FOR-135

University of Kentucky
College of Agriculture, Food and Environment
Cooperative Extension Service

PART 6

IDENTIFYING WOOD—*A Primer for Everyone*

Softwood Growth Rings

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Lumber stores carry softwood construction lumber (2 x 4s, etc.) and planks for home building projects, and if it weren't for the labels many people wouldn't know the difference between spruce, hemlock, white pine, or southern pine. Many softwoods look similar to the naked eye at first; the colors are often similar, maybe light-colored overlaid with tinges of yellow-brown or perhaps a slight pinkish cast. Even the weights of similarly-sized pieces (the densities) might seem similar. There are, however, differences in the wood structure that we can use to separate the various species. Two of the most important characteristics we look at are 1) the presence or absence of resin canals (as discussed previously) and 2) the appearance of the earlywood-latewood transition in annual growth rings.

Growth Ring Transitions

Three out of four of the resinous softwood genera have similar-appearing resin canals (tiny and sparse!), so you're probably wondering how to further distinguish them. Some of the things to consider have already been mentioned—color and hardness/density, for example—but these attributes are variable enough that they're less reliable than anatomical structure. After determining that an unknown piece of wood is a softwood, and that it's resinous, the next step is to examine the transition from earlywood to latewood.

As the growing season progresses softwood species form earlywood and latewood cells that are visibly different to the naked eye. In softwoods, the cambium at first makes cells with large diameters and thin cell walls, but later in the year the cells grow smaller in diameter and form much thicker cell walls. These changes in cell size and cell wall thickness make the growth increments distinguishable at the annual boundaries, creating the growth rings on the cross-section. The changeover from earlywood to latewood, however, doesn't always happen at the same rate for every species. In some species the transition from earlywood to latewood occurs abruptly, almost dramatically, while in other species the switch from one to the other happens gradually during the growing season. Growth ring transition, therefore, is another feature with significant diagnostic value for softwood identification, and observing the transition (gradual or abrupt) is very important.

Abrupt Transition

The micrograph below (Figure 6-1) shows a single growth ring (cross-section) of Douglas-fir (*Pseudotsuga menziesii*); the change from the earlywood to latewood production is very abrupt, almost like someone flipped a switch.[1] The thick-walled latewood tracheids are easily distinguished from the thinner walled earlywood tracheids, and it is these thicker-walled cells that make the darker bands of softwood growth rings visible to the naked eye. Like most softwood species, Douglas-fir has uniseriate rays (i.e., one cell wide).

Figure 6-1. Photographed from a stained thin section, this micrograph of a single year's growth of Douglas-fir shows the abrupt transition between earlywood and latewood. The end of the preceding year's growth is closest to the pith, at the bottom of the photo, and the beginning of the next year's growth is at the top,

1 The tracheids have larger diameters only in the radial direction. The width of the cells in the tangential direction doesn't change between the earlywood and the latewood.

