CROSS TIMBERS

by Elizabeth Dodd

Remains of tree from 1747. All photos, unless otherwise credited, by Elizabeth Dodd

In 1974, A.W. Küchler, a geographer at the University of Kansas, published what he called a "new vegetation map" of Kansas. It was not, however, a presentation of the agricultural landscape which then dominated the state. This "new" map depicted what he called, in a scientific portmanteau word composed of 'that which has grown' and 'mingling together,' both from the Greek, phytocenoses. It identified "the potential natural vegetation," or plant communities, throughout the state. Based on soils, weather, and other underlying elements of the land, he portrayed the "floristic composition as dictated by its evolution and by the environment" (586). "Man can destroy the natural vegetation by ploughing, etc.," he wrote, "but when the land is abandoned, the natural vegetation will usually return" (586).

It's a hopeful, maybe even an innocent, concept. Such a map invites imagined time-travel to romanticized, unpeopled realms—a false past where indigenous land management is erased, or a future where the catastrophe required for such widespread abandonment has left no trace. In Küchler's granular detail, county names, lati-

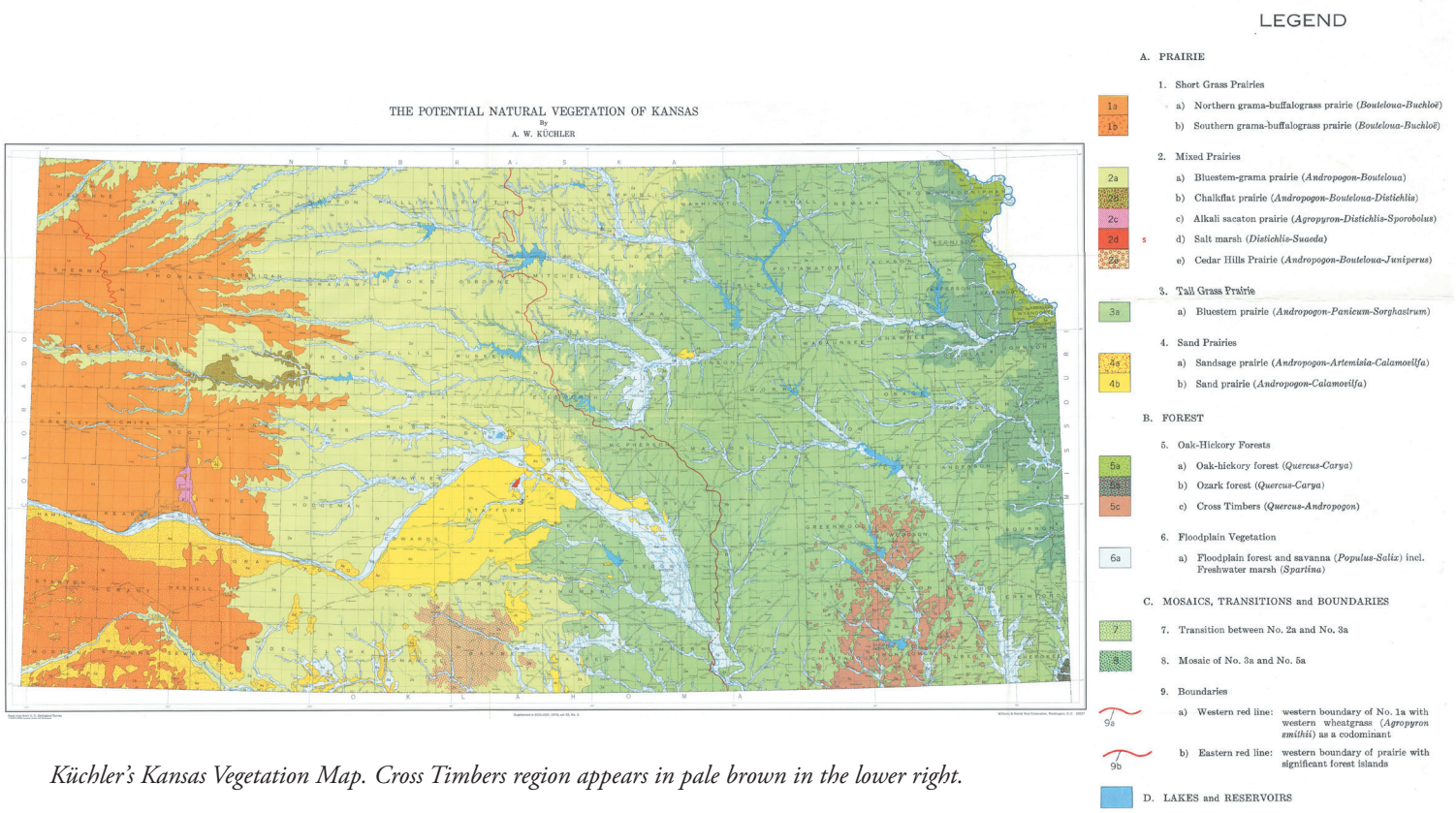
tude and longitude lines, railroads, reservoirs—all these are recorded. Towns and cities alike are marked with an inconspicuous dot. But there's no hint of the great mesh of roads laid across the land. Instead, the color wheel unrolls from warm in the west to cool in the east, delineating ten types of prairie and two of oak-hickory forest, all transected by wide, pale floodplains or savannahs, within which skinny rivers writhe in royal blue.

