RESIN DISTRIBUTION IN SECOND-GROWTH PONDEROSA PINE

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RESIN DISTRIBUTION IN SECOND-GROWTH PONDEROSA PINE

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Introduction

In a study of specific gravity of second-growth ponderosa pine, there was visible evidence of resin in a part of the specific gravity specimens. Each specimen contained 10 annual growth rings in cross sections taken at 4 heights in the merchantable length of the trees. Since the presence of resin introduced an uncertain amount of error in the specific gravity values, it seemed advisable to extract the resin not only from the visibly resin-soaked specimens but also from all other specimens used. In this way, the general distribution of resin in the trees was found, and an approximate correction factor was obtained for the specific gravity values of the unextracted wood.

Source of Sample Material

The material used was collected in the summer of 1953 under the direction of Diana M. Smith who was assisted by Harvey Smith of the Forest Utilization Service unit of the California Forest and Range Experiment Station, Berkeley, Calif., and Robert E. Lang of the La Porte Ranger District, Plumas National Forest. The trees that were cut and sampled grew in the vicinity of Challenge, Calif. They were in an even-aged, 80-year stand growing on a Quality II site. The areas sampled represented 3 degrees of stocking: well, medium, and sparsely stocked. Two dominant, 2 co-dominant, and 2 intermediate trees were chosen by random sampling to represent each of the 3 areas. The sample trees were numbered from 1 to 18, beginning with the fully stocked stand and ending with the sparse stocking.

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[1]Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

Sampling Procedure

Full, round cross sections about 3 feet in length were cut at approximate heights of 1, 16, 36, and 80 feet in the trees. One tree lacked the 80-foot section. The respective bolts were identified vertically in the trees by letters of the alphabet corresponding to successive 4-foot lengths of the tree bole; A, E, J, and T. A suitable flitch, about 2 inches in thickness and including the pith, was cut from each bolt. From the flitch, sections that were 4 inches along the grain were cut off for specific gravity specimens. The remainder of the flitch was used for other tests. The specific gravity specimens, each containing 10 growth rings, were cut from the pith outward on each radius. Opposite radii were designated by the letters H and L, and the specimens were numbered in sequence from pith to bark. Some of the specimens next to the bark contained less than 10 growth rings.

Resin Extraction

To facilitate resin determination, it was decided to cut a cross section 1/4 inch along the grain from each of the specific gravity samples, which had previously been ovendried in the usual procedure for specific gravity determinations. The 1/4-inch sections were subjected to ether-alcohol extraction in a Soxhlet or a Lloyd extraction apparatus. Each of these procedures provided for vaporizing and recondensing the solution after each syphonic emptying of the extraction chamber. Although the specimens were left immersed in the solution during the night and over weekends, the solution was circulated only during each working day. The treatment was continued over a period of 3 weeks for each charge.

Data Procured

The 1/4-inch-long cross sections from the specific gravity specimens were dried to a moisture-free condition and weighed before and after the resin extraction on a Sartorius automatic balance under controlled humidity conditions. Weighing bottles were used to keep the samples at constant weight during the weighing process. The percentage of resin removed from the samples was based on the weight of the specimens after extraction. The percentage loss provided a correction factor for the specific gravity values obtained for the specimens from which the thin extraction sections were cut.

Distribution of Resin

There appears to be a rather general pattern of resin distribution in the second-growth (80-year) ponderosa pine studied. Visibly resin-soaked specimens were mostly of heartwood located close to the pith. Resin in such specimens ranged up to a high of 86.4 percent of the dry weight of the section after extraction. Amounts of resin usually were greater in A bolts than in those which grew higher in the trees.

In the horizontal distribution of resin from the center of the trees outward, amounts usually decreased considerably in a decade or 2 and then fluctuated somewhat until the last decade or 2 near the bark, where there was usually a noticeable increase. Diagrams showing maximum, minimum, and average resin percentages by decades for the 3 groups of 6 trees each appear in figure 1. Average percentages of resin for each group and for bolts at each height in each group are given in table 1. It is worthwhile to mention that trees 13 to 18, which came from the more openly stocked sites, averaged somewhat higher in resin content than those of the other 2 groups. This is an indication that trees with relatively larger crowns store more resin in the wood.

Application of Results

The percentage weight loss of specimens due to extraction of resin may be applied directly to the standard specific gravity determinations to correct the specific gravity of the specimen. This, of course, is not a precise determination for the entire original specific gravity specimen, since there is likely to be some variation in resin within its 4-inch length. With a few exceptions, however, the results obtained are undoubtedly a close approximation, and they provide a satisfactory correction for the specific gravity of samples of the size used.

In the new specific gravity technique, known as the "maximum moisture content method," it is essential that pitch be extracted from specimens in advance of saturating them. Otherwise, resin occupies space that should be filled with water when specimens are saturated, and weights of resin-containing specimens are in error.

Summary and Conclusions

1. Visibly resin-soaked specific gravity samples of second-growth ponderosa pine gave such unreliable specific gravity values that they were unsuitable for use in analysis.

2. In resin extraction of all specimens in the study, great variability in resin content was found even in pieces from outer sapwood that showed no external indications of unusually high resin content.