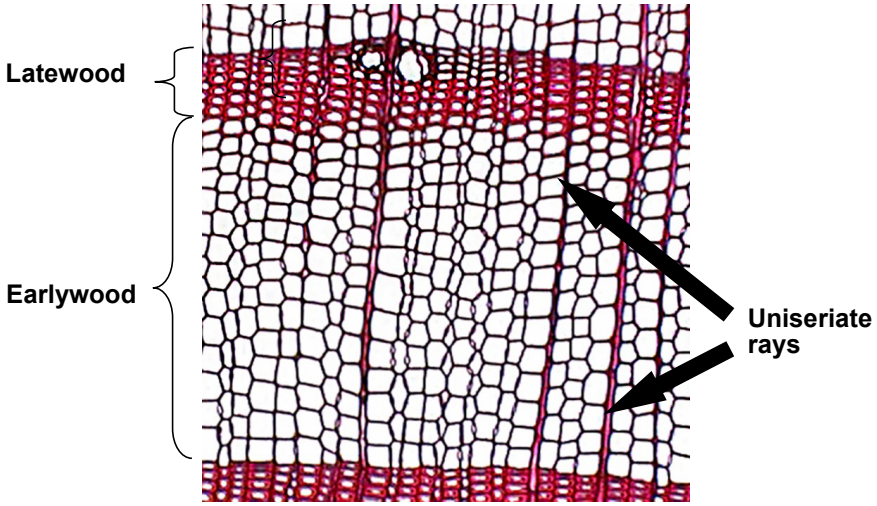

Figure 6-1. Photographed from a stained thin section, this micrograph of a single year's growth of Douglas-fir shows the abrupt transition between earlywood and latewood. The end of the preceding year's growth is closest to the pith, at the bottom of the photo, and the beginning of the next year's growth is at the top, closest to the bark. Douglas-fir is a resinous softwood, and there are a couple of resin canals in the upper latewood in this micrograph

Figure 6-2. There is a clear distinction between the light-colored earlywood and the darker-colored latewood in each growth ring on these southern pine veneers (shown in x, r, t sequence). The abrupt transition between earlywood and latewood is easily visible on each plane. There are some streaks from resin canals visible on the tangential veneer photograph. These images are photographs of veneer sections from R.B. Hough's *American Woods*, shown actual size.

closest to the bark. Douglas-fir is a resinous softwood, and there are a couple of resin canals in the upper latewood in this micrograph.

We've already seen what southern pine looks like; photographs of southern pine veneers were presented earlier in the section about growth rings. Here's another chance to see what the earlywood and latewood differences look like (Figure 6-2). The abrupt transition seen in the preceding micrograph of Douglas-fir can also be seen with the naked eye in southern pines.

In addition to Douglas-fir and the southern pines, there are other North American softwood species with an abrupt transition. Some of these are red pine (*Pinus resinosa*), Ponderosa pine (*Pinus ponderosa*), and redwood (*Sequoia sempervirens*).

Gradual Transition

Many softwood species have gradual cell wall changes between the earlywood and the latewood. In the micrograph of a balsam fir (*Abies balsamea*) cross-section below (Figure 6-3), notice how the cell diameters gradually get smaller toward the end of the growing season; it's very difficult to establish the precise boundary between earlywood and latewood.

The latewood thickness can vary from species to species and even from one growth ring to another. For an example of how latewood thickness can vary among species, look at the micrographs of eastern white pine and Sitka spruce, both softwood species with gradual transitions (Figure 6-4).

Red spruce (*Picea rubra*) is another species with a gradual transition between the earlywood and the latewood. The photographs of red spruce in Figure 6-5 show what growth rings with a gradual transition look like to the naked eye. The latewood is distinct, but the color change within individual growth rings is much more subtle than it is for species with abrupt transitions. Compare the growth ring appearance on the tangential and the radial faces to those of the southern pine sample shown in Figure 6-2. If you suspect you have a sample exhibiting an