Against the background green of tallgrass prairie in the southeast corner of the state, what looks like a splatter of cinnabar seems splashed up from somewhere below the Kansas state line. This represents the third forest type in Kansas, the Cross Timbers, where post oak and blackjack oak grow in close association. In Küchler's map, this final phytocenosis is an archipelago stretching from the Caney River on the west to the Neosho on the east, and not quite reaching to the Redmond Reservoir on the north. Named Quercus-Andropogon for its two dominant genera—oak and bluestem—the Cross Timbers west of the Neosho are the northern most peninsula of a forest that once dominated Oklahoma and stretched hundreds of miles into Texas. Like ecosystems and habitats everywhere, that forest is much diminished—no surprise there. However, scattered among the landscape's reservoirs and patchy woods are some relict stands of very old trees, survivors of not just decades, but centuries.

"Only one acorn in a thousand ever grew large enough to fight rabbits," Aldo Leopold wrote in *A Sand County Almanac;* "the rest were drowned at birth in the prairie sea" (7).

Musing on the convergence of conditions that might have led to the survival of one particular tree in the sand prairie of his Wisconsin farm, in the sketchbook narratives of his almanac Leopold presented a primer of what he called "an ecological education"—here, recounting the ten-year rabbit cycle and laying the life-span of a lightning-killed tree against a record of human activity on the landscape. Felling the tree for firewood, he reflected on "the integrated transect of a century," tracing the record of human actions in the sand prairies—burned and drained prairies; extirpation of predators, market slaughter of prairie-chickens, wild turkeys, and passenger pigeons; and a great plow-up of what he called "wheating the land to death" (13). As "fragrant little chips of history spewed from the saw cut," Leopold recounted the years, back to both the decade of the Civil War and the very year when John Muir asked his brother to sell him their family's old Wisconsin farm as a sanctuary for wildlife. "Our saw was biting its way," he mused, "stroke by stroke, decade by decade, into the chronology of a lifetime, written in concentric annual rings of good oak" (9). The tree in question was a blackjack oak, a species which, along with its frequent companion post oak, provides a textbook example of a plant well-adapted to grassland cycles of drought and fire. And in commentary on this particular blackjack's ledger, Leopold listed wet years and dry, all of which were laid down in the variable width of annual ring growth.

While the fact that tree rings record local weather history had long been known, including mention by Leonardo da Vinci in the 16th century and George-Louis Buffon in the 18th (Liutsko et al., 2016), the development of dendrochronology—tree ring dating—took place in the same region where Leopold worked for the US Forest Service from 1909-1924. While Leopold was stationed in Arizona and New Mexico, an astronomer named Andrew Ellicott Douglass was in Arizona pursuing his



Küchler's Kansas Vegetation Map. Cross Timbers region appears in pale brown in the lower right.

theory that the eleven-year sunspot cycle drove weather patterns on Earth. Beginning in 1904, Douglass sampled ancient trees, starting with ponderosa pines from Arizona, then reaching out to collaborators to acquire giant Sequoia from California, and specimens from Germany and Scandinavia. The men's time in the Southwest overlapped at a significant point in their careers; by the time Leopold was a supervisor in Carson National Forest (1912-1925), Douglass was establishing a long chronology using additional, well-preserved timbers in Ancestral Puebloan ruins in the Four Corners region.

