

ANALYSIS OF TRACHEID DEVELOPMENT IN SUPPRESSED-GROWTH PONDEROSA PINE USING THE FPL RING PROFILER

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EXTENDED ABSTRACT

The Ring Profiler was developed to examine the cross-sectional morphology of wood tracheids in a 12.5-mm core sample. The instrument integrates a specially designed staging apparatus with an optical imaging system to obtain high-contrast, high-resolution images containing about 200-500 tracheids. These images are further enhanced and analyzed to extract tracheid cross-sectional properties such as shape, double-wall thickness, and lumen area. Subsequently, localized density can be calculated for specific regions of interest (e.g., earlywood and latewood), as it varies throughout the tree.

We showed that tracheid development in trees can be closely examined with the Ring Profiler. In particular, we showed that for the same core sample, recent periods of “suppressed” growth result in very narrow growth rings containing as few as 2-10 radial fibers/year (Fig. 1). In contrast, normal periods of growth may contain 20 or more radial fibers/year, resulting in dramatically different tracheid development (Fig. 2). This was observed in ponderosa pine (*Pinus ponderosa* Dougl. Ex Laws.) trees of various diameters harvested from an even-aged, high density stand in the Pringle Falls Experimental Forest near Bend, OR. For this study, sample disks were extracted from each tree at diameter at breast height (d.b.h.) and every 6 m up the tree. Radial strips (Fig. 3) were then prepared for examination by the Ring Profiler. The entire strip was scanned and image algorithms were applied to calculate tracheid cell wall area, relative proportion of earlywood and latewood, and local density in select growth rings. A calculation of yearly mass accumulation was made by assuming that the tree volumetric growth can be approximated by a sequence of concentric cones. Measures of stored carbon were then estimated based on the chemical composition of the wood.

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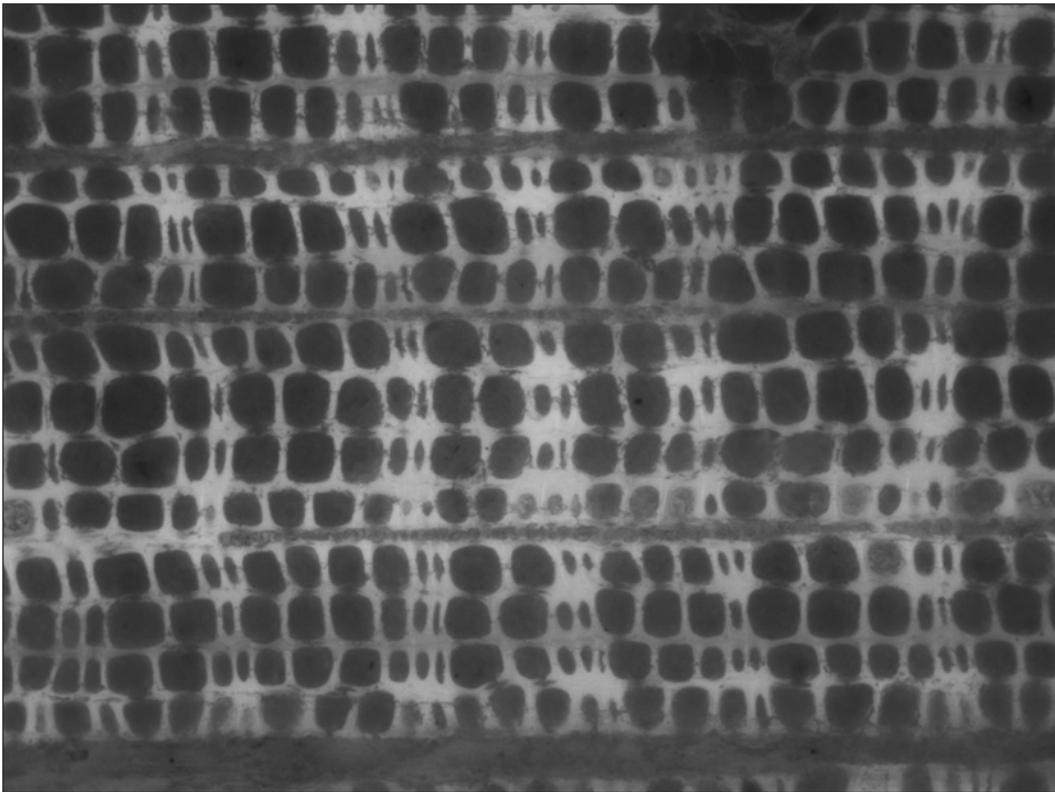


Figure 1.—Narrow growth rings circa 1992.

