

For Immediate Release

The Science of Autumn Beauty

CHAMPAIGN, IL (October 2012) – For many people, autumn weather brings a welcomed time of the year. Adding to the pleasure of the season are the vibrant colors displayed in nature. Leaf pigment, the physics of light, weather conditions, plant species, and geography all play important roles in the color of autumn.

Leaf Pigment and Light

Thanks to the physics of sunlight striking pigments in leaves, we see various leaf colors throughout the year. Leaf pigments play a crucial role in the colors we see. Chlorophylls, carotenoids, and anthocyanins present in a leaf help determine what color the leaf will display.

The pigment that gives leaves their green color is chlorophyll. Chlorophyll is used in photosynthesis which is the process that uses sunlight to transform carbon dioxide and water into carbohydrates (sugars) that fuel tree growth. During the spring and summer, with more hours of sunlight and warmer temperatures, this photosynthetic process is most active thus leaves are green.

When daylight hours become less and temperatures are cooler, photosynthesis slows down, and there is less chlorophyll. This decline reveals a yellow or orange pigment, carotenoid. Carotenoids, the same pigment found in carrots and corn, are usually masked by the chlorophyll.

Unlike chlorophyll and carotenoids which are present in leaf cells throughout the growing season, anthocyanins are produced in autumn. Anthocyanins give color to familiar fruits such as cranberries, red apples, cherries, and plums. These complex water soluble compounds in leaf cells react with excess stored plant sugars and exposure to sunlight creating vivid pink, red, and purple leaves. A mixture of red anthocyanin pigment and yellow carotene often results in the bright orange color seen in some leaves.

Weather and Color

Weather conditions that occur before and during the decline of chlorophyll production can affect the color that leaves may display. Carotenoids are always present so the yellow and gold colors are the least affected by weather.

Colors most affected by weather are the red tones created by anthocyanin. On warm sunny days lots of sugar is produced in the leaves. Trees exposed to brighter sunlight generate the reaction between the anthocyanins and the excess sugar creating the bright red hue.

Cooler temperatures cause the veins in the leaves to gradually close preventing the sugars from moving out which preserves the red tones. Thus a succession of warm sunny days and cool crisp nights can paint the most spectacular display of color.

The level of moisture in the soil can also affect autumn color. A severe summer drought can delay the onset of color change by weeks. Ideal conditions for producing the most brilliant colors are a warm wet spring, favorable summer weather, and sunny fall days with the cooler temperatures at night.

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Species and Geography

The genetics of different tree species help determine what color the leaves will turn. Color depends on the levels of iron, magnesium, phosphorous, or sodium in the tree and the acidity of the chemicals in the leaves. Some tree species displaying yellow foliage are ash, birch, beech, elm, hickory, poplar, and aspen. Red leaves are seen most often in dogwood, sweetgum, sumac, and black tupelo trees. Some oaks and maples present orange leaves while others range in color from red to yellow, depending on the specific species.

Deciduous forests and trees, with their many broad leaves that change color almost in unison, display the most noticeable fall color. Evergreen species also display fall colors, only slowly and gradually. The appearance of autumn color starts as early as mid September in more northern latitudes and moves southward, reaching its peak in October, but color continues to appear in more southern regions and higher elevations in the west throughout November.

Only a few places in the world have the combination of tree species and climatic conditions necessary for the most vivid fall foliage. Some of the best locations with broadleaved deciduous trees and favorable conditions for brilliant fall color are:

- Northeastern U.S. (New England)
- Southeastern Canada
- Adirondack, Appalachian, Smokey, and Rocky Mountain Regions
- Select areas around Seattle, Portland, and San Francisco.

Remember that cooler, higher elevations will display color before lower, warmer geographic regions.

Even with these facts, the timing, location, and intensity of autumn color are not completely predictable. To truly experience the colorful display, you must be adventurous. There are many states with thousands of scenic byways designed to focus on the palettes of autumn color. So even if you live in a region that does not produce an array of color, take an autumn vacation and explore nearby states that do. For up to date regional information, you may contact the U.S. Forest Service Fall Color Hotline at 1-800-354-4595 or on the internet at <http://www.fs.fed.us/news/fallcolors/index.shtml>.

About ISA

The International Society of Arboriculture (ISA), headquartered in Champaign, Ill., is a nonprofit organization supporting tree care research and education around the world. To promote the importance of arboriculture, ISA manages the consumer education web site, www.treesaregood.org, which fulfills the association's mission to help educate the public about the importance and value of proper tree care. Also, as part of ISA's dedication to the care and preservation of shade and ornamental trees, it offers the only internationally-recognized certification program in the industry. For more information on ISA and Certified Arborists, visit isa-arbor.com.



International Society of Arboriculture

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