I can't prove it, but I suspect that Leopold would have been acquainted with Douglass's pursuits. In 1922, Douglass addressed the American Association for the Advancement of Science meeting in Tucson; if Leopold, then exploring his theories of erosion control in mountain headwaters, wasn't in attendance, he could certainly have read the published remarks later that year. Both men employed the metaphor, widely used by 19th century natural history writers and literary Transcendentalists, of reading the book of nature—and more specifically the stories written within the bodies of trees.

"The forest is one of the smaller pages in nature's book," Douglass wrote, "and to him who reads it too tells a long and vivid story…The trees composing the forest rejoice and lament with its success and failures and carry year by year something of its story in their annual rings. The study of their manner of telling the story takes us deeply into questions of the species and the individual, to the study of pests, to the effects of all kinds of injury, especially of fire so often started by lightning, to the closeness of grouping of the trees and to the nearness and density of competing vegetation…" (5).

When you look at a very large, old stump left standing in the forest, you might marvel at its size, pause to count its rings, like pages, and reflect a little on the difference in potential longevity between trees and ourselves. Personified as Tolkien's Ents, tree-beings' sense of scale would surely dwarf our own—we would appear, as Treebeard observed, "a hasty folk." Leopold knew the death date of his oak, as did Douglass with the first pines he felled to establish his data set. Once you have that end date, it's simple enough to count back to germination. In his next step, Douglass studied the specific patterns—wide rings and narrow—across a range of trees in the

American west, from leviathans he cut specially for the task to ancient beams in Native American buildings. He essentially lined them up, cross section by cross section, the rings overlapping when two trees revealed they had been living compatriots. The resulting ruler stretched ever further into the past as the older specimens revealed earlier patterns of growth.

If concentric growth rings are one sort of circular visualization of chronology, the great cyclical patterns of the Mayan calendar are another. Two calendars of days mark time on a human scale (the Tzolkin and the Haab, which measure cycles of 260 days and 365 days, respectively). A third, the Long Count, cycles through 5,126 solar years—a period that could more properly count the rise and fall of cultures or, perhaps, some of the very oldest living organisms on the planet, the North American bristlecone pines or clonal quaking aspens, or a particular cypress tree from South America. Together, the calendars laid out the rich substrate of time on which events both sacred and secular unfolded in the Maya's written histories, all recorded in the illustrated, folding books referred to now as codices. "They wrote their books," Bishop Diego de Landa wrote in 1562 "on a long sheet doubled in folds, which was then enclosed between two boards finely ornamented…The paper they made from the roots of a tree, and gave it a white finish excellent for writing upon" (Section 7). Famously, the Spanish priests installed in South America destroyed nearly every written record. The few which escaped you can count on just one hand. "We burned them all," Landa wrote, "which they (the Maya) regretted to an amazing degree, and which caused them much affliction." Centuries of a cultural past, reduced to illegible ash and the still-infinitesimal carbon footprints of anthropogenic change.

Only recently did I learn that *codex* derives from Latin's *caudex*, meaning the split trunk of a tree. Fascinatingly, *library*, too, has etymologically Latinate roots within the bodies of trees: *liber* meaning *book* appears, says the *Oxford English Dictionary,* "to be a use of liber, bark, the bark of trees having…been used in early times as writing material." I often realize that words know more than I do, through their own long histories. But whatever connection between liber-book and liberty might lie within metaphor—or not—my language skills can't quite untangle.

Meanwhile, Leopold, in the final pages of *A Sand County Almanac*, noted the difference "of velocity" between change on the level of evolution ("slow and local," he termed it) and anthropogenic change. The latter he called "Man's…changes of unprecedented violence, rapidity, and scope" (217). By then he had come to describe land itself as "an energy circuit," and was much concerned with the "comprehensive" and "unforeseen" effects of disrupting the beauty, stability, and integrity—his touchstones of a land ethic—with planet-wide disruption. Some of his words can seem tragically prescient. Agriculture, industry, and transportation he singled out for attention. "Transportation taps the energy stored in rocks," he noted, and this accelerated release of stored energy amounted to a release of "biotic capital" that would "becloud or postpone the penalties of violence." (218)

Kansas is widely recognized as home of the largest relict of the tallgrass prairie, one of the most endangered ecosystems in North America, with less than 4% of its pre-European contact expanse still left intact. *Andropogon gerardi, Sorghastrum nutans, Panicum virgatum*—big bluestem or turkeyfoot, Indian grass, switchgrass—from whichever shelf in the cupboard of language you pull out the names, the grasses whisper about their long hold on the soils of the central plains. However, the oak forests that remain in Kansas represent another vanishing biome far less celebrated or even recognized. Post oak, blackjack oak, white oak—these are the trees that dominate the splatter-pattern soil map Küchler laid out

Sandstone outcrops

in 1974. And it's oaks, as well as prairie forbs and grasses, that tie Kansas species to Leopold's love of sand prairies in Wisconsin as well as to Douglass's examination of tree rings in the southwest.