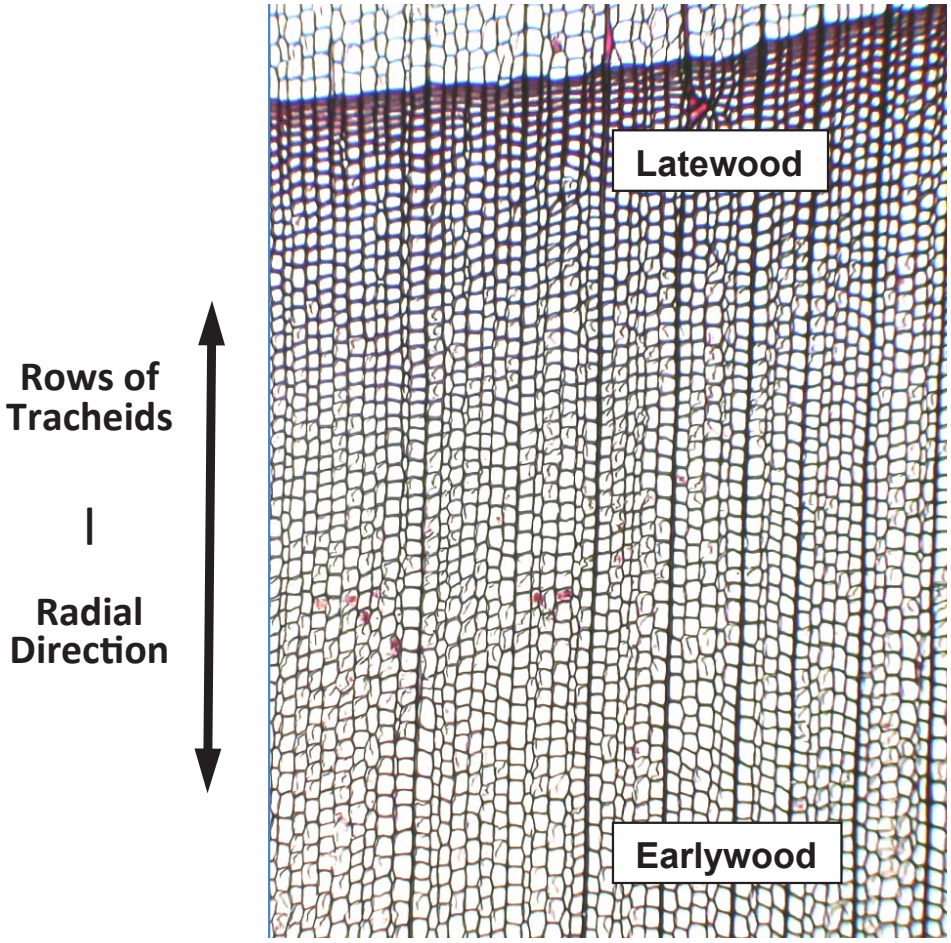

Figure 6-3. Cross-section of balsam fir (*Abies balsamea*), a softwood. Tracheids are lined up in the radial direction (*i.e.*, from the bottom to the top of the micrograph). Almost one complete growth ring is shown starting at the bottom of the micrograph, and the beginning of the next growth ring (more earlywood) is shown at the top.

