

WISCONSIN DEPARTMENT OF NATURAL RESOURCES: THE SCIENCE OF FALL LEAF COLORS

Leaf color comes from pigments. Pigments are natural substances produced by leaf cells. The three pigments that color leaves are: chlorophyll (green); carotenoid (yellow, orange and brown); and anthocyanin (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.

Carotenoids create bright yellows and oranges in familiar fruits and vegetables. Corn, carrots, and bananas are just a few of the many plants colored by carotenoids.

Anthocyanins add the color red to plants, including cranberries, red apples, cherries, strawberries and others.

Chlorophylls and carotenoids are in leaf cells all the time during the growing season. But the chlorophyll covers the carotenoid - that's why summer leaves are green, not yellow or orange. Most anthocyanins are produced only in autumn, and only under certain conditions. Not all trees can make anthocyanin.

HOW LEAVES CHANGE COLOR

As the Earth makes its 365-day journey around the sun, some parts of the planet will get fewer hours of sunlight at certain times of the year. In those regions, the days become shorter and the nights get longer. The temperature slowly drops. Autumn comes and then winter.

Trees respond to the decreasing amount of sunlight by producing less and less chlorophyll. Eventually, a tree stops producing chlorophyll. When that happens, the carotenoid already in the leaves can finally show through. The leaves become a bright rainbow of glowing yellows, sparkling oranges and warm browns. What about red leaves? Read on.

DO LEAVES CHANGE BECAUSE OF WEATHER?

Perhaps you've noticed that in some years,



Photo by Jolean Louis

A view of all of the vivid colors starting to show at Bakken's Pond between Spring Green and Lone Rock Oct. 5. Ever wondered why leaves turn a certain color? Read on.

the red fall colors seem brighter and more spectacular than in other years. The temperature and cloud cover can make a big difference in a tree's red colors from year to year.

When a number of warm, sunny autumn days and cool but not freezing nights come one after the other, it's going to be a good year for reds. In the daytime, the leaves can produce lots of sugar, but the cool night temperatures prevent the sugar sap from flowing through the leaf veins and down into the branches and trunk. Anthocyanins to the rescue! Researchers have found out that anthocyanins are produced as a form of protection. They allow the plant to recover nutrients in the leaves before they fall off. This helps make sure that the tree will be ready for the next growing season. Anthocyanins give leaves their bright, brilliant shades of red, purple and crimson.

The yellow, gold and orange colors created by carotenoid remain fairly constant from year to year. That's because carotenoids are always present in leaves and the amount does not change in response to the weather.

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. 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 come 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.

YOU CAN TELL A TREE FROM ITS COLORS

You can use the fall leaf color to help identify different tree species. Look for these

leaf colors on the trees in your neighborhood:

- Oaks: red, brown or russet
- Hickories: golden bronze
- Dogwood: purple-red
- Birch: bright yellow
- Poplar: golden yellow
- Maple trees show a whole range of colors:
 - Sugar maple: orange-red
 - Black maple: glowing yellow
 - Red maple: bright scarlet

WHY LEAVES FALL

A tree's roots, branches and twigs can endure freezing temperatures, but most leaves are not so tough. On a broadleaf tree like a maple or a birch, the tender, thin leaves -- made up of cells filled with water sap -- will freeze in winter. 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.

Evergreen trees -- pines, spruces, cedars and firs -- don't lose their leaves, or needles, in winter. The needles are covered with a heavy wax coating and the fluids inside the cells contain substances that resist freezing. Evergreen leaves can live for several years before they fall and are replaced by new growth.

On the ground, fallen leaves are broken down by bacteria, fungi, earthworms and other organisms. The decomposed leaves restock the soil with nutrients and become part of the spongy humus layer on the forest floor that absorbs and holds rainfall.

AN EXCERPT OF HUNTING IN WISCONSIN: PEACE OF THE WOODS MAKES IT EASY TO FORGET

J.B. Sensenbrenner, Author, *The Love of Hunting*

This story is an excerpt from "The Love of Hunting," by J.B. Sensenbrenner of Appleton. The author recounts his many adventures enjoying hunting and fishing in Wisconsin, from youth experiences to present day. The book is available for order through Arcadia Books.

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My boots crunching on the gravel road sounded like a marching army. Thankfully, I had the cover of darkness hiding me as I slowed down to soften the sound.

"Crunch ... crunch ... crunch." No matter what I did, my steps were loud. I put my head down, realizing it was hopeless to be any quieter, and walked faster to get to the logging road.

After walking past the trail in the blackness, I turned around and walked back along the shoulder of the road until I found the trail in the tall grass. I stepped off the road into a foot of water. What a terrible way to start the hunt.

I was excited because it was the opening day of the deer bow hunting season. The cold water soaking my right foot didn't slow me down as I followed a

narrow deer trail.

Something jumped to my left! I don't know who was more surprised, me or the creature. I froze and listened. It was a stalemate. I moved first, walking slowly to my tree stand. It felt good to be in the woods engulfed by nature. I climbed the tree and sat down to wait for daylight. I listened to the eerie silence. It was so quiet that it challenged my hearing to tune into the slightest sounds.

I turned my head left and right, trying to identify noises. I heard water running in a babbling brook. A second sound was the breeze shaking leaves in the maple trees. Then it was quiet again. It was so peaceful.

I felt hidden from the world. As the morning light started to separate the trees from the sky, I felt safeguarded by the green September leaves surrounding me, making it hard for me to be seen and for me to see deer.

It was good. I felt like my purpose was to blend in with God's creation. Mission accomplished.

I sat back and took a deep breath.

Woods air was different than city air.

It wasn't hurried or pressured. It was clean and fresh. My eyes opened when I heard crunching.

Two shadows appeared with long necks slowly moving up and down chewing acorns. I could hear the shells crack. Two young deer were eating their breakfast.

I looked around for their mother. A scratching of leaves on the hilltop gave her away. Within minutes, the deer drifted away like clouds and disappeared into a thicket on my left.

Then it was quiet again. The peace of the woods was beautiful. I sat back once again and relaxed.

After sitting several hours, I climbed down and walked back to our small log cabin. I felt cleansed. I wasn't done hunting but was satisfied.

When I opened the cabin door, I saw my bow and arrows in their case leaning in the corner.



Photo by Linda Freshwater Arndt, vis WI DNR

Sometimes, simply spending time in a quiet woods — with maybe a wildlife visitor or three along the way — is enough for even the most seasoned hunter.

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