In the early 1980s, a doctoral student in the Physical Geography Department at Arizona State University named David Stahle was collecting tree core samples from oak forests in the southeast. He had begun his college studies in archaeology at the University of Arizona, the institution where A.E. Douglass had established his Laboratory of Tree-Ring Research and the early science of dendrochronology helped to date precisely the construction of Ancestral Puebloan kivas and great houses. In the early 1980s Stahle and his team conducted core sampling from a few old historic buildings in Arkansas, as well as their real focus: post-oak and white oak forest from 42 separate locations scattered across Oklahoma, Texas, Missouri, Arkansas—and Kansas.

He located ancient trees—old-growth forests, he called them—from the Kansas Cross Timber woodlands in Elk River, Fall River, and Toronto Lake.

Stahle's point was not simply to identify the oldest trees in any of these spots. Instead, he was assembling a long chronology of growth rings, within which he could read not just the regular pulse of years but also the disturbances within that pulse that would indicate weather anomalies. His main interest was locating rings which showed damage to the cambium from spring frost—the so-called "false spring" events when severe sub-freezing temperatures strike after more than a week of mild weather—the thermometer's version of mercury in retrograde. Prompted by early warmth, a tree leaves its dormant phase and begins to make "early wood," the light-colored, less-dense tissue indicating rapid springtime growth; a sudden plunge of ten degrees Fahrenheit or more leaves a record in the growth ring, crushed or exploded xylem cells that can be clearly seen under a microscope. Stahle's team first assembled a frost-ring chronology stretching over 330 years, and then cross-referenced the years with cellular damage against any available weather records elsewhere in the US, in order to connect the local oak damage with widespread weather events.

Frost rings in the trees' cellular structure speak of late freezes 1826, 1828, and 1870; newspapers and diarists from Iowa to Arkansas to Mississippi record mild winters—*peach blossoms by Christmas near Little Rock!—or late springs—4 degrees F on April 10 in Ft. Snelling, Minnesota!*—and in the confluence of these accounts, Stahle infers particular weeks or even days when a cold snap gripped the living tree and left behind the print of injury. Samples from the data set reveal frequent injuries in the Southern Plains between 1814 and 1821; he mused that "it may not be merely coincidental" that this spate of false springs falls around the 1814, 1815, and 1818 Tambora volcanic eruptions. However, no record of those possibly-volcanic-prompted freezes appeared in the tree samples from Kansas, so there's no definitive connection visible this far north in the Southern Plains.

The urge to map human time onto evolutionary time, geologic time, or any other kind of longue durée, draws us to whatever kinds of "clocks" we can find in the more-than-human world, and to the records we infer from such time-keeping. We're a species deeply predisposed to notice patterns. And we want to bring the calibration of personal experience into alignment with much larger scales. The very fact that hillsides in Kansas were still home to trees that sprouted as early as the 1720s caught the imagination of Doyle Niemeyer, the superintendent of the state parks at Toronto Lake and Fall River for nearly twenty years. In 2002, drawing on Stahle's research from the early 1980s, Niemeyer laid out a trail above the reservoir at Toronto Point, and convinced the Kansas legislature to rename the park in honor of the Cross Timbers biome.

Cross Timber forests are dominated by both post oak and blackjack oaks, but the latter generally don't exceed 80 years or so of age—the lightning kill of Leopold's blackjack oak was a timely death. It's post oaks that become the truly venerable. Sandy soils and sandstone outcrops in the hills above the former stream channel of the Verdigris River are precisely the kinds of semi-xeric habitat where both oaks thrive. And because neither species has much value as commercial lumber, they're rarely clear-cut as a commodity. Following construction of the dam in 1960, the old trees on the upper slopes survived in the relative protection of the park; far more may have been submerged in the impounded waters. Niemeyer's Ancient Trees interpretive trail speaks to the urge to map ourselves into older cycles and landscapes. It winds for a mile along a hillside overlooking Toronto Lake, tracing a line of sandstone outcrops and skirting several open patches of big bluestem. Mostly, though, it loops through post oaks, cedars, a few hickories, some blackjack oaks—an accessible relict of the old Cross Timbers forest that once stretched through the Chautauqua Hills. Signage installed in 2002 guides visitors past trees that have stood on that particular slope of land not just for decades, but, in a few cases, for centuries.