3. Average resin content for the 3 groups decreased progressively from the bases of the trees upward with the exceptions of E bolts of trees 1 to 6 and T bolts of trees 13 to 18.

4. The average resin content for all heights of the 3 groups was 5.6 percent for trees from well-stocked stands, 5.5 percent for trees from medium-stocked stands, and 9.1 percent for trees from sparsely-stocked stands.

It may be concluded from this study that resin extraction should be made an integral part of specific gravity determinations with resinous species, particularly when only very small specimens such as increment cores are used. The variations in resin content found were of such magnitude that, unless they are taken into account, wrong interpretations could be made of the effect of environmental conditions or other factors upon wood characteristics, particularly in experimental tests of forest-management methods.

Table 1.--Average percentages of resin in 3 groups of ponderosa pine trees and averages for bolts at 4 heights in each group of 6 trees

Bolt	Height in tree	Tree numbers by groups		
		1 - 6	7 - 12	13 - 18
	Feet	Percent	Percent	Percent
T	80	4.0	5.0	9.2
J	36	4.7	5.1	7.8
E	16	7.1	5.3	8.9
A	1	6.4	6.5	10.5
Group average		5.6	5.5	9.1

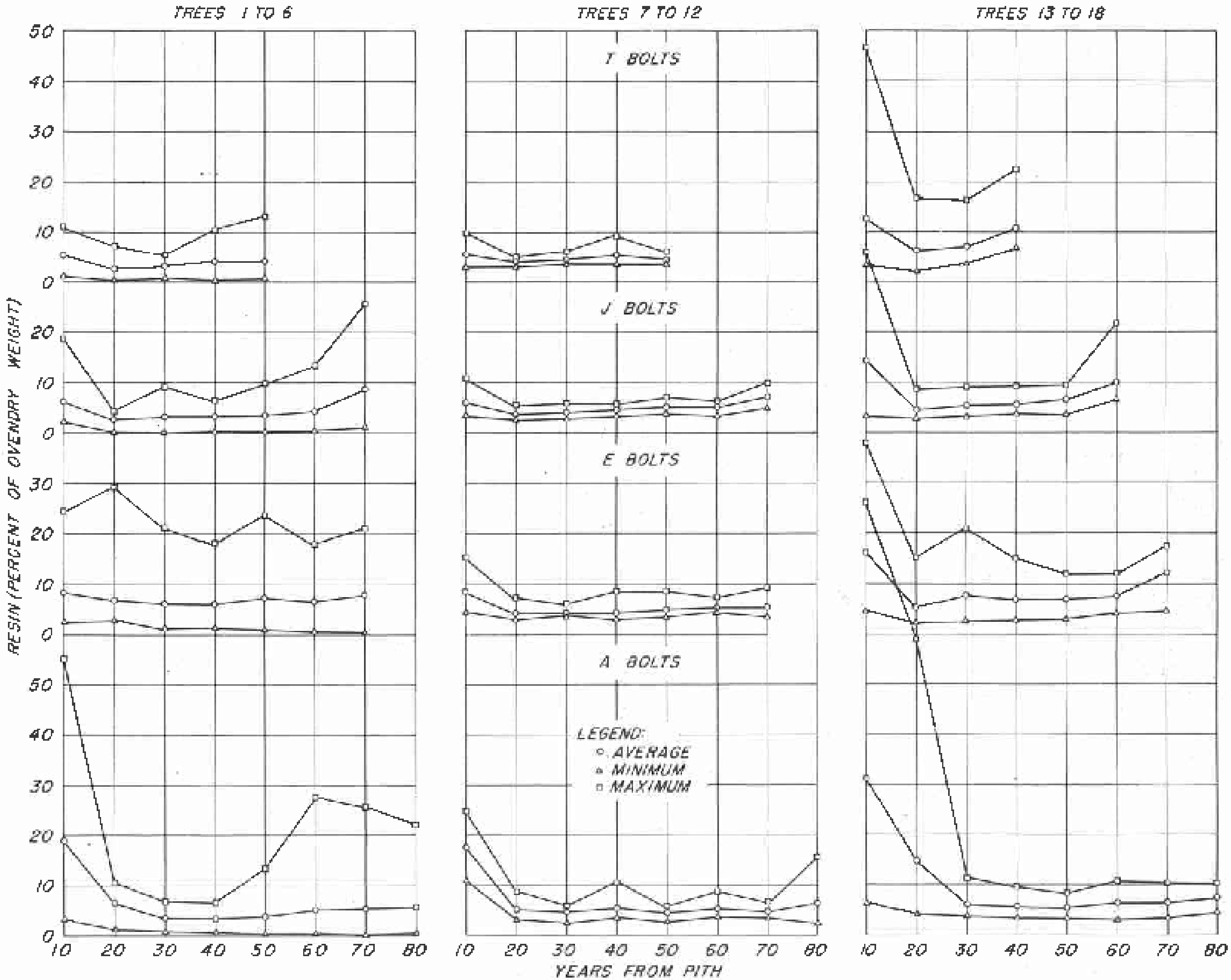

Figure 1. --Average, minimum, and maximum percentages of resin by decades from the pith at 4 heights in each of 3 groups of second-growth ponderosa pine.

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