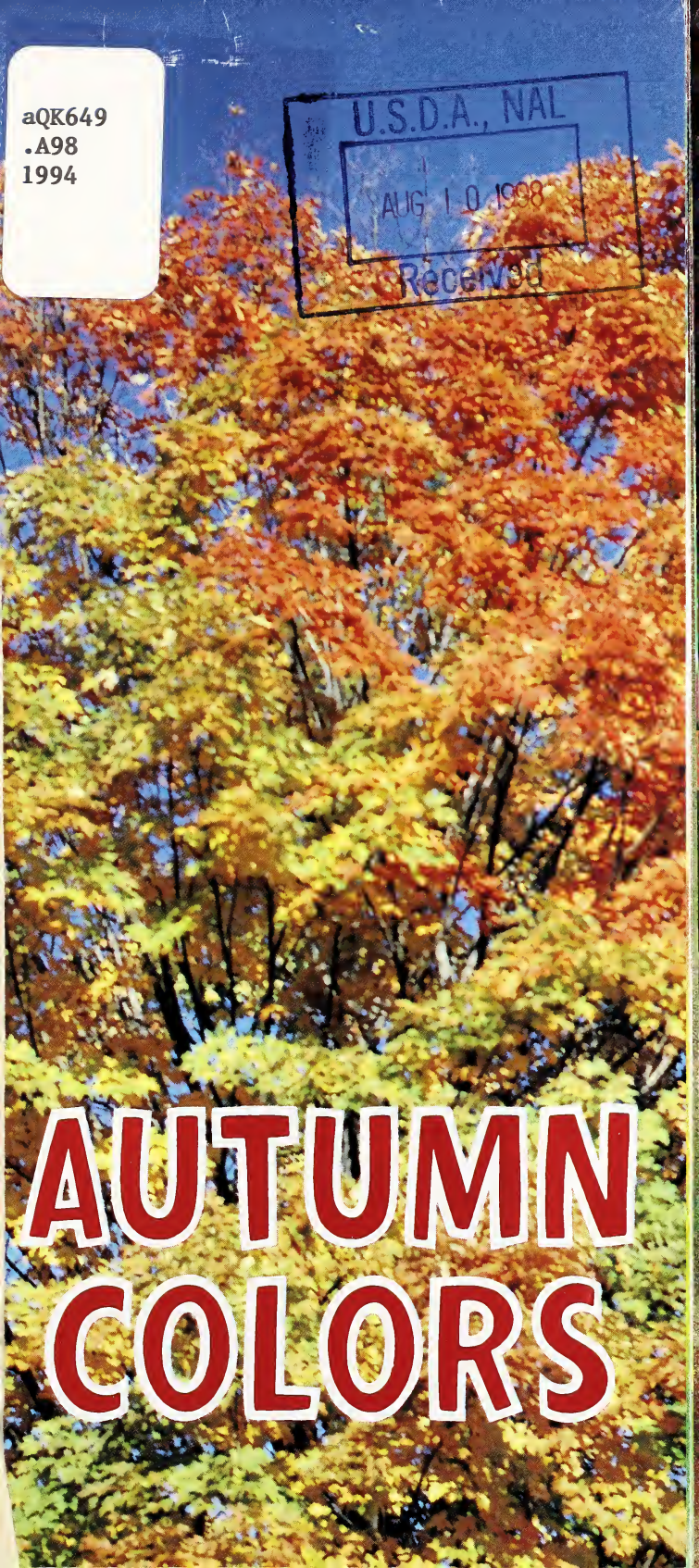


AUTUMN COLORS

DAYS OF AUTUMN

The "Indian summer" days of eutumn, when the days are clear and sunny and the nights cool and crisp, provide an almost irresistible lure to those who enjoy the outdoors. This type of weather is also the most favorable for a spectacular show of autumn colors, making this season of the year still more delightful.