On a warm, clear day in early September, Gail Harshaw is my guide as we walk together and discuss the trail and the old trees. (I'd spent the night before at Mann's Cove campground, only a dozen or so primitive spots on a peninsula flanked by the reservoir's arms, where coyotes and a pair of barred owls called after sunset.) Gail, a resident of Fredonia, Kansas, worked with the park under the AmeriCorps program at the time the trail was first established. She did some of the research for the interpretive signage, managed aspects of the project's purchasing, wrote grant proposals. It has been several years—maybe a decade—since she visited the place and she generously risks ticks and chiggers (both of which, it turns out, are abundant despite the weeks of dry summer weather) to come stroll with me among the trees. Leaf litter rustles underfoot and sunlight slants through the deciduous canopy, falling on the occasional swallowtail butterfly. Vultures coast over the lake below and we hear occasional calls of killdeer from the water's edge.

Despite spending three decades in tallgrass country, I'm deeply drawn to ancient trees. No—I love them. In the Appalachian forest where I grew up I've hiked in old-growth forests where 500-year-old poplars and oaks stretch a hundred feet into the air, shading out most understory shrubs or grasses. There a "cove" means a little valley, a bowl between ridgelines where the soil is deep and rich. In the Pacific Northwest I've slept in old-growth groves of Douglas firs that can reach 300 feet above the pine-needle duff of the forest floor. Cross timber forests resemble neither. Here, the oldest oaks

grow no more than 30 feet or so in height. They're slow-growing, so even trees a century old might be no broader than a cottonwood half that age. But if you look carefully, they do seem old. They're knobby and twisty, with massive limbs. Holes gape. Lumps show where, once, limbs protruded from the trunk. Oaks self-prune through *cladoptosis*, shedding lower limbs that might be damaged or shaded out by the canopy above. Over time the scars left behind bark over like calluses or muscular-looking boles. Such trees seem highly expressive, each one a personality with a life story, even more so than the ancient evergreens of the northwest forests.

Niemeyer selected fourteen of the trees Stahle had dated twenty years before and threaded the trail among them—not so close that you would touch each tree as you passed it, but rather so you'd stand a short distance away, lifting your gaze from sign to trunk to crown and then back down. Each sign includes a photo of the tree's appearance in 2002 and gives the date it sprouted. The text then calibrates the oaks' lives with moments in state and national history.

"This tree," reads one, "was 6 years old in April, 1869 when Enoch and Sarah Jane Reeves, early settlers along the Verdigris Valley deeded land to the incorporated town of Toronto. Some of the founders of the town, formerly of Canada, named the town after Toronto, Canada." Today the understory has grown up, but it is still easy to recognize the wavy, gnarled cast of the upper limbs from the photo in the standing tree. One of the largest branches is now shattered, and we imagine there's a threat of rot traveling down to the trunk.

Another, dated to 1780, "was 24 years old when Meriwether Lewis and William Clark, by order of President Thomas Jefferson, began exploring the territory of the Louisiana Purchase." Here the undergrowth is particularly thick, and I thrash around a bit, trying to get a glimpse of the upper branches. Gail and I think both think we see a few green leaves. "It actually looks healthier now than it did in the picture," she says. And it does! But that might also be a trick of the green light from the saplings below.

"In 1832 when this tree began to grow," reads another signpost, "Washington Irving published his account of travels through the Cross Timbers in *A Tour of the Prairies*, a book which is to be credited for authenticating the Cross Timber name." The trunk bends slightly

Sandstone outcrops

Gail Harshaw and remains of 1752

off-center, as if it once leaned to the side to avoid yet another, long-vanished tree. Much as I like the allusion to the 19th century novelist—he called the Cross Timbers a "forest of cast iron"—I'm tempted to supplement the text with other references—*This tree was 24 years old when John Brown led a massacre of pro-slavery homesteaders at Osawatomie.* Or maybe, *When this tree was 21 in 1853, all of what would become next year Kansas Territory was guaranteed by treaty to various Indian nations.*

