

Methuselahs in Our Midst

Scientists and tree lovers are discovering old-growth trees—and clues to the past—in places where they were long thought to be lost

MIDDLEBURGH, NEW YORK—At the edge of a windy escarpment, towering 245 meters above this rural valley where Revolutionary War militias and British troops once clashed, arborist Fred Breglia is admiring a view that probably has changed little in 300 years. In the flat bottomlands down by the Schoharie Creek are wooden houses, the steeple of the Middleburgh Methodist church, and wide ancestral fields of corn and cows, sloping up to stands of second-, third-, or fourth-growth timber; people have been cutting every tree in sight here for centuries. But as Breglia has found, they missed a few. Rooted into the precipice and the steep talus at its base, Breglia has discovered a strip of gnarled red cedars, many no more than 20 or 25 centimeters across—and up to 500 years old. Twisty old chestnut oaks nearby run to 400 years and more. “This place has literally never been touched. It’s too hard to get at, and the trees aren’t worth logging,” he says.

The site is not unique. Other people are now finding scores of places in eastern North America where ancient trees have somehow been protected or hidden from the logger’s saw. A few of these elder trees are big, but many, like the red cedars, survived in part because they grew slowly in marginal places and lack the size to match their age. Located on up to 800,000 hectares in scattered bits—perhaps 0.5% of the primeval forest, according to Robert Leverett, a seasoned amateur old-tree searcher in Holyoke, Massachusetts—they offer scientists a new window on past climate, pollution, forest ecology, and human history. “The first big breakthrough was just to show you could find these sites,” says Edward Cook, head of the dendrochronology lab at Columbia University’s Lamont-Doherty Earth Observatory in Palisades, New York. “Now we know they have important and interesting things to tell us.”

Discovering survivors

Until recently, many professionals believed that the East’s native forests were gone by 1830, when the region was basically a giant sheep pasture. Except for a few remnants in

parks, it was assumed that “old growth” was only in the cathedral-like Western groves of sequoias and redwoods. Then researchers such as dendrochronologist David Stahle of the University of Arkansas, Fayetteville, began coring Eastern trees for climate reconstructions, and they turned up surprises. In 1985, Stahle documented what are still the



Hanging on. Fred Breglia (left) and Neil Pederson check out a dead cliffside cedar near Middleburgh, New York.

East’s oldest known living trees: stands of 1700- to 2000-year-old bald cypresses in swamps along North Carolina’s Black River. Loggers had bypassed them because they were gnarly and often hollow.

Cook has found dozens of other sites with presettlement hemlocks, oaks, and other species. And recently, dendrochronologist Peter Kelly of the University of Guelph, Canada, extracted an as-yet-unpublished 2767-year tree-ring chronology from living white cedars in Ontario that are up to 1050 years old, plus well-preserved dead ones that stretch back to 3900 years. The diminutive trees survived because, like the Middleburgh cedars, they are on inaccessible cliffs

(*Science*, 12 March 1999, p. 1623). Kelly says the rings suggest that very hot summers, like those increasingly seen in the Northeast, may retard the cedars’ already slow growth.

Other examples illustrate the corners of the landscape where ancient trees might survive: Small lake islands in lower Ontario and Quebec harbor large conifers aged at up to 800 years; the world’s oldest known pitch pine germinated in 1617 on a rocky ridge at Mohonk, an upstate New York mountain resort long held by a conservation-minded family; a humble-looking 687-year-old tupelo stands in a backyard swamp near Concord, New Hampshire; and 200- to 400-year-old longleaf pines thrive on northern Florida’s Eglin Air Force Base, which maintains the pines’ fire-dependent habitat with blazes started by bombs.

Few sites are true “virgin” forest. Rather, they’re the leftover scraps—rarely more than 30 hectares and selectively logged or otherwise disturbed. But a few bigger tracts remain: parts of New York state’s Adirondack and Catskill forest preserves, set aside in the 19th century; Great Smoky Mountains National Park, which is up to 25% old growth; and some 3800 square kilometers of post oaks up to 400 years old, spread across rugged uplands in Texas, Oklahoma, and Kansas. “We used to get excited about trees that were 200 years old, but this has changed our whole concept of what is old,” says Gary Walker, a biologist at Appalachian State University in Boone, North Carolina, whose paper on 1000-year-old cedars on ledges along the Obed River of eastern Tennessee is in press at *Southern Naturalist*.