Scientists don't yet fully understand all of the complicated actions and even more complicated *interactions* involving pigments, sunlight, nutrients, chemicals, hormones, temperetures, length of daylight, rain, genetic traits, and so on that make for a perfect eutumn color displey. As research probes deeper end deeper into the basics of life, more and more answers will be forthcoming.

But full understanding is not necessary to the enjoyment of the lovely days of eutumn in forest, city, and countryside. Americans are blessed with many opportunities to see this yearly splendor.

The roads, trails, lakes, streams, and recreation areas of the National Forests are available for your pleasure.

The forest roadsides of autumn attract by far the greatest number of sightseers. But trails, often winding deep into forest solitude, offer special closeness to nature for hikers, backpackers, and horseback riders.

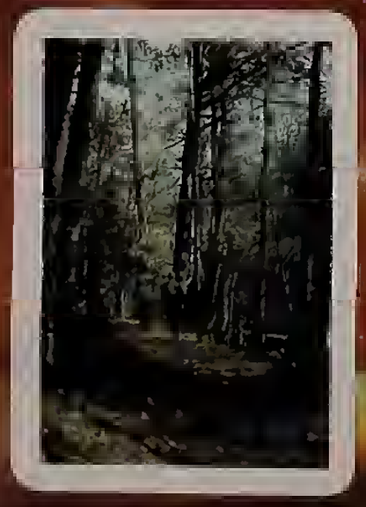
Streems and lakes add special enchantment in the fall for fishermen and boeters, and colorful backgrounds for photographers. The surfaces of quiet forest lakes double the colorful mantle of their surrounding hills.

Hunting in eastern forests often coincides with the peak of the color season, end the pleasure of just being out-of-doors in the golden days rivals the thrill of the hunt.

And even along city streets the colors blaze forth, delighting residents of towns fortunate or farsighted enough to have retained some trees.

"Sweet and smiling are thy ways,
Beauteous, golden Autumn days."

Will Carleton



Each acre of the 191 million in National Forest lands belongs to the people of the United States. Together, these acres represent a great treesury of netural resources.

Netionel Forests provide a variety of uses, products, and pleasures for people. They were originelly established to protect watersheds, and they still do. But in addition, these forest lands are now rich in timber, wildlife, forege, and recreation opportunities.

These and other uses are directed by the Forest Service, U.S. Department of Agriculture. Specialists in many fields coordinate and belance these uses so that one doesn't interfere with another, and so that all Amoricens will receive maximum benafits throughout the years.

In addition, Forest Service research strives to find new and better ways of managing and using forests and their products. Also, through cooperation with Stetes and with private owners of forestland, tha Forest Service encourages the practice of good forestry throughout the Nation.

HOW LEAVES CHANGE COLOR

A GREEN LEAF IS GREEN beceuse of the presence of a group of pigments known as *chlorophylls*. When they are abundant in tha leaf's cells, as they are during the growing seeson, the chlorophylls' green color dominates and masks out the colors of any othar pigments that mey be present in the leaf. Thus the leeves of summer are cherecteristically green.

The chlorophylls have a vital function: they cepture some of the sun's energy and utiliza it in the manufacture of the plant's food - simple sugers which are produced from weter and carbon dioxide. These sugars are the basis of the plent's nourishment - the sole source of the carbohydrates needed for growth end development.

In their food-manufacturing process, the chlorophylls themselves break down and thus are being continually "used up." During the growing season, however, the plent replenishes the chlorophyll so that the supply remains high and the leaves stay green.

But as autumn approaches, certain influences both inside end outside the plent cause the chlorophylls to be replaced at a slower rate than they ere being used up. During this period, with the total supply of chlorophylls gradually dwindling, the "mesking" effect slowly fades away. Then other pigments that have been present (along with the chlorophylls) in the cells all during the leaf's life begin to show through. These are the *carotenoids;* they give us colorations of yellow, brown, orange, and the many hues in between.