Halfway into our hike, we find a vigorous oak with a girth we could hardly reach around together if we tried. It's a beautiful tree, taller and straighter than many we've seen, and the grain of the bark slants a bit, as if the tree had twisted slowly, the way you might cast your gaze across the landscape. No sign accompanies it, but we think surely, the researchers would have considered this a promising sample. We circle the trunk, scouring it for the kind of blemish that might indicate it once was cored. But we find nothing that small—core samples

were only about the size of a pencil. Another tree appears to have been tagged at some time. Like one of the quarters you'd slide into a dryer at the laundromat, the bright aluminum is disappearing into the tree—only a single digit is legible, a 9 or a 6.

Kimberly Jones, the current manager of the park, examined their archives but found no files that might identify other trees from the original sample set that might have been omitted from the trail. When I wrote to Stahle inquiring about how to pinpoint the exact locations of any additional trees, he pointed out that all their collecting took place "pre-GPS." At first I was disappointed. But, in the end, isn't there something attractive in the idea that a stationary tree might shake free from whatever grid or file inscribes it in a data set, and then slip out into deciduous anonymity in the forest?

But we're struck by how many of the trees have died. Of the nine trees dating to the 1700s, only one seems to still have a little green life in it. The others lie as logs among the leaf litter, or stand as rotting snags, or have vanished altogether. "I don't remember that many being down," Gail says, recalling the last hike she took here, with her grandchildren. Back at the trail's start, a park sign promised fourteen ancient trees; we find only three still alive.

Stahle's collection sites ranged throughout Oklahoma and into Texas, sampling the full expanse of remaining Cross Timbers forestland. Several trees in Oklahoma and Texas were decades older than their kin in Kansas. A tree in the Black Fork Mountain Wilderness that straddles Arkansas and Oklahoma dated to 1650; another, in the McCurtain Wilderness in southeastern Oklahoma, dated to 1627 (*Tree Ring Records* 28). The most ancient ever found grew near the Keystone Ancient Forest Preserve in Oklahoma. Sprouted in 1610, it had seen four centuries of springs and autumns, summers and winters, when it was felled. "This tree was destroyed in 2013 to clear a building site," Stahle explained, "an inglorious fate for the oldest known post oak in the entire ecoregion" (*Ancient Cross Timbers* 9).

Those very old dates from Oklahoma make me wonder about the dying trees around the lake. As we walk the return loop of the trail we note the high-water line. Pale logs, some as big as trees featured along the trail, lie beached above the cove's shoreline like enormous bone piles; perhaps some were cohorts of these ancients, floated up from some former thicket in the bottomland.

I wish I knew about the health of the elders farther south, and whether some widespread die-off has affected the greater Cross Timbers biome, or whether this is a local phenomenon. Recently, Thomas R. Rogers and F. Leland Russell have studied "recruitment" of second-growth trees to the Kansas Cross Timbers forests over the past few decades. They found that blackjacks—one of Leopold's favorites in the sand prairies far to the north—do quite well in dry years, post oaks slightly less so, but I haven't found studies regarding recent die-off in the old-growth forest. Could it be a consequence of the lake itself? Post oaks thrive in sandy soil, in stony, dry conditions. While the stones remain, the fluctuations in the water table through the past sixty years have surely meant wet feet for some of the trees. Still, the surrounding forest is home to some mighty burly, vibrant trees. I wonder how many additional ancient oaks Stahle's team cored that weren't spotlighted in Niemeyer's trail. Gail and I locate a few likely candidates, full of gnarly character, and we never stray far from the trail. So perhaps, a little ways away, there could be several still quickening

Summer Tanager (Pirangra rubra) by Bob Gress, BirdsInFocus

each spring, laying on new wood and opening buds. A few lines from the poet Mary Oliver come to mind.

> Around me the trees stir in their leaves
> And call out, 'Stay awhile.'
> The light flows from their branches.

And it's true—in September's slant light, it feels as if light pours from the trees themselves, instead of only washing past them. Stand still enough in shafts of autumn light, the equinox drawing near, and you can feel yourself straddling a point where time, in its myriad cycles and scales, seems to swing close enough to splash you in shadow before it banks and wheels away.

"I think that was one reason Doyle [Niemeyer] wanted to get it done," Gail muses as we contemplate the number of dead, "—to capture it before it all died and nobody ever knew about it."

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