

CHANGES IN SPIRAL GRAIN DIRECTION IN PONDEROSA PINE

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CHANGES IN SPIRAL GRAIN DIRECTION IN PONDEROSA PINE

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Introduction

Standing dead trees that have lost their bark frequently exhibit checks in the wood running at variance from the lengthwise axes of the trees. In some trees, these checks spiral to the right; in others, to the left of the observer. They show the direction of the grain of the wood on the surfaces of the tree trunks. Variation in the degree of this spiral grain both in the exterior and interior parts of trees is of interest, since grain direction with reference to the axis of a piece of timber influences strength, warping during seasoning, and twisting of posts and poles. Reversals of grain direction within the trunks of trees indicate the presence of opposing forces that might influence the behavior of wood, particularly the twisting of round products.

Source of Sample Material

The material used was part of a sample collected in the summer of 1953 in cooperation with the California Forest and Range Experiment Station, Berkeley, Calif., and the La Porte Ranger District, Plumas National Forest. The trees cut and sampled originated in the vicinity of Challenge, Calif. They were in an even-aged, 80-year-old stand growing on a Quality I site. Areas representing three degrees of stocking, well, medium, and

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

sparsely stocked, were sampled. Two dominant, 2 codominant, and 2 intermediate trees of average diameter at breast height for the respective crown classes were chosen by random sampling to represent each of the 3 areas. The sample trees were numbered 1 to 18, beginning with the fully stocked stand and ending with the sparsely stocked stand.

Samples

Full, round cross sections about 3 feet in length, cut at approximate heights of 4, 40, and 80 feet in the trees, were the source of the specimens used. One tree lacked the 80-foot section. Vertically in the trees, the respective bolts were identified by letters of the alphabet corresponding to successive 4-foot lengths of the tree bole, such as, A, J, and T. A suitable flitch about 2 inches in thickness including the pith was cut from each bolt.

A portion of each flitch from the A, J, and T bolts, approximately 10 inches along the grain, was cut into specimens 1 by 1 inch in cross section from pith outward. Opposite radii of the flitch were designated H and L, and the individual specimens were numbered consecutively from the pith on each radius.

Measurement of Spiral

The direction of grain on the outer tangential face of each specimen was found by using a swivel, needle-pointed scribe drawn along the length of each piece in such a way that the needle point left a visible track in the wood showing the direction of the wood fibers.

The slope of grain was measured with a device calibrated to show the number of inches along a base line that would equal a grain deflection of 1 inch. For convenience in computing the average slope of grain, these direct measurements, recorded as slope of grain, were converted to angular measurements (table 1) with positive values indicating a left-hand spiral and negative values a right-hand spiral.

Analysis of Data

Variation Within Tree Classes

Since the trees were selected to represent 2 dominant, 2 codominant, and 2 intermediate trees from each of the 3 areas sampled, it seemed appropriate to compare the fluctuation in the grain within each of the tree classifications. Accordingly, the average grain angles at 1-inch intervals from the pith were calculated for the opposite radii of the 6 trees within each of the tree classifications. Comparisons within groups were made at 3 heights represented by the A, J, and T bolts (approximately 4, 40, and 80 feet). Values for T bolts were not calculated for intermediate trees because of the insufficient number of specimens. In the case of the codominant trees, only five trees were represented at the T bolt.

The average grain angles at each height for 6 trees are illustrated in figure 1. In general, there was an average reduction in the grain angle from the pith outwards. The few exceptions to this trend occur in the outer portion of the trees where the full number of radii are not represented. There is also a trend of increasing grain angle with increasing height in tree. At any given height, the dominant trees had a larger grain angle than the codominant and intermediate trees.

Variation Within Individual Trees

Changes in grain angle from a left-hand to a right-hand spiral along a single radius occurred at 1 or more heights in 17 of the 18 sample trees. There was also considerable variation between adjacent specimens within a radius (fig. 2). One tree showed a consistently large slope of grain on 5 out of 6 radii (fig. 3).

Summary

Measurements of grain angle for successive inches from the pith outwards were made on opposite radii at 3 heights in 80-year-old, second-growth ponderosa pine trees.

In general, there was a reduction in grain angle from the pith outward which was accompanied by an increase in grain angle with height in tree at equal inches from the pith. At any given height, dominant trees had a larger grain angle than codominant and intermediate trees.

In spite of the general trends reported here, there was considerable variation between adjacent specimens within a radius. Reversals of direction of spiral occurred within 17 of the 18 trees on 1 or more radii, indicating the existence of opposing forces that may influence twisting of round timbers in drying.

Spiral grain as it appears on the surface of a tree may not be an indication of the degree of spiral throughout the tree.

Table 1. --Grain angle in degrees
from lengthwise axis
expressed as slope of
grain

Grain angle	:	Slope of grain
<u>Degrees</u>	:	
1	:	1 in 57.29
2	:	1 in 28.64
3	:	1 in 19.08
4	:	1 in 14.30
5	:	1 in 11.43
6	:	1 in 9.51
7	:	1 in 8.14
8	:	1 in 7.12
9	:	1 in 6.31
10	:	1 in 5.67
11	:	1 in 5.14



Figure 1. --Average grain angle for successive inches from the pith at three heights in ponderosa pine. Each point represents the average of 6 trees from each of 3 tree classes.