The reds, the purples, and their blended combinations that decorate eutumn follage coma from another group of pigments in the cells called *anthocyanins*. These pigments are not present in the leaf throughout the growing season as are the carotenoids. They develop in late summer in the sap of the cells of the leaf, and this development is the result of complex interactions of many influences - both inside and outside the plant. Their formation depends on the breakdown of sugars in the presence of bright light as the level of a certain chemical (phosphate) in the leaf is reduced.

During the summer growing season, phosphate is at a high level. It has a vital role in the breakdown of the sugars manufactured by chlorophyll.

But in the fall, phosph[illegible] along with [illegible] other chemicals and nutrients, moves out [illegible] leaf into th[illegible]m of the plent. When this heppens [illegible]r-breakdown [illegible] changes, leading to the production o[illegible] pig[illegible] The brighter the light during this period, t[illegible] on of anthocyanins and the more brillant the resulting color display thet we see. When the days of autumn are bright and cool, and the nights chilly but not freezing, the brightest colorations usually develop.

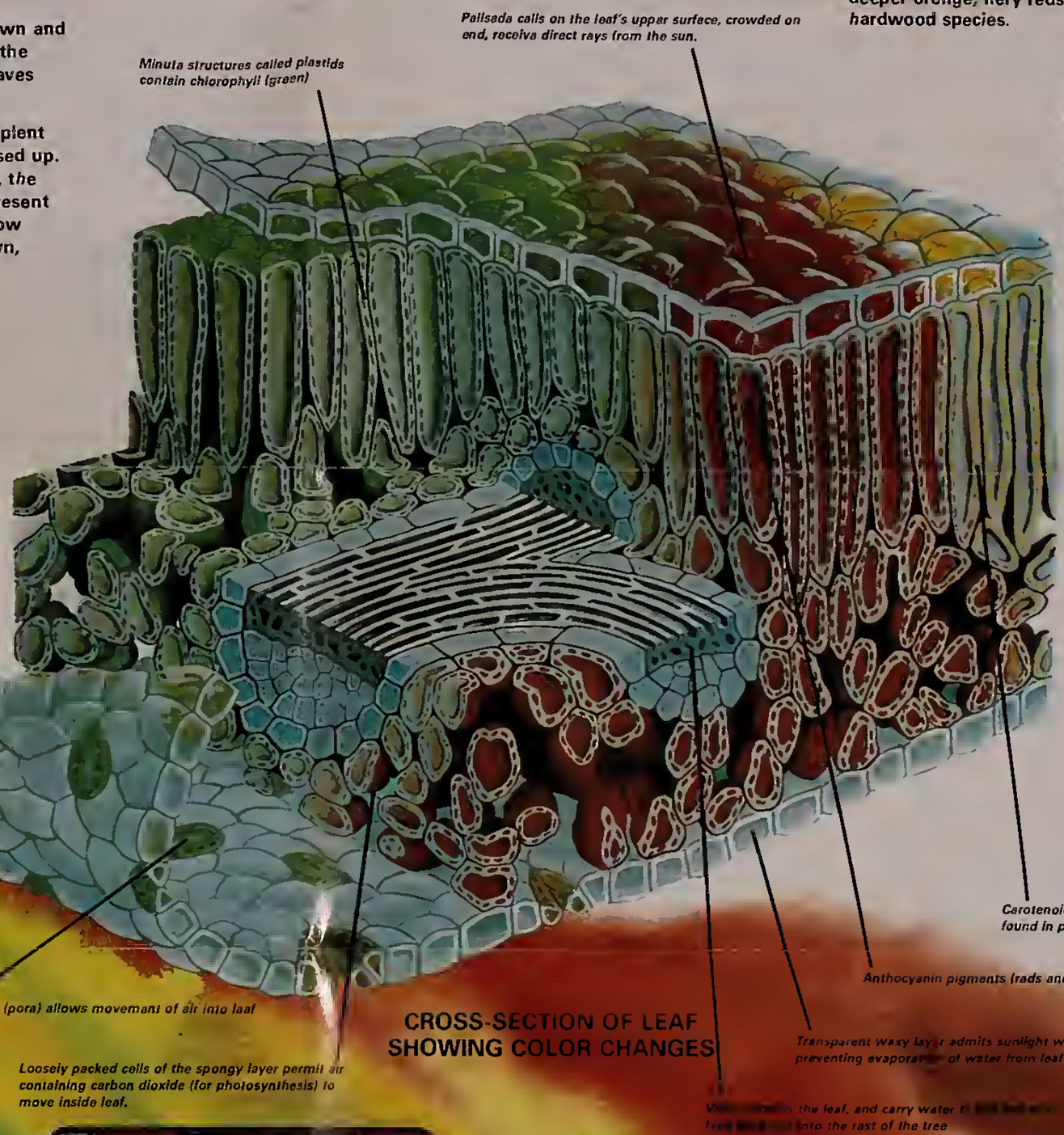
Anthocyanins temporarily cr[illegible]es of some of the very young leaves es tha[illegible]m the buds in eerly spring. They also give[illegible] color to such common fruits as c[illegible]s, blueb[illegible], ch[illegible]nd plums.