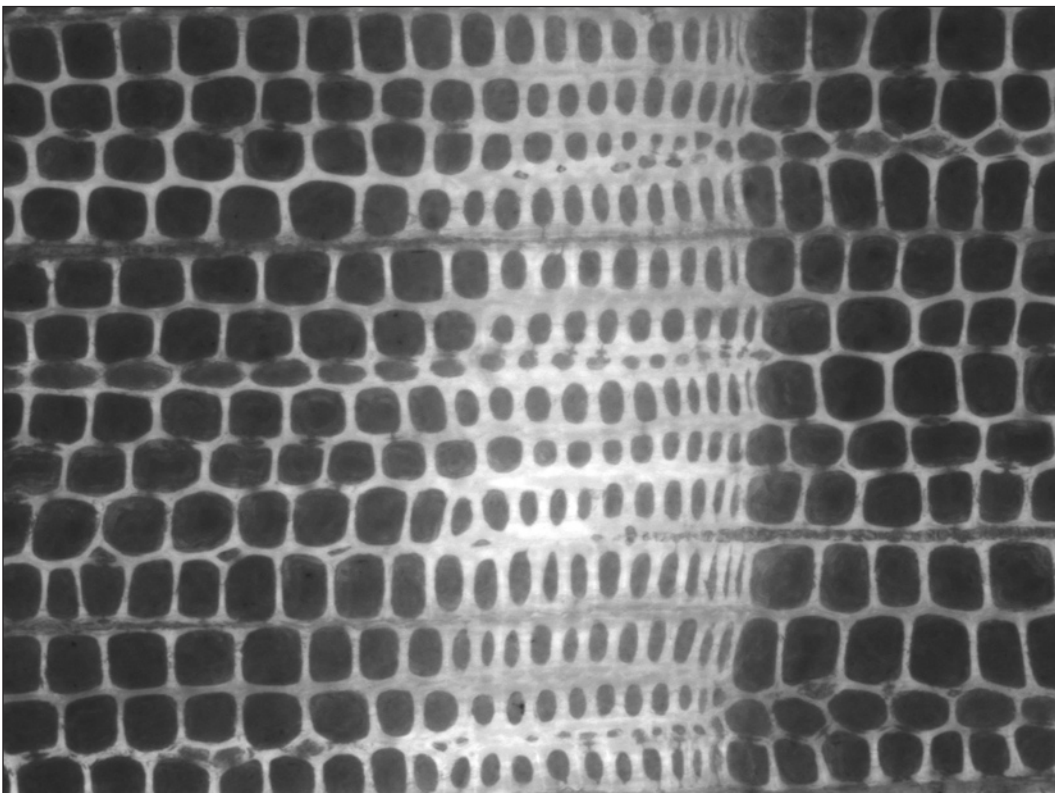


Figure 2.—Wide growth ring circa 1957.

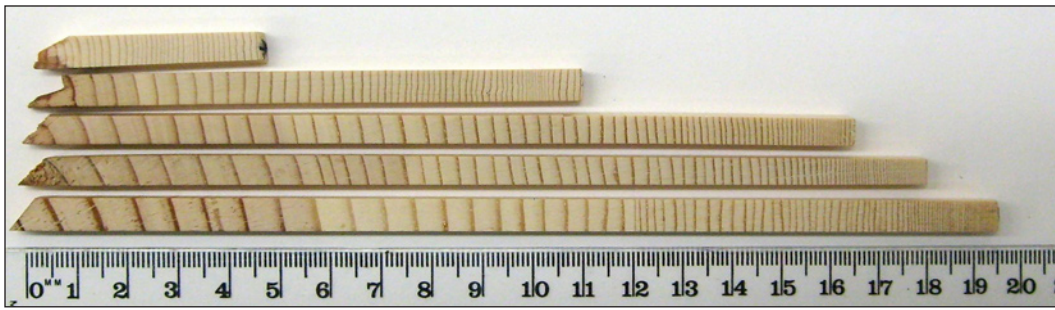


Figure 3.—Five radial samples from a century-old, 33-m ponderosa pine. The bottom strip was prepared from the diameter at breast height (d.b.h.) disk with the rest taken at 6-m intervals up the tree.

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