

How Tree Rings Challenged the Myth of American Wilderness

By studying fire scars in ancient wood, many scientists have become convinced that Indigenous people transformed North America long before Christopher Columbus arrived.

By [M. R. O'Connor](#)

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A dendrochronologist collects fire-scar data during field research in the Missouri Ozarks, in the Pioneer Forest, a stretch of woodland maintained by the L-A-D Foundation.

Photographs by Whitten Sabbatini for The New Yorker

In 1620, William Bradford, a Pilgrim and the future governor of Plymouth Colony, stepped off the Mayflower and saw what he described as a “hideous and desolate wilderness.” North America was forested as far as his eye could see, devoid of the roads and towns he was accustomed to. The word he chose to describe the land—wilderness—connoted an uncultivated or uncivilized place. Accounts like Bradford’s tended to minimize or belittle the Native Americans who already

lived in the New World. As Roderick Frazier Nash noted in “[Wilderness and the American Mind](#),” missionaries claimed that their work “irradiated an Indian wilderness.” In President Andrew Jackson’s 1830 annual address to Congress, he said, “What good man would prefer a country covered with forests and ranged by a few thousand savages to our extensive Republic?” Only a few decades later, environmentalists recast wilderness as something that needed saving. Yet they, too, divorced Native Americans from the history of the land. Ralph Waldo Emerson and Henry David Thoreau defined the wilderness as a pure place, untrammelled by man, where one could commune with God. John Muir, sometimes called the father of the national parks, carried Emerson’s essays in his pack. He described Yosemite, a place where Native Americans were still living, as “fresh unspoiled wilderness.”

If a landscape is truly untouched by humans, then natural forces—plants, animals, wind, water, lightning—should be able to account for everything that happens there. But, starting in the nineteen-eighties, dendrochronologists—who study growth rings in the trunks of trees and link them to calendar years—made a puzzling discovery. Tom Swetnam, a dendrochronologist at the University of Arizona, spent eight years researching giant sequoias in Yosemite and other national parks. He documented an average of sixty scars from forest fires in each of the trees he studied. (Tree rings also record traces of solar activity, droughts, volcanic eruptions, and other phenomena.) The number of fire scars surprised him. Scientists had always assumed that such markings were the result of fires caused by lightning. “Are there enough lightning strikes to account for that kind of frequency?” Swetnam remembers thinking. “My back-of-the-envelope calculations said probably not.”

The mystery extended far beyond sequoias. Trees around the country contained scars that lightning fires simply could not explain. In many places, there were scars in the parts of tree rings that correspond with the dormant season—autumn through early spring—when thunderstorms rarely or never occur. At study sites across the East, as many as eighty-eight per cent of scars dated to this season. What was the source of these fires?

Richard Guyette, a self-taught dendrochronologist at the University of Missouri, researched pine, oak, and cedar trees. “Foresters learn to read their rings like it is a book made for them,” Guyette, who had a background in anthropology, once wrote. He hired Michael C. Stambaugh, a young graduate student in forestry, and Joe Marschall, a field researcher, to rove the woods with him in search of ancient wood. As they reconstructed the history of fire in places like the Ozarks, they noticed a clear link between burn scars and human population density. Guyette and his colleagues increasingly suspected that fires were not natural but anthropogenic—ignited by people. In some places, they found what they called a “wave of fire,” which appeared to move geographically as Europeans built settlements and violently disrupted Native American

communities. Before Guyette’s death, in 2023, he established the Center for Tree-Ring Science, which Stambaugh now directs. “Trees are witnesses,” he told me.



From left to right: Joe Marschall, Neal Humke, and Michael Stambaugh conduct fire-scar field research in the Missouri Ozarks.

This past January, Marschall, now a senior research associate at the center, drove to Alabama, to visit Flagg Mountain, the southernmost peak in the Appalachian Mountains. Marschall has a reddish-white beard and a genial disposition; the pocket of his faded blue button-down was stocked with pens. He parked by the side of a dirt road, put on oil-stained chaps and a large backpack, and slung a chainsaw over his shoulder. Then he started hiking downslope through the forest. He ignored the maple, oak, and hickory trees that thrived in the area. Instead, he scoured the damp leaf litter for the nubs of old longleaf-pine stumps—the remnants of an evergreen forest that once covered more than ninety million acres. Generations ago, longleaf pines were logged to a fraction of their former range. As far as Marschall knew, no dendrochronologist had ever studied fire history in these woods before.