In our [illegible]ow up vividly in the ma[illegible] sweetgum, dogwood, tupelo, [illegible]mon. These same pigments of-[illegible]n com[illegible]h the carotenoids' colors to give us the deeper orenge, fiery reds, and bronzes typical of meny hardwood species.

The carotenoids occur, along with the chlorophyll pigments, in tiny structures - called plastids - within the cells of leaves. Sometimes they ara in such ebundance in the leaf that they give a plant a yellow-green color, even during the summer. But usually we becoma aware of their presence for the first time in autumn, when the leaves begin to lose their *chlorophyll*.

Carotenoids are common in many living things, giving characteristic color to carrots, corn, canaries, and daffodils, as well as egg yolks, rutabagas, buttercups, and bananas.

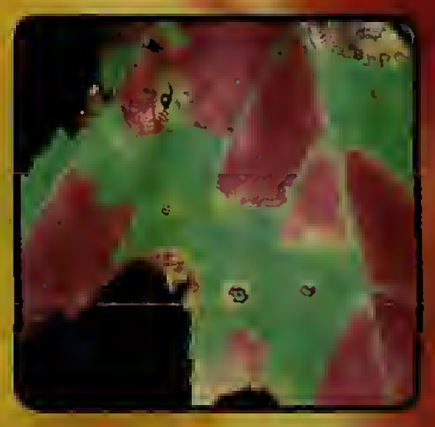
Their brilliant yellows and oranges tint the leaves of such hardwood species as hickories, ash, maple, yellow-poplar, aspen, birch, black cherry, sycamore, cottonwood, sassafras, and alder.



CROSS-SECTION OF LEAF SHOWING COLOR CHANGES

In late summer the veins that carry fluids into and out of the leaf ara gradually closed off as a layer of special cork cells forms at the base of each leaf. As this cork layer develops, water and mineral intake into the leaf is reduced, slowly at first, and then more rapidiy. It is during this time that the chlorophyll begins to decrease.

Often the veins will still be green after the tissues between them have almost completely changed color.



Individual leaves, even of the same species, turn color in many different ways.

These maple leaves show both a complete change across an entira leaf (left), and partial change (right), with blocks of tissues turned brilliant red while adjacent areas still remain green.

When conditions of temperature, moisture, and the amount and strength of sunlight are all in the right combinations, we will be treated to spectacular fall colorations.

Then entire trees blaze forth in vivid hues, along city streets as well as across the open countryside.

Certain specias almost always lead off the autumn color display. On a yellow-poplar (above), a singla leaf turns to clear yellow in late summer, hinting of the color season still weeks away.

Or, each leaf may be two or more colors at the same time, as in the black tupelo (above).

The yellow from the carotenoid pigments blends with the red from the anthocyanins.

Occasionally clusters of leaves, or leaves of entire branches, will be in full autumn dress ahead of others on the same tree.

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Forest Service • Southern Region

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