Steve Shaluta

The Secret World of Trees

By Paul J. Harmon

This fall, surround yourself with some glorious maples or oaks and imagine what it would be like to live for a year as a tree. It has to survive changing temperatures, drought, rain, snow and ice. Fortunately, our native trees have a number of adaptations that enable them to survive the dry cold of winter, then grow and reproduce in the warmth of summer.

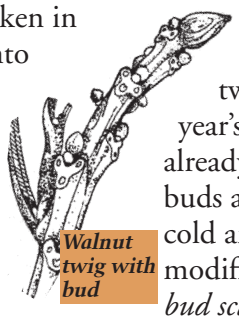
A tree, like any green plant, has the ability to absorb water and mineral nutrients from the soil and collect carbon dioxide and solar energy with its leaves -- all for the purpose of making a variety of sugars through *photosynthesis*. Think of these sugars as tiny packets of energy that can change into substances which the plant needs now or which can be stored for the future.

To help this occur, there are "pipelines" of vascular tissue through which water, minerals and sugars travel among leaves, trunk, branches and roots. If you look at the cut-away illustration of a tree's trunk (at right), you can find the heartwood and sapwood. Most people don't realize the heartwood of an older tree is actually dead and filled with waste products, but it serves as the strength for the tree. The sapwood (or xylem) is the system for the movement of water and dissolved minerals from the soil all the way out to the leaves. If you place a stethoscope to the trunk of a smooth barked tree, you can hear the spring sap gurgling as it rises.

Next, notice the thin cylinder of actively dividing cells called the *vascular cambium*. Each year, the vascular cambium peels off a new layer of sapwood cells toward the inside edge and a layer of inner bark to the

outside, thus producing the familiar annual growth rings in the wood. The inner bark is another kind of fluid-conducting tissue that permits the movement of sugar-laden water from the leaves to the growing buds, the sapwood, and finally to storage cells in the trunk and roots.

The process by which water moves through the tree is called *transpiration*. In plants, more than 90 percent of the water taken in by the roots is given off into the air as water vapor. In the process, not only does that water carry minerals to the leaves, it also carries summer heat from the roots and trunk. This is lost as the water vapor evaporates, cooling the leaves, branches and eventually the trunk—like an internal air conditioner.



Walnut twig with bud

Throughout the summer growing season, as long as there is sufficient water, the right combination of daylight, appropriate day and nighttime temperatures, and adequate mineral nutrients, transpiration and photosynthesis continue. This permits the tree to elongate at growing points such as the ends of twigs and at flowers. It can also expand in girth at the cambium cylinder.

With the coming of fall, shorter daylight hours gradually reduce the amount of light available to our trees. Cool nights become common, signaling the trees to make preparations for the long, cold winter. Freezing temperatures could kill sensitive growing tissues in buds or leaves were it not for the fascinating adaptations trees have for surviving those wintry blasts of ice and air.

Older trees are protected by a layer of dead cork cells in the outer bark which serves both as an insulator and as a barrier to water loss, like a warm winter coat. Deciduous trees drop their leaves in the fall by forming a layer of corky tissue that cuts the leaf from the twig and seals the leaf scar from the dry winter air, greatly reducing the amount of water the tree would otherwise lose during the winter.

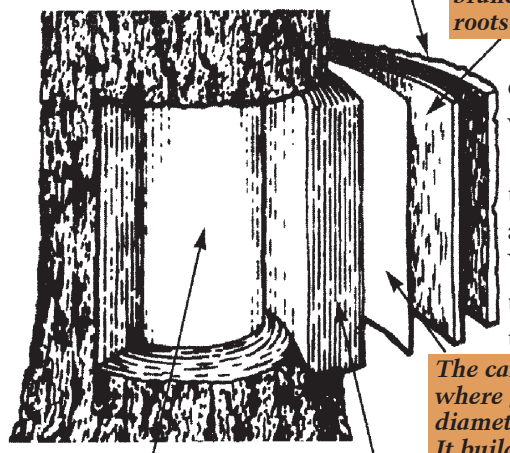
Most deciduous trees have terminal buds on the end of each twig where next year's young shoots are already formed. Most buds are protected from cold and water loss by modified leaves called *bud scales*. Scales may be paper thin or heavy and waxy, and are often covered with fine hairs that add further protection from the cold, just like mittens.

Coniferous trees have skinny, needle-like leaves whose surface area to volume ratio is much smaller than on broad-leaved trees. Their leaf surfaces are thick and waxy and their needles don't fall at once. Thus, conifers keep their leaves, continuing photosynthesis, yet they reduce water loss and tend to drop snow from their pliable branches.

Elizabeth Byers

Most people don't think of conifers having leaves, but that's exactly what the narrow, waxy needles are.

Deciduous trees require a rest period during which active growth and flowering cease called dormancy. Once buds become fully dormant, this state cannot be broken without the proper cues, such as the correct amount of chilling temperatures followed by warmth and increased light.



Last spring early warm temperatures caused many trees to leaf out and bud too early in much of West Virginia. Then, after several days of unseasonable freezing temperatures, those trees lost their leaves and fruit buds and appeared almost dead. But after another round of chilling temperatures, and the return of warmth and adequate water, leaf buds began to show. The cycle had begun again and most trees began to awaken.

It's not easy being a tree!

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