



Creating the Nation's first BioPark

National Zoological Park · Smithsonian Institution · Washington, D.C. 20008-2598

Letter From the Desk of David Challinor
December 1996

A century ago Longfellow wrote:

"Under the spreading chestnut tree
The village smithy stands..."

When this was written, the reader could easily visualize this magnificent tree that once dominated the eastern forests from southern Maine to Georgia. They grew tall and straight in the woods, filling the canopy and bearing bountiful crops of edible nuts at irregular intervals as oak and beech do today. The nuts of these hardwoods are collectively known as mast and furnish an important food source for bears about to hibernate as well as for deer and turkey. In medieval Europe pigs were driven through the forest to fatten on the mast crop.

In 1904 the fate of the great American chestnut tree was sealed. A particularly virulent strain of fungal pathogen entered the USA on a shipment of European chestnut logs and within a few decades the fungus infected all American chestnuts which had no immunity to the new arrival. European chestnuts, which are of the same genus as the American ones, were relatively resistant to the more common hypo-virulent strain of this fungus in Europe, but frequently succumbed to the rarer hyper-virulent strain, the type we now believe entered America on the log shipment. It was just bad luck that the more powerful of the two types of fungus was the one that entered the U.S. because the local trees might have resisted the milder pathogen as had their European relatives.

The fungus kills by extending its mycelial threads through the chestnut tree's cambium layer. This layer or ring is one cell wide and forms the tree's inner and outer layers (sap wood and heartwood) and is therefore the source of annual diameter growth. When the mycelia completely encircle the cambium layer, the tree is effectively girdled and soon dies. The stump, however, continues to sprout but sadly, as soon as a sprout grows large enough to start fruiting, the fungus attacks and kills it. Before the blight struck, some American chestnut trees were planted well beyond their natural range; being geographically isolated, they survived to provide viable pollen for cross breeding experiments with resistant old world chestnut species. None of the latter, however, grew as tall or as straight as the American species and it is these growth characteristics that geneticists have been trying to retain in the hybrids. The results of the last 75-80 years' breeding efforts now seem



promising for individual hybrid chestnuts, with the requisite form, and they are becoming mature enough to fruit. Success will be determined by whether the trees grown from the nuts of these hybrids retain their parents' resistance or if they can survive only by being cloned from the resistant parent. Reintroduction to forests with clones is not a practical way to re-establish the species in the wild.

Besides the chestnut, another American forest tree has vanished from the wild, this one shortly after it was botanically discovered. In 1765 the early plant explorer, William Bartram, found *Franklinia* in Georgia. He sent seed to the Morris Arboretum in Philadelphia and named the new found tree after Benjamin Franklin. It was last seen in the wild 25 years after its discovery and today survives only as a horticultural specimen. Fortunately, we can still enjoy the beautiful white blossoms of this fall flowering tree, which is still readily available in commercial nurseries.

The ginko, a tree better known than *Franklinia*, has not been seen in the wild for millennia. It is a gymnosperm, which means naked seeded, in that its seed is not enclosed in an ovary; it thus belongs to the same large category as the conifers. Unlike most conifers, however, it is dioecious -- the male and female flowers grow on separate trees instead of having both kinds on the same tree, as in oaks and pines. Most city grown ginkos are male because the fruit has a soft outer layer which produces a pungent rotten-egg smell when it drops after ripening and is crushed by cars or pedestrians. The internal nut, however, is readily eaten in the Orient. The tree is still popular and frequently planted in cities because of its high tolerance for pollution.