The East can’t match the West, however: Living bristlecone pines in Nevada and California, the world’s oldest known trees, reach 5000 years. Plant ecologist Charles Cogbill of Hubbard Brook Experimental Forest near North Woodstock, New Hampshire, says that most common Eastern species such as sugar maples and red oaks max out at 350 to 400 years, perhaps because many have canopy structures that make them inherently more susceptible to damage than, say, sequoias are. And the East has insects, pathogens, ice storms, and hurricanes aplenty that chip away at trees until they die not so much of old age but of the thousand cuts that time inflicts. Still, bald cypresses, cedars, and eastern hemlocks can reach 500-plus years, says Cogbill, although no one knows the maximum possible ages for most species, nor why one outlives another.

Amateur tree lovers have played a surprisingly large role in spotting these survivors. Twenty years ago, computer analyst Leverett turned his passion for hiking into a systematic weekend search for old trees, and he’s now

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recognized by scientists and amateurs alike as a sort of guru of Eastern old growth, having found dozens of sites. He is co-author of the forthcoming *Sierra Club Guide to the Ancient Forests of the Northeast*.

Among his dozens of emulators is Breglia, head horticulturist at the Landis Arboretum in Esperance, New York, who spotted the Middleburgh cedars by squeezing through a fracture in the bedrock to get below the cliff face. He found himself next to a rough-barked cedar that had apparently survived being blown over at least twice and had developed a wild U-shaped main stem with numerous extra trunks. A cross-section of a nearby dead tree revealed 500 rings.

The long view

Once the amateurs discover ancient trees, the scientists swoop in. One recent day Neil Pederson, a doctoral candidate at Columbia, scrambled alongside Breglia through the talus at Middleburgh. Pederson, who is studying how climate change affects Eastern forests, says that the oaks on this site are some of the oldest anywhere and that only a series of ledges near Franklin, West Virginia, holds similarly old red cedars. Researchers compare tree rings to local weather records to explore the effects of climate on trees, then try extending the record back into the uncharted past by using the rings alone. A group headed by Daniel Druckenbrod, a graduate student at the University of Virginia, Charlottesville, has refined drought records by coring trees at the estates of U.S. Presidents James Madison and Thomas Jefferson, then comparing rings to the men's daily weather diaries, written when the trees were young.

Pederson's data so far suggest that some species further north are growing faster with the increased warmth, but that others near their southern range limits, such as white spruce, may be experiencing heat stress. This is the first good support for theoretical models predicting that the composition of many Eastern forests could change significantly in the next 100 years, as some species migrate north 100 to 250 kilometers. "You need long chronologies to tease out these different effects," Pederson explained as he cranked hard on a hand borer to extract a core from a battered 65-centimeter-diam-

eter chestnut oak. "Holy moley. Holy moley!" he cried, pulling out the core and inspecting it. "This is in the 300-, 400-year range!"

Global-warming studies are only one application. Cook believes that most eastern species are in fact more sensitive to moisture than temperature, and since the 1970s he has assembled a widening chronology of droughts using tree rings. Early studies reached back to about 1700 and showed that the Dust Bowl of the 1930s was the worst recorded. However, recently Cook, Stahle, and others have found enough older trees to extend the record back another 200 years and more, and they've shown that at least two earlier episodes were far worse, with some regions seeing little rainfall for up to 5 years. Stahle asserts that one such episode may have caused the mysterious disappearance of the earliest English colony on Roanoke Island, Virginia, in the 1580s (*Science*, 24 April 1998, p. 564). "Getting the really old trees completely changes the picture," says Cook. "It's scary, because it means this could happen again, and municipal water systems today couldn't possibly stand droughts of that magnitude."

Stahle and his colleagues, along with geologist Roy Van Arsdale of the University of Memphis, Tennessee, have used damaged trunks and suppressed growth in old trees to demonstrate that the devastating New Madrid, Missouri, earthquakes of 1811–12 were the worst of the last 500 years. Some trunks cracked, then largely ceased growing for 50 years, probably due to shaking of their roots, says Malcolm Cleaveland, a geographer at the University of Arkansas, Fayetteville.

Some believe that the trees' greatest scientific value today is their genetic material. Alan Gordon, an emeritus scientist at the Forest Research Institute in Sault Ste. Marie, Canada, argues that loggers have long "high-graded" forests, taking the tallest, straightest trees and leaving

twisted, smaller ones to reseed. That might select against straightness and height—bad news for loggers—and remove genes that allow species to adjust to fluctuating climate or new diseases. "It's a sad tale," says Gordon, who advocates collecting seed from dwindling old trees. Lee Frelich, director of the Center for Hardwood Ecology at the University of Minnesota, Twin Cities, is beginning a project to test for gene loss in New England.



Splendid isolation. These ancient hemlocks and white pines in the Mohonk Preserve in upstate New York were too small and remote to be worth logging and have also been protected by their owners.



Magic forest. Few elder trees are as big as this ancient beech in Cook Forest, Pennsylvania.

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