

UI Extension Forestry Information Series

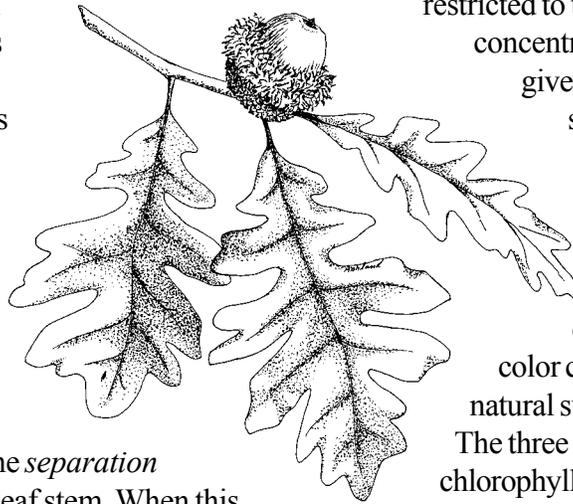
Colored Leaves and Needles Means Fall in Idaho

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Come autumn, deciduous trees and shrubs turn color and lose their leaves. Everyone expects this to happen in the fall. A tree's roots, branches, and twigs can endure freezing temperatures, but most leaves cannot. Thin, tender leaves are made up of cells filled with water sap, which freeze in winter. As the water in the cells expands as it freezes, the cells burst and irreparable damage is done. Because of this, any plant tissue unable to live through the winter must be sealed off and shed to ensure the tree's survival. As sunlight decreases in autumn, the veins that carry sap into and out of a leaf gradually close. A layer of cells, called the *separation layer*, forms at the base of the leaf stem. When this layer is complete, the leaf is separated from the tissue that connected it to the branch and it falls. Oak leaves are the exception. The separation layer never fully detaches the dead oak leaves, and they remain on the tree through winter and only fall in the spring when they are "pushed off" by newly emerging leaves in the spring.

Coniferous (often called evergreen) trees also lose their leaves, they just do it a bit differently. Conifer leaves are needles that are covered with a heavy wax coating and the fluids inside the cells contain substances that resist freezing. Needles can live for several years before they fall and are replaced by new growth. Natural foliar shedding varies with the species of evergreen. Pines lose their third year needles, those closest to the trunk. The needles turn brown to red-brown (the dryer the year, the brighter the color) and

are cast, sometimes all in one day if there is a good wind. Arborvitae and related species with scalelike leaves shed their oldest branchlets (those in the interior). Spruce and fir bear several age classes of needles along their branches and shedding is not restricted to the oldest age class, although it is concentrated there. The foliage on a given branch segment of these species may brown and thin progressively over 2 to 3 years.



And those deciduous trees and shrubs? Why do they change color anyway? Leaf color comes from pigments, which are natural substances produced by leaf cells. The three pigments that color leaves are chlorophyll (green), carotenoid (yellow, orange, and brown), and anthocyanins (red). Chlorophyll is the most important of the three. Without the chlorophyll in leaves, trees wouldn't be able to use sunlight to produce food (photosynthesis). Carotenoids create bright yellows and oranges in familiar fruits and vegetables, while anthocyanins add the color red to plants. Chlorophyll and carotenoid are in leaf cells all the time during the growing season. The green of the pigment chlorophyll covers the yellows and oranges of the pigment carotenoid during the summer, giving us green leaves. Not all trees can make anthocyanins, and most anthocyanins are produced only under certain conditions.

As the days get shorter and the temperatures start to drop, trees respond by producing less chlorophyll. As chlorophyll levels drop, the carotenoid already in the

leaves can finally show through and leaves become a bright rainbow of glowing yellows, sparkling oranges, and warm browns. While the yellow, gold, and orange colors created by carotenoid remain fairly constant from year to year, anthocyanins (which give leaves the bright, brilliant shades of red, purple and crimson) will vary. In some years, the red fall colors seem brighter and more spectacular than in other years. Both temperature and cloud cover can make a big difference in a tree's red colors from year to year. A series of warm, sunny autumn days and cool but not freezing nights provides the perfect conditions for a fall with a lot of reds. This is because during warm, sunny days leaves can produce lots of sugar, but cool nights prevent the sugar sap from flowing through the leaf veins and down into the branches and trunk, where it is used by the plant. Researchers have found that anthocyanins are produced as a form of protection and allow the plant to recover the "lost" nutrients from the leaves before they fall off. This insures that the tree will have adequate nutrients for the next growing season.

The amount of rain in a year also affects autumn leaf color. A severe drought can delay the arrival of fall colors by a few weeks, and sometimes the leaves just turn brown and drop without much color. A warm, wet period during fall will lower the intensity, or brightness, of autumn colors. A severe frost will kill the leaves, turning them brown and causing them to drop early. The best autumn colors occur when there's been a warm, wet spring, a summer that's not too hot or dry, and a fall with plenty of warm sunny days and cool nights.

Warm days and crisp nights. Apples and hunting. The smell of those colored leaves and pine needles as you crunch them under your feet. That's fall in Idaho!

This article first appeared in Woodland NOTES, Vol. 16, No. 1.

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Ashland 92