Marschall has a playful classification system for old wood: there are “janky snags,” “stump orchards,” and “wood boogers.” On a steep slope, he spotted the withered trunk of an old longleaf

pine. “This is really a kick-ass tree,” he said. “It shows all the classic signs of age. It’s got this twisting grain on it.” He started up his chainsaw and cut through the trunk, spraying sawdust across the ground. Then he knelt down and scanned the freshly exposed surface. Inside the tree were hundreds of concentric rings, each one representing a year of growth. He pointed to the rings in the center of the slab—“this is probably mid-sixteen-hundreds”—and looked for fire scars. “One, two, three, four, five, six . . .”

Marschall’s initial assessment was that the tree’s life probably began before European settlers arrived in the region, at a time when the mountain was populated by autonomous Indigenous nations that later became part of the Creek Confederacy. “What I really want are the trees that were here even before this tree,” he told me. “They’re just bones, in some cases, but they’re still here.”

Since Swetnam and Guyette began their work, dendrochronologists have found fire scars across the continent, from Central America to the northern tip of Alaska. The North American Tree-Ring Fire-Scar Network, which was launched in 2022 by eighty-seven dendrochronologists, is a database of more than three thousand study sites and more than thirty-seven thousand fire-scarred trees. It has helped researchers understand the ways that Indigenous communities may have used fire, and how this practice was transformed by European colonization. “We believe that Native Americans and Indigenous people were the main ignition sources for fire,” Marc Abrams, a forest ecologist at Pennsylvania State University who has utilized the network for his research, told me. Another ecologist, Charles Kay, has estimated that Native American ignition rates were potentially hundreds or thousands of times greater than lightning-ignition rates.

Dendrochronologists are now chasing the traces of Indigenous fires deeper into the past. Their quest becomes more difficult every year, however, as the remains of pre-Columbian trees slough back into the earth or are dug up to make way for agriculture and construction. “Wood is ephemeral,” Marschall told me more than once. One day, at a hardware store near Flag Mountain, he was pained to see bundles of fatwood—pine heartwood—being sold as kindling. Ten pounds of potentially irreplaceable data was going for \$25.99.

Marshall spent five days relentlessly hunting for stumps. Only three per cent of North America’s longleaf-pine ecosystem remains, and he knew that every specimen he left behind might disappear forever. He’d cut a slab, peer at its rings, and then cut another, just in case the tree might “give up any more secrets.” He often swaddled samples in duct tape to keep them from crumbling.

Some days, Marschall worked into the evening, under the light of a headlamp. Once, he worked during a prescribed burn that local authorities ignited to clear vegetation and nurture the ecosystem. Longleaf pines depend on frequent, low-intensity blazes in order to reproduce. As the

fire crept along, Marschall worked around the flames, cutting stumps before they could burn. By the time he drove back to Missouri, his S.U.V. reeked of pine and sagged under the weight of so much wood.



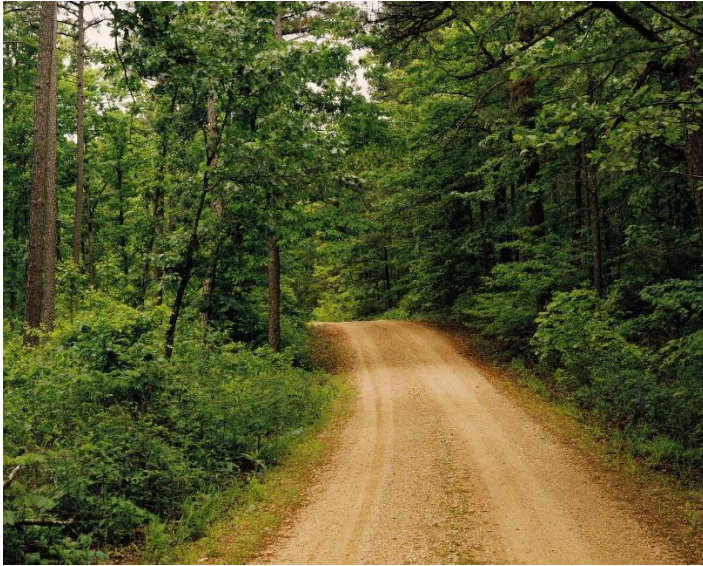
Fire scarring is visible in the tree rings on a stump.