If the ginko is associated with cities, then the American elm evokes images of shaded streets in towns and villages from New England to the mid-west. The elm may be the grandest of all eastern American trees and until the 1930's had dominated village greens for centuries. In the early 1900's, elms planted by George Washington were still alive at Mount Vernon. On the Cambridge (MA) Common, the huge elm under which Washington was said to have taken command of the Continental Army died in the 1920's. Pieces of its wood were salvaged for bookends and other souvenirs, but one skeptical dendrologist took his hand lens, counted the rings on the stump, and calculated that the tree must have been a mere sapling in July 1775. Washington, who was well over six feet tall, would have had trouble standing in its shade. Whether that story is true or not, other historic elms have lived long; one in Avon, NY had a diameter of almost 50' and was over 600 years old.

Sadly, this magnificent tree has fallen on hard times. New Haven, CT, where I lived for ten years (1957-66), used to be known as Elm City, but today most of its large elms have succumbed to a fungal blight (Ophiostoni ulmi) that entered the US in 1931 on a shipment of European elm logs bound for a furniture plant in Cleveland. This fungus lives on the body of a ubiquitous elm bark beetle and infects the elm when a beetle holes through the bark. Once inside, the burrowing beetle soon reaches the cambium layer of cells and the fungus it carries rapidly spreads in this layer, thereby killing infected branches. Symptoms of infection are leaf yellowing and loss even in spring and summer. Soon whole parts of the tree are defoliated and death occurs in as little as two years after the initial infection. Regular spraying can control the bark beetle hosts to some extent, as does the removal of diseased trees. Both sanitary measures are generally needed to maintain groves of elms, but most towns and cities cannot afford these treatments. The National Park Service, however, exercises such precautions and has been successful in Washington, D.C.; it still plants elms on the Mall between the Capitol and the Washington monument. Young elms regularly replace dying old ones around the Lincoln and Jefferson memorials. In other cities, however, when large elms die they are often interchanged with oaks, especially willow oak, which seems to do particularly well around Washington where it grows relatively quickly and produces a widespread crown.

Because of the intensive labor needed to keep American elms alive, other simpler solutions have been tried. A mild fungicide has been injected into an elm to control fungal spread, but with only marginal success. The best hope seems to be in breeding resistant trees, and for the past 20 years researchers have been following this approach. The results of this effort are encouraging. As a first step, scientists located elms that appeared to survive Dutch elm disease. Thousands of elm seedlings and cuttings from resistant elms were inoculated purposely with the fungal pathogen. Only about one in 100,000 was completely immune. Many isolated elms, thought to be resistant, turned out not to be so when their cuttings succumbed after being infected. It was found that most of the "disease resistant" trees had just been lucky in avoiding bark penetration by infected beetles.

Scientists took cuttings from the tops of as many disease-free elms that they could find growing among infected ones. Roots were forced by exposure to a growth hormone and the cuttings were then cultivated in large batches in greenhouses. All were inoculated with the fungus and those that survived for 3 or 4 years were segregated for close observation of their apparent resistance to Dutch elm disease. By 1983, the National Arboretum reported in its newsletter (Fall '96) that 20 of the most disease resistant clones had been isolated and grown for nine years.

Then the best eight clones -- that is eight groups of genetically identical saplings grown from cuttings taken from eight disease resistant elms -- were sent to about 30 nurseries around the country to be planted and monitored for growth characteristics and disease resistance. After four years of testing, two varieties of American elm were designated the most resistant clones. Although not 100% resistant, they are by far the most promising and the cooperating nurseries are now growing them for distribution. It will be another two or three years before they are available commercially, but it seems reasonable to hope that our grandchildren will enjoy the shade and majesty of these great American trees.

I am strongly attracted to trees; they appeal to me not only aesthetically, but also for their longevity. Trees 200 years old or more are not uncommon, and the thought that they were alive when Washington was President makes me humbly aware of the transitory nature of humans as opposed to other organisms -- particularly trees. I enjoy today century-old trees planted by my grandfather in the 1890's on our Connecticut place.

I urge you all to consider planting a tree to celebrate the birth of a relative -- even a street tree. When these children turn six or seven and thus old enough to remember, show them their trees, which will probably outlive them and will be enjoyed by generations to follow.

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