log volume could be reduced 12 percent and still produce the same amount of products (fig. 6).

Conclusions and Inferences

The 23 sawmill recovery studies conducted from 1997 to 1999 were a snapshot-in-time of these operations. Results of these studies indicate there is no correlation of the factors of the four goals except, on the average, sawmills with bandsaw headrigs have higher recovery than sawmills with circular saw headrigs (fig. 1). Improvement is needed in recovery in nearly all of Alaska's operating sawmills. This is important considering timber supply constraints and the economic barriers in Alaska.

Several changes have been made at many of these sawmills in the last 4 years. Changes at one operation were made before the study was completed. It would be of interest to the Alaska sawmill industry to conduct followup studies to document the increase in recovery brought on by improvements of the mills.

Our objective in reviewing the reports from the 23 studies was to answer questions about the differences in recovery owing to mill location, size, or equipment used. There was no significant difference in LRF when viewing studies by region, production level, or equipment type, although one would think there was when looking at the mill overrun (fig. 2). The mill overrun numbers point out the problems of using overrun to compare sawmills and show how differences in average log size can affect the accuracy of a log scale.

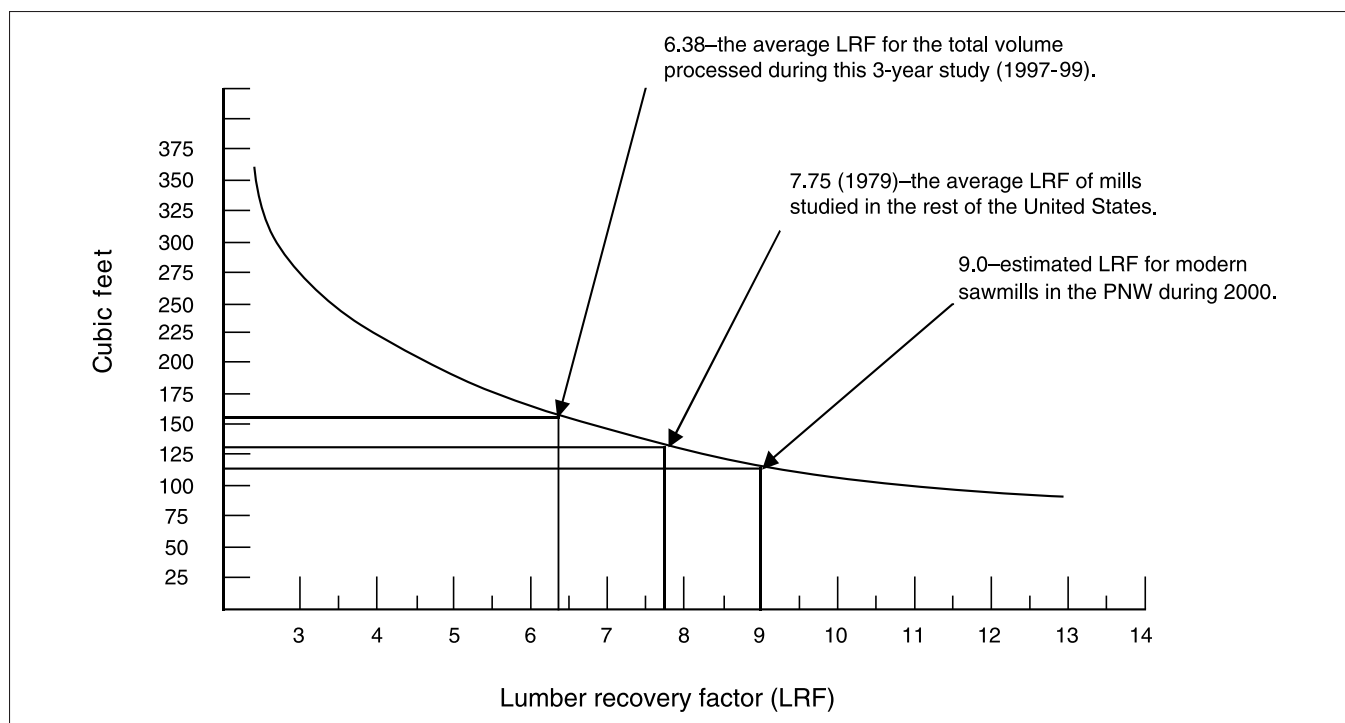


Figure 6—Cubic volume of logs required to produce 1,000 board feet of lumber.

The lower-than-expected LRF in the southeast region seems to be due to the requirement of the present markets for thicker material than is typically required for construction lumber. The sawmills in this region can still reduce sawing variation, even though it was the lowest average of the three regions, and this reduction will improve their recovery and still meet the needs of the current market.

The higher lumber recovery occurred when band headrigs were used for log breakdown and was probably related to the thinner kerf of bandsaws. The highest average recovery of the mills studied occurred when the operation used a band headrig and a circular saw resaw. There were only three operations in this category, and two were in the 0.25- to 1-MMBF production level. At the third mill, the circular blades in the resaw were thin in comparison to many circular resaw operations. Usually one would expect the highest recovery when using bandsaw headrigs and bandsaw resaws. There are usually several reasons why mills are using circular saws and not bandsaws. Bandsaw operations can be more expensive, in both equipment purchase and equipment maintenance costs.

Many of the improvements needed could be achieved inexpensively. The two outstanding areas of opportunity are in reducing target thickness to eliminate oversizing and reducing sawing variation by being more aggressive in maintenance and checking sawmill alignment more frequently. Setting up a quality control program for their operations, even if on a weekly or monthly basis, would likely result in improved recovery.

Acknowledgments

I thank the sawmill owners and operators who allowed their mill operations to be studied. Paul and Adam Kilborn; and Dan Parrent, Juneau Economic Development Council, assisted with data collection. Lynda Kilborn entered data to complete these studies. I also thank Dan Parrent; John “Rusty” Dramm, Forest Products Laboratory; and Eini Lowell, Pacific Northwest Research Station for reviewing the paper.

Much support and assistance was given by the Wood Utilization Research and Development Center team in Sitka. Bridget Kauffman helped with suggestions, editing, and formatting; Pete Tsournos and David Nicholls with suggestions and editing; and Linda Christian with suggestions.

English Equivalents

When you know:	Multiply by:	To find:
Centimeters (cm)	0.39	Inches
Meters (m)	3.28	Feet
Square meters (m ²)	1.20	Square yards
Kilograms (kg)	2.21	Pounds
Grams (g)	0.035	Ounces
Hectares (ha)	2.47	Acres
Kilograms per hectare (kg/ha)	0.89	Pounds per acre
Liters (L)	1.057	Quarts
Celsius (°C)	1.8 and add 32	Fahrenheit

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