When one revisits colonial accounts of North America, one finds a striking amount of evidence that Native Americans set fire to the landscape. A settler in Virginia described air so smoky that he could not see nearby mountains. In 1632, a colonist noted that Native Americans burned underbrush twice a year, in the spring and fall, and that the burning “makes the Country very beautiful and commodious.” The fires created open, savannah-like forests that were easier to travel through and supported diverse flora and fauna. Yet another settler wrote of a forest that was choked with berries as a result of repeated burning: “Your foot can hardly direct itself where it will not be dyed in the blood of large and delicious strawberries.” Indigenous people used fire for many other reasons, including warfare and insect control. When they were killed by disease or forced off their lands, their absence was felt. In 1634, a settler in Massachusetts wrote, “In some places where the Indians dyed of the Plague some foureteene years agoe, there is much underwood . . . because it hath not beene burned.”

Fire scars reinforced these historical examples. They provided independent confirmation of research by the anthropologist Omer Stewart, who began documenting Native American burning practices in the nineteen-thirties. Stewart found that Indigenous communities burned prairies to attract bison to fresh grass, and to maintain oak “orchards” where food could be gathered. He became convinced that Native Americans had reshaped the geography, and in some cases the climate, of North American ecosystems. Their impact “was profound, in terms of the amount of land converted to agriculture, the species they hunted and fished, and most particularly the way they shaped their world through the use of fire,” the naturalist Scott Weidensaul wrote, in his 2012 book [“The First Frontier.”](#) Weidensaul argued that early America “was fruitful beyond modern recognition, it was riotous in its natural wealth, but it was not wilderness.” The dendrochronologist Evan Larson, at the University of Wisconsin-Platteville, made a similar claim: settlers encountered rich landscapes because Native Americans were tending them. “Whenever you’re talking about fire, you’re engaging with a central narrative around this untamed frontier and wilderness,” Larson told me. “In fact, that’s never been true. The early success of pioneers was already benefitting from the labor of somebody else.”

Not all scientists agree that Native Americans were an ecologically significant force before Europeans arrived. Researchers led by a team at the Harvard Forest have argued that charcoal and pollen records in New England do not support the idea of extensive Indigenous burning. Others believe that tree-ring research, and the scientific journals that publish it, overestimate the number of historical fires. “A study of fire-scar frequency which finds no fire scars is of no interest in most journals,” Glenn Matlack, a biologist at Ohio University, told me. He characterized Native Americans as “ordinary people trying to make a life for themselves and their families under difficult conditions,” not people who were planning in the long term or significantly manipulating the landscape. George Wuerthner, an ecologist at the Rewilding Institute, a conservation nonprofit, writes that the myth of a pristine wilderness is being replaced, incorrectly, with a myth of “human manipulation everywhere in pre-Columbus America.”

Stambaugh has engaged with critics, but considers the data clear-cut. “They have to argue with a piece of wood,” he said. “Good luck.” Tree rings, he said, show such a strong signal of anthropogenic fire that they record pivotal historical events. In the Boston Mountains of Arkansas, he and Guyette found that shortleaf pines experienced an increase in fire in 1817—the same year that Cherokee from the Southeast were relocated to the area by treaty. After the 1830 Indian Removal Act, the U.S. government began to forcibly march Native Americans westward, along the Trail of Tears, and fires in their ancestral lands decreased. From 1831 to 1833, at the terminus of the trail, in present-day Oklahoma, the number of fires spiked. Stambaugh believes that the blazes may have been a desperate attempt to generate forage, perhaps to attract animals for hunting or to feed domesticated animals. “There are years in the data when there are two fires in one calendar year,” he said. “This was a terrible time. People were trying to survive.”



A dirt road winds through a forest in the Missouri Ozarks.

Back at the University of Missouri, Marschall deposited his new tree-ring samples in a collection that already includes tens of thousands of others, from hundreds of study sites. Stambaugh keeps a mental list of the places he wants to study. “The list would take me longer than I have on this planet,” he told me. The center’s laboratory, in the basement of the School of Natural Resources, contains samples that pre-date Christianity and the Egyptian pyramids. High on a shelf, I saw a forty-thousand-year-old piece of bald cypress that was discovered in a South Carolina sandpit. Another chunk of wood was labelled “Floor Beam Mark Twain Boyhood Home.”