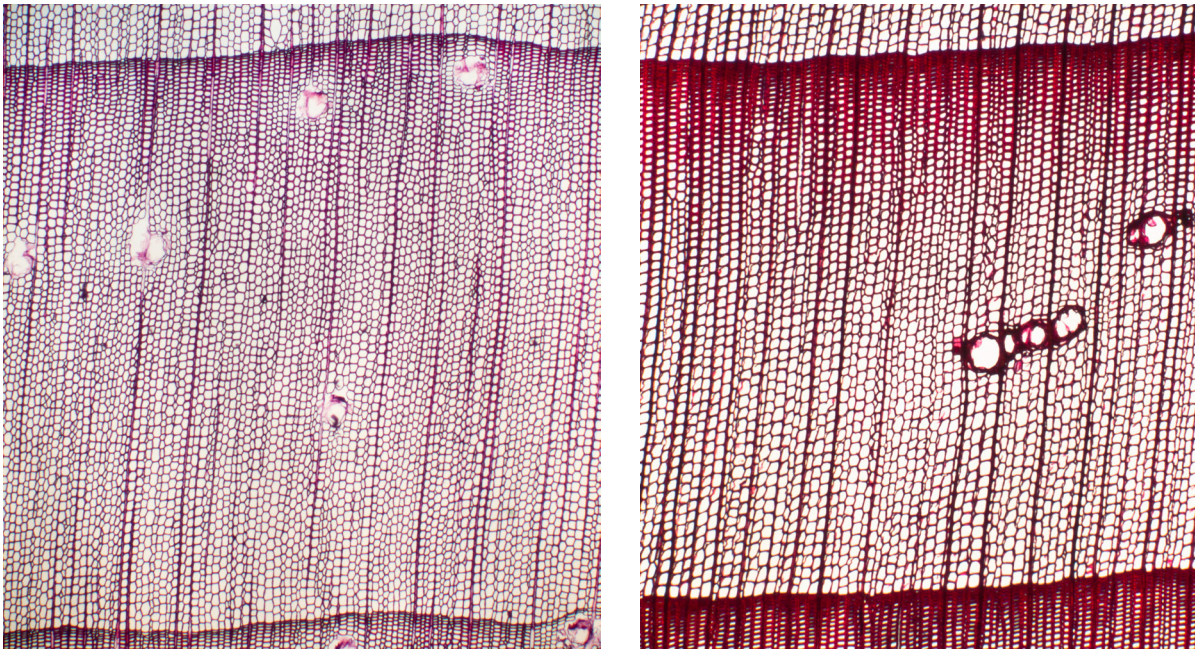

Figure 6-4. Shown here are two more examples of single growth rings from species with gradual transitions. On the left is a micrograph of an eastern white pine specimen (*Pinus strobus*) with a very thin latewood, and on the right is a micrograph of a piece of Sitka spruce (*Picea sitchensis*) with somewhat thicker and better-defined latewood.

