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# RESEARCH NOTES

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## PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION

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### THE YIELD OF DOUGLAS-FIR IN THE PACIFIC NORTHWEST MEASURED BY INTERNATIONAL $\frac{1}{4}$ -INCH KERF LOG RULE

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The International log rule is little used in the Douglas-fir region today, but it is likely to find wider use here in the future. This is the opinion of a number of foresters preparing plans for the management of forest properties in the region. Advantage of the International  $\frac{1}{4}$ -inch kerf log rule is that log scale by this measure approximates the volume of green lumber recovered by sawmills of average efficiency and cutting a normal mill-run of lumber sizes.

One of the standards of measurement recommended by the West Coast Forestry Procedures Committee for compilation of second-growth Douglas-fir inventory, growth, and depletion data includes volumes of trees in the 12-inch d.b.h. class and larger to an 8-inch top log diameter inside bark expressed in International  $\frac{1}{4}$ -inch kerf log rule. Accordingly, to fill this need the present table 1 has been compiled. Volumes shown are for normal stands on a fully stocked acre basis. Obviously, understocked areas support correspondingly lower volumes.

Table 1 was derived by adjustment of table 4, page 27, of U. S. Dept. Agric. Tech. Bul. 201, "The Yield of Douglas Fir in the Pacific Northwest," by Richard E. McArdle and Walter H. Meyer, October 1930, which gives volumes by the Scribner rule for trees 12 inches and larger to an 8-inch top, scaled in 16-foot logs. Adjustment factors relating volumes by International  $\frac{1}{4}$ -inch kerf rule to those by Scribner were

<sup>1/</sup> Full credit is given to Mrs. Edgel Skinner, Statistical Clerk, for the analysis of data used in the preparation of this Note.

correlated to average tree d.b.h. through the use of second-growth Douglas-fir taper tables. Scribner volumes on page 25 of Bulletin 201 were multiplied by factors corresponding to diameter of average tree, given in table 4, page 25, of that bulletin. The resulting products appear in table 1 attached. This table was checked by applying separate adjustment factors to trees in each diameter class in the stand tables of basic plots used in the construction of Bulletin 201. There was no significant difference between the result so obtained and that given in table 1.

The International  $\frac{1}{4}$ -inch kerf rule shows a log scale from 5 to 21 percent greater than does the Scribner, depending on tree size. See table 2 which shows, by average tree diameter, the adjustment factors used to transform Scribner to International scale. The greatest difference between scales by the two rules is found in stands with the smallest trees; differences in second growth of advanced age on the better sites are smaller. For 100-year-old timber on average site III (indicated age of maximum mean annual increment), the International gives a scale 12 percent higher than does the Scribner.

#### Does International Scale Equal Lumber Tally?

Answers to this question vary, depending on efficiency of manufacture, sizes of lumber cut, and, to an extent, on log size. In a study carried on last year at four small mills cutting second-growth Douglas-fir in western Washington, green lumber recovery underran International  $\frac{1}{4}$ -inch scale of logs, on the average, by 5 percent; it overran Scribner scale by 5 percent. The 332 logs in this test were all 16 feet long; they ranged from 8 to 24 inches in diameter. Incidentally, lumber recovery from the 8-inch logs overran International scale by 11 percent. Most of these were top logs in which taper exceeded the  $\frac{1}{2}$ -inch per 4-foot section allowed by the International rule. All of the four mills were equipped with circular saws. One was a highly portable mill, two were semi-portable, and the fourth a stationary mill. All had edgers except the portable mill. Principal products cut were dimension and small timbers. Utilization was not as good as the average in better-equipped mills.

One of the principal sources of overrun of lumber cut in comparison to Scribner log scale arises from the practice of scaling logs without making taper allowance. The length in which logs are scaled has relatively little influence on overrun when using the International rule, because of the taper allowance this rule provides.

Table 1.--Yield of Douglas-fir on a fully stocked acre, trees 12 inches in diameter and larger to an 8-inch top, yield in board feet, International rule ( $\frac{1}{2}$ -inch kerf)<sup>1/</sup>