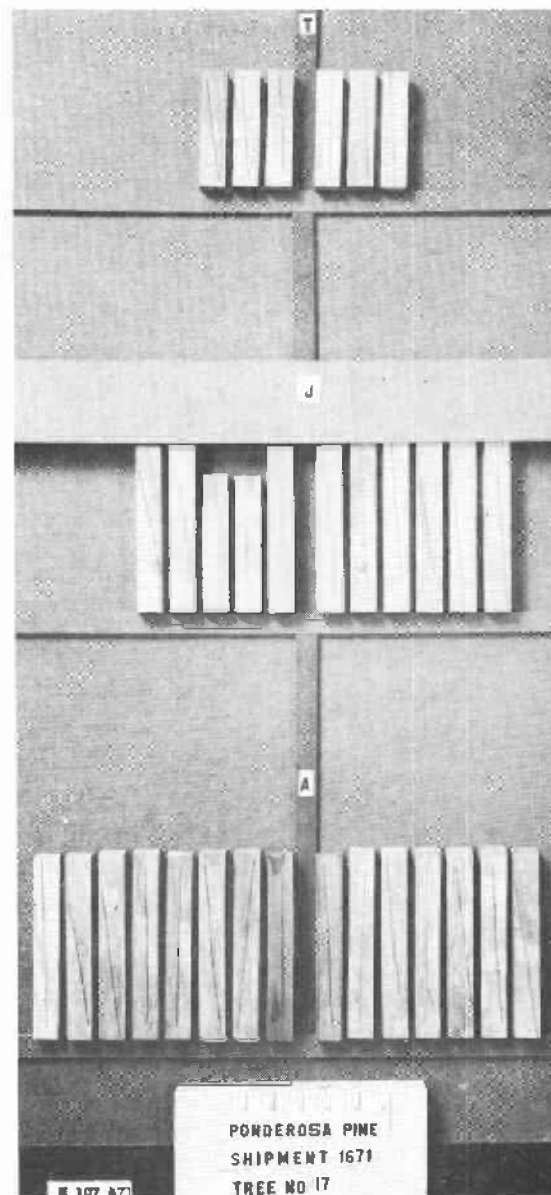


Figure 2. --Reversal in direction of grain in ponderosa pine specimens shown by scribe marks.

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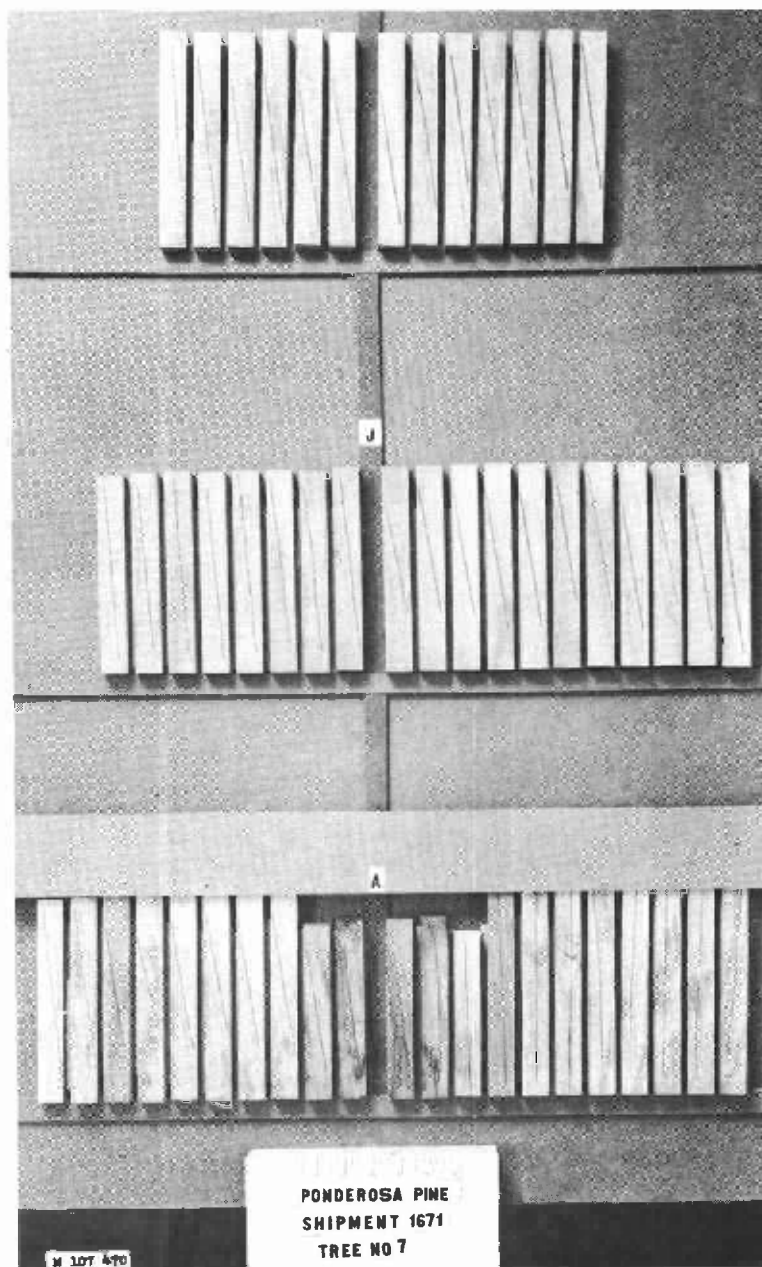


Figure 3. --Consistently large angle of spiral in ponderosa pine specimens, except in lower (A) right radius.

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