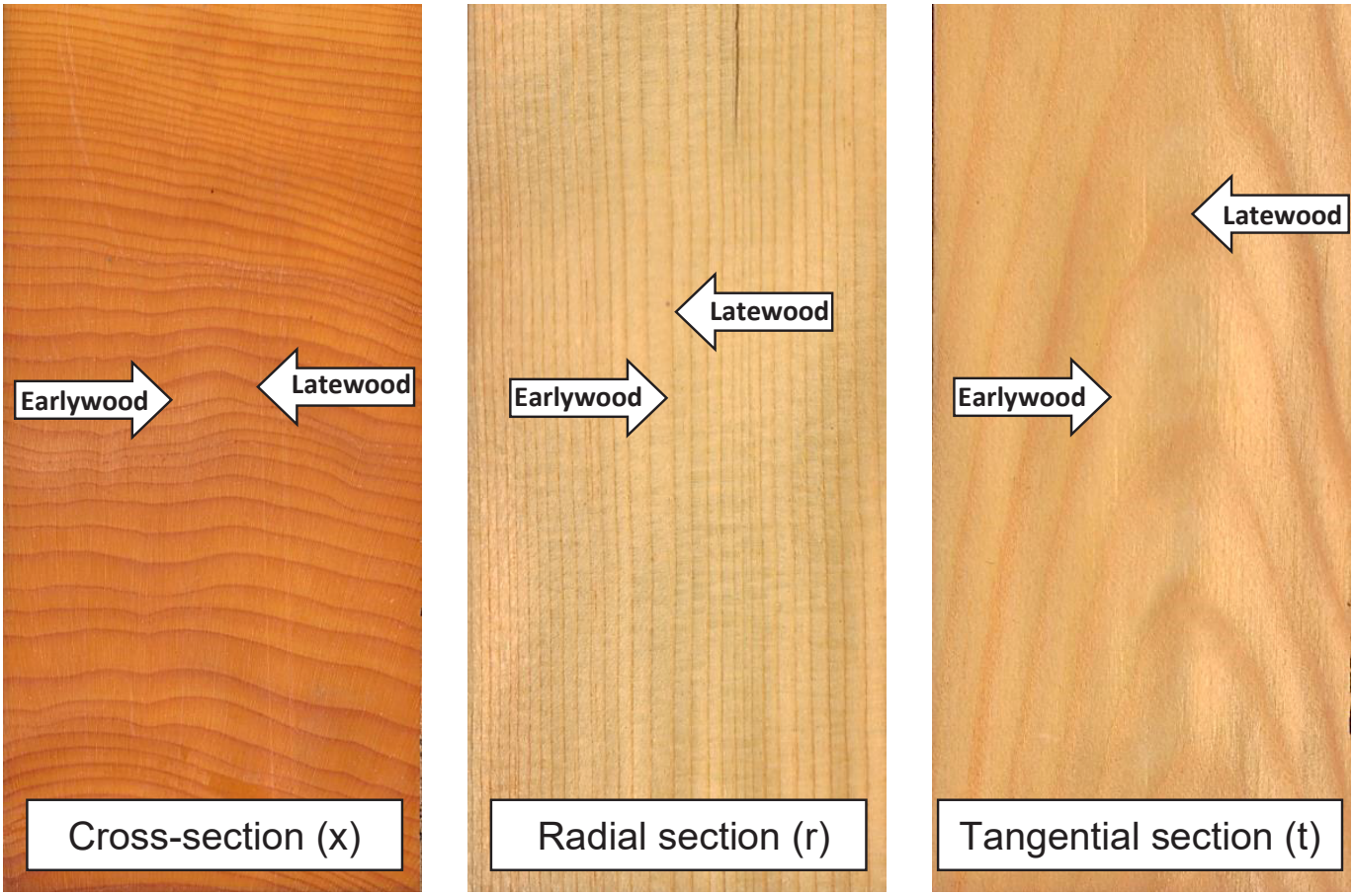

Figure 6-5. Three views (x, r, t) of red spruce (*Picea rubra*) showing a gradual transition between the earlywood and the latewood. There isn't much of a distinction between the earlywood and latewood tones on the radial face compared to that in the abrupt transition of the southern pine. Even the distinctions between the earlywood and latewood on the tangential face are less obvious. These images are photographs of veneer sections from R.B. Hough's *American Woods*, shown actual size.

abrupt transition but you can't see an obvious transition on the side grain then the sample should be classified as having a gradual transition. The appearance on the radial face is often particularly useful.

Gradual-to-Abrupt Transitions

A few species have transitions that are categorized as gradual-to-abrupt. This sounds confusing, but what this means is that some growth rings (on a single piece of wood) appear to be more abrupt, while others appear to be more gradual. Eastern hemlock is a good example of a species in this category; see Figure 6-6.

Sometimes the appearance of the earlywood-latewood transition may be affected by the width of the growth rings, as seen in this photograph of a true fir (*Abies concolor*) (Figure 6-7). Narrower growth rings tend to make the growth ring transition look more abrupt, particularly on the cross-section.

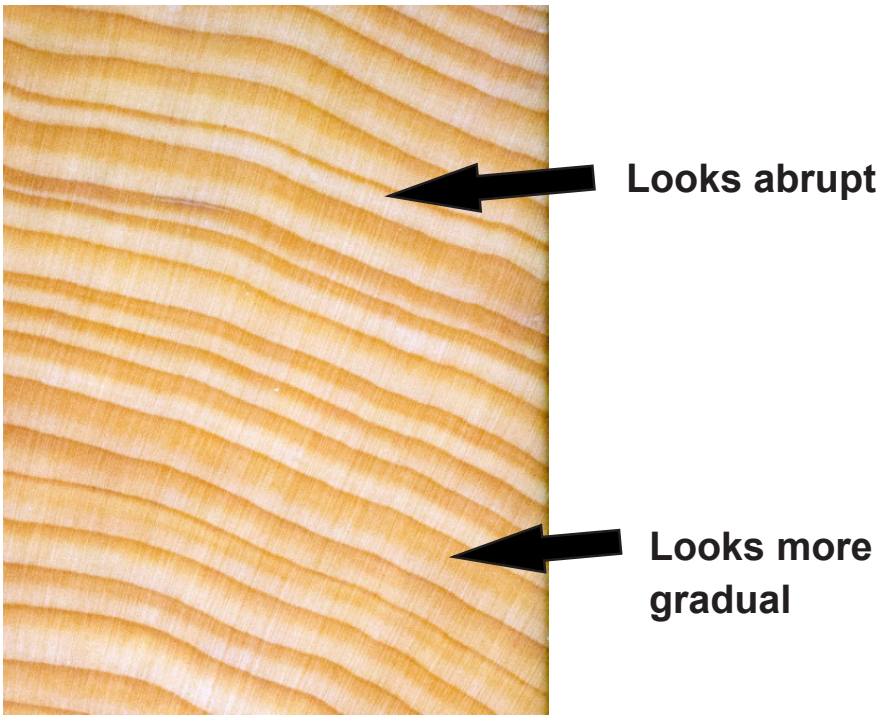

Figure 6-6. Photograph of western hemlock (*Tsuga heterophylla*) (from a Hough veneer). Some growth rings appear much more abrupt than others. Shown about twice actual size.