Marschall pointed out a sliver of brown wood on a crowded countertop. During a research trip to Pennsylvania, one of Marschall’s colleagues had sat down to eat an apple on a rotting, weather-beaten log. “I think we should sample that,” Marschall had told the colleague. Its inner ring dated to 1579. It had five fire scars, the first from 1590.

Until recently, few dendrochronologists looked for fire scars in the eastern U.S., but in 2010 Marschall, Stambaugh, and Guyette began collecting wood samples in central Pennsylvania. One nub of red pine turned out to contain three hundred and forty rings, but they could not be cross-dated with any other tree-ring data. The wood became part of what dendrochronologists call a “floating chronology,” meaning a group of trees with start and end dates that align with each other, but that don’t match the calendar years for which data is available. The sample sat in the lab for two years, until researchers finally collected enough additional data to pin down the tree’s age. The tree’s innermost ring dated to 1370. The first of its nineteen fire scars was from 1402. The fire-scar chronology was the oldest ever recorded in eastern North America. Stambaugh and Marschall went on to visit Maine and New York, and to create a citizen-science fire-scar app. Abrams, the forest ecologist in Pennsylvania, believes that some environmental challenges facing

eastern states—the spread of invasive species, the shrinkage of meadows, the failure of oak trees to regenerate—might have more to do with the disappearance of fire than with climate change.

Land managers are already using fire-scar data to decide when to ignite blazes on purpose. “This kind of data helps us make more confident, informed decisions about when and how to use fire on the ground today,” Jonathan Stober, a biologist at Talladega National Forest, not far from Flagg Mountain, told me in an e-mail. Several members of the Fond du Lac Band of Lake Superior Chippewa trained in dendrochronology to collect fire-scar data. Their research, published last year in *Proceedings of the National Academy of Sciences*, showed that fires rapidly declined after treaties ceded tribal lands to the U.S., in 1842 and 1854. Last November, on twenty-two acres of traditional tribal territory, the Fond du Lac Band Fire Program led the first intentional burn in generations. On Thursday, they conducted a second burn on seventeen acres of pine woodland at neighboring Minnesota Point in Duluth. Larson, the lead author of the paper, was there. “What is so powerful about the tree rings is that through boarding schools, through reservations, there were attempts to remove people from the land and places that carried their knowledge,” he told me. Yet the trees contain “irrefutable evidence of their connection to land and stewardship.”



Michael Stambaugh looks through a clinometer, an eyepiece that uses triangulation to measure tree heights, vertical angles, and slope steepness.

It takes hundreds of hours to map out the fire history of one study site. In the laboratory, I saw a four-hundred-year-old piece of longleaf pine that contains a hundred and eight fire scars. Stambaugh is not aware of any other sample in North America that holds a record of such frequent fires—but this specimen is one of many that have yet to be written up because of a lack of funding. Marschall guessed that the wood from Flagg Mountain would sit for a year or two while they tried to secure the money to analyze it. But, in April, he took out two of the samples anyway.

Cross-dating tree rings is tactile and laborious. During my visit, I helped an undergraduate student sand the samples for hours with increasingly fine sandpaper, until their surfaces became silky and lustrous. The growth rings now appeared under a microscope as high-contrast light and dark bands, which represent the early growing season and the late growing season. Marschall showed me how to measure every ring down to a hundredth of a millimetre. Then a computer program compared the sample to tree-ring data from around the world, estimating the statistical probability that it would cross-date with other specimens.

Marschall printed out a series of enormous spike graphs and brought them over to a light table. He placed the graphs of his new samples on top of master dating chronologies of tree-growth patterns, shifting each one to the left and right in search of a match. He cross-dated the first sample in minutes: its innermost rings dated to the early seventeen-hundreds, and the wood contained about six fire scars from the eighteen-hundreds. (Each fire-scar sample in the lab is reviewed at least three times.) But he could not find a match for the second one. “My gut is that we’re not going to have this sucker dated,” Marschall told me. “And that’s beautiful. It’s good to have a mystery.”

That evening, however, Marschall kept thinking about the sample. By 7:30 A.M., he was back at the lab, moving the sample’s spike graph over a master dating chronology from Talladaga National Forest. Suddenly, he managed to align the graphs. The tree had begun its life