| Age<br>(yrs.) | Site class V        |                     | Site class IV        |                      |                      | Site class III       |                      |                      | Site class II        |                      |                      | Site class I         |                      |                      |
|---------------|---------------------|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|               | Site<br>index<br>80 | Site<br>index<br>90 | Site<br>index<br>100 | Site<br>index<br>110 | Site<br>index<br>120 | Site<br>index<br>130 | Site<br>index<br>140 | Site<br>index<br>150 | Site<br>index<br>160 | Site<br>index<br>170 | Site<br>index<br>180 | Site<br>index<br>190 | Site<br>index<br>200 | Site<br>index<br>210 |
| 30            | --                  | --                  | --                   | --                   | --                   | --                   | 400                  | 1,100                | 1,800                | 3,100                | 4,800                | 7,100                | 9,500                | 12,400               |
| 40            | --                  | --                  | --                   | 200                  | 1,400                | 3,100                | 5,400                | 7,700                | 10,600               | 14,000               | 18,200               | 22,900               | 28,300               | 33,800               |
| 50            | 40                  | 200                 | 1,900                | 3,900                | 6,500                | 9,900                | 14,600               | 20,000               | 26,000               | 31,800               | 37,700               | 43,900               | 50,100               | 56,400               |
| 60            | 1,300               | 3,100               | 5,700                | 9,600                | 14,700               | 21,100               | 27,000               | 34,300               | 41,700               | 49,000               | 56,000               | 63,100               | 69,300               | 75,700               |
| 70            | 2,900               | 6,300               | 10,600               | 16,500               | 24,100               | 32,400               | 40,600               | 48,700               | 57,000               | 64,600               | 72,500               | 79,600               | 86,400               | 93,300               |
| 80            | 5,200               | 10,200              | 16,300               | 23,500               | 33,100               | 42,600               | 52,200               | 61,600               | 70,000               | 78,400               | 86,700               | 94,200               | 101,500              | 108,600              |
| 90            | 8,200               | 14,100              | 21,800               | 30,200               | 41,000               | 51,600               | 62,300               | 72,100               | 81,500               | 89,900               | 98,400               | 106,600              | 114,100              | 121,400              |
| 100           | 11,300              | 18,000              | 26,500               | 36,200               | 48,000               | 59,400               | 70,600               | 80,900               | 90,800               | 99,800               | 108,500              | 116,700              | 124,500              | 132,100              |
| 110           | 14,300              | 22,000              | 30,900               | 41,600               | 54,000               | 65,900               | 77,600               | 88,200               | 98,500               | 107,900              | 116,800              | 124,900              | 133,200              | 140,300              |
| 120           | 17,200              | 25,300              | 35,000               | 46,400               | 59,200               | 71,600               | 83,500               | 94,600               | 105,000              | 115,000              | 124,000              | 132,200              | 140,500              | 147,900              |
| 130           | 19,800              | 28,400              | 38,700               | 50,700               | 63,800               | 76,700               | 88,600               | 100,300              | 110,800              | 121,000              | 129,800              | 138,600              | 147,100              | 154,900              |
| 140           | 22,300              | 31,300              | 42,000               | 54,600               | 67,900               | 81,100               | 93,300               | 105,300              | 116,000              | 126,200              | 135,300              | 144,000              | 152,700              | 160,800              |
| 150           | 24,700              | 33,900              | 45,100               | 58,200               | 71,400               | 84,900               | 97,500               | 109,800              | 120,800              | 131,000              | 140,500              | 149,000              | 157,800              | 166,000              |
| 160           | 26,900              | 36,500              | 47,800               | 61,300               | 74,700               | 88,500               | 101,500              | 113,900              | 125,200              | 135,500              | 145,000              | 153,600              | 162,400              | 170,100              |

<sup>1/</sup> Derived by adjustment of Scribner volumes in table 4, page 27, of U. S. Dept. Agric. Tech. Bul. 201, "The yield of Douglas Fir in the Pacific Northwest," by Richard E. McArdle and Walter H. Meyer, October 1930.

Table 2.--Relationship of scale by International  $\frac{1}{4}$ -  
inch kerf rule to Scribner rule scale,<sup>1/</sup>  
by average diameter class

| <u>Diameter at</u><br><u>breast height,</u><br><u>average tree</u><br><u>Inches</u> | <u>Relationship of scale</u><br><u>by International <math>\frac{1}{4}</math>-inch</u><br><u>to Scribner scale</u><br><u>Percent</u> |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| 12                                                                                  | 120.7                                                                                                                               |
| 14                                                                                  | 117.7                                                                                                                               |
| 16                                                                                  | 114.7                                                                                                                               |
| 18                                                                                  | 112.8                                                                                                                               |
| 20                                                                                  | 111.3                                                                                                                               |
| 22                                                                                  | 110.3                                                                                                                               |
| 24                                                                                  | 109.5                                                                                                                               |
| 26                                                                                  | 108.7                                                                                                                               |
| 28                                                                                  | 108.1                                                                                                                               |
| 30                                                                                  | 107.5                                                                                                                               |
| 32                                                                                  | 106.9                                                                                                                               |
| 34                                                                                  | 106.4                                                                                                                               |
| 36                                                                                  | 106.0                                                                                                                               |
| 38                                                                                  | 105.7                                                                                                                               |
| 40                                                                                  | 105.0                                                                                                                               |

<sup>1/</sup> Logs scaled in 16-foot lengths to 8-inch top.