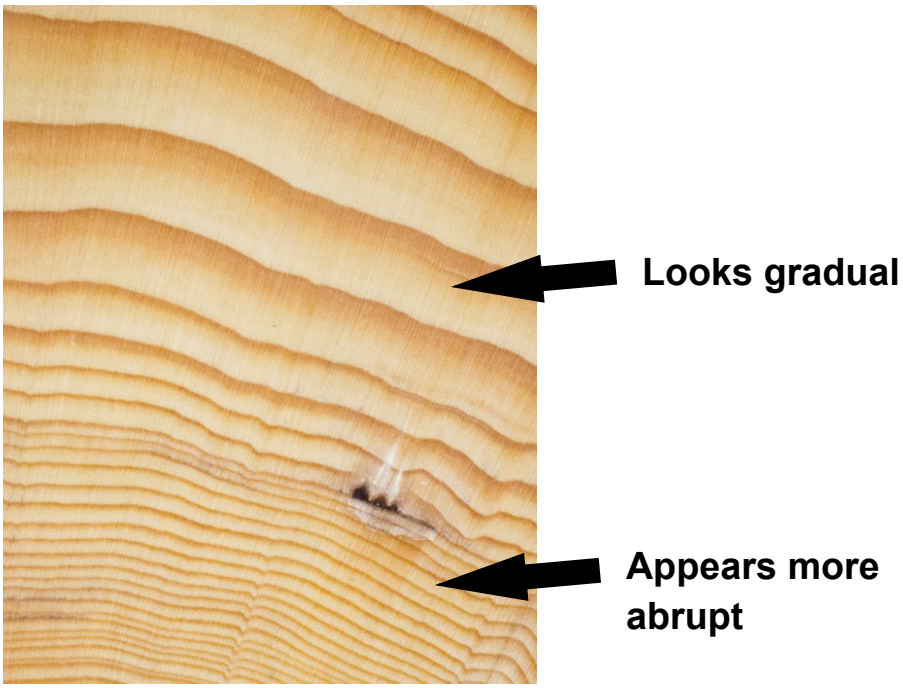

Figure 6-7. This photograph of true fir (*Abies concolor*) (from a Hough veneer) shows how growth ring width can affect the appearance of the earlywood-latewood transition. Narrow growth rings seem to have more abrupt transitions than the wider growth rings. Shown about twice actual size.

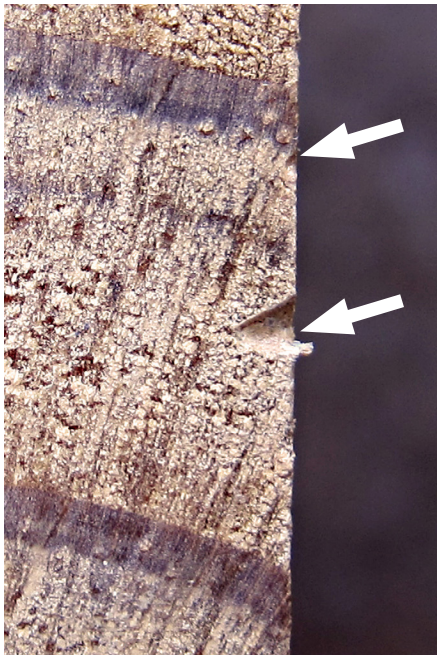

Figure 6-8. Evidence of my attempts to dent the earlywood (bottom) and latewood (top) of a southern pine growth ring with my thumbnail. The denser latewood is much harder than the earlywood.

Figure 6-9. This photograph of baldcypress (*Taxodium distichum*) shows multiple growth rings containing thin premature latewood bands, resulting in the production of "false growth rings." Three growth rings with both false latewood and true latewood bands are marked; the false growth rings are the thinner, less distinct "growth rings" closer to the pith in each case. Growth rings 1 and 2 each have a single false growth ring; growth ring 3 appears to have two false latewood bands.

Density Differences within Growth Rings

Latewood tracheids have thicker cell walls than the earlywood tracheids, and this affects the density. The band of latewood in southern pine is about three times denser than the earlywood! The difference isn't always so pronounced for other softwood species, but it's easy to demonstrate that density is related to hardness. Here's what happened to a southern pine growth ring when I tried to dent it with my fingernail; it was pretty easy to make a mark in the earlywood, but my fingernail mostly slid off the latewood and I was barely able to make even a shallow dent (Figure 6-8).

False Growth Rings

Growth rings form in response to climatic and local factors (sunlight, temperature, moisture, and so forth). Some tree species grow in locations with frequently changing conditions, and the appearance of the growth rings can be influenced even within a single year.

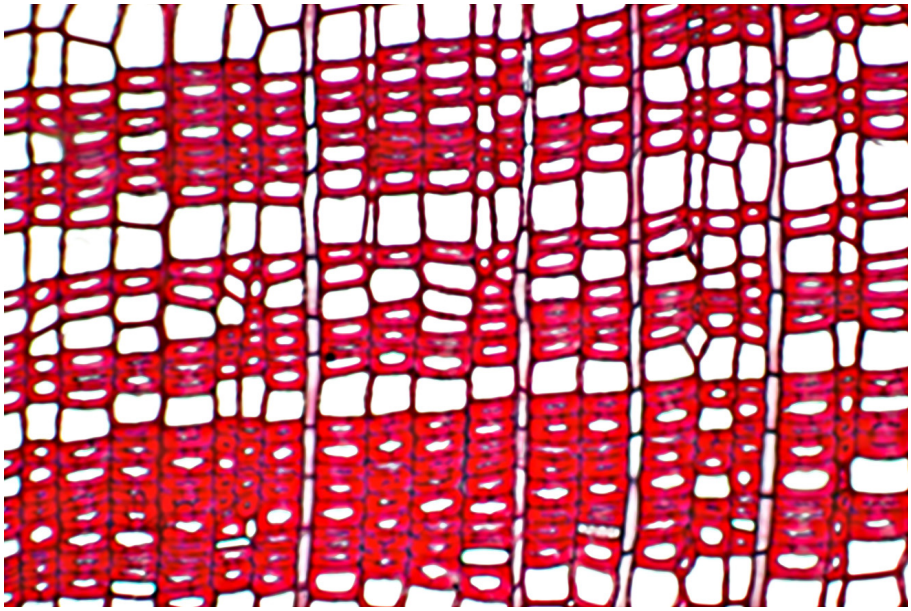

Figure 6-10. Micrograph of baldcypress (*Taxodium distichum*) showing normal latewood at the bottom of the image and multiple false growth rings.

Baldcypress (*Taxodium distichum*) is one such species; the tree is frequently found in swampy areas where the water levels rise and fall during the course of the year. The available water appears to determine whether the tree produces earlywood or latewood, so baldcypress trees frequently have one (or more) thin bands of false latewood-type tissue followed by additional earlywood, and finally a genuine latewood band. False growth rings are usually thin compared to true latewood, and often they are not uniformly distinct around the circumference of the tree. False growth rings are fairly common in baldcypress, but they are not present in every year's growth ring. See Figures 6-9 and 6-10.

Vocabulary

If you don't remember any of the following words, please review this section. Vocabulary is very important!

1. Resin canal
2. Gradual transition
3. Abrupt transition
4. Gradual-to-abrupt transition
5. False growth rings
6. *Pinus* (the genus name for the pines)
7. *Picea* (the genus name for the spruces)
8. *Pseudotsuga* (the genus name for Douglas-fir)
9. *Larix* (the genus name for the larches and tamaracks)
10. *Abies* (the genus name for true firs)
11. *Pseudotsuga menziesii* (Douglas-fir)
12. *Pinus resinosa* (red pine)
13. *Pinus ponderosa* (Ponderosa pine)
14. *Sequoia sempervirens* (redwood)
15. *Abies balsamea* (balsam fir)
16. *Pinus strobus* (eastern white pine)
17. *Picea sitchensis* (Sitka spruce)
18. *Picea rubra* (red spruce)
19. *Tsuga heterophylla* (western hemlock)
20. *Taxodium distichum* (baldcypress)

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