Oregon State University

Ring Research Goes Cellular

Researching wood anatomy, tree rings, and sap flow at the College of Forestry

Notable notes in forest research at Oregon State University College of Forestry

Despite centuries of research, scientists still have much to discover about some basic components of trees. For example, how is water transported through trees? And why do trees make certain types of wood? At OSU's College of Forestry, Professor Barb Gartner (Wood Science & Engineering) is working to fill in some of the gaps through her research on tree rings, wood anatomy, and the flow of sap.

Most of us have seen cross sections of trees and know what annual growth rings look like. "We know that trees grow by adding annual rings around their cores. We also know that heartwood is the darker wood in the center of the tree that enlarges as the tree gets wider," says Gartner, "and that sapwood is the outermost section where water is transported from the roots to the rest of the tree. But we are just beginning to learn about 'juvenile' and 'mature' wood."

Juvenile wood is the inner 10-20 growth rings, from the base to the tip of the tree. (Think of it as a "telephone pole" of "different" wood in the center of the tree, Gartner suggests.) This wood usually has lower wood density, shorter and narrower cells, and cell walls that are built in a weaker way. Juvenile wood does not expand as trees grow—so the quantity of this type of wood gets proportionately smaller over time as trees get larger. That means that younger trees have more juvenile wood than older trees do, and newer growth on a tree has more than older parts of the tree.

Gartner's research group is trying to learn why trees produce both juvenile and mature wood. One possibility is for hydraulic reasons—to help move water through the tree. "Juvenile wood appears to be more drought resistant than mature wood," notes Gartner. "It makes sense that juvenile wood is found in seedlings and in the tops of trees."

But then why is mature wood needed? Most scientists think that trees make mature wood to give the tree extra mechanical support as it grows large. But Gartner has a different view—and one that goes against the grain.

"Trees need to increase their leaf area more than their sapwood area as they get bigger," she explains. "They need more leaf area because as trees get bigger, they have proportionately more stem and root, all of which needs photosynthate to maintain it." To get the water to that larger leaf area, they need to have wood that's more conductive. "Small changes in cell anatomy make mature wood able to transport more water faster," she says. "The two types of wood—juvenile and mature—are both needed for better hydraulics."

Gartner is now researching wood and sap relationships in conifer roots. "We don't even know whether they make juvenile wood," she says, "much less the way root hydraulics work. But we are looking forward to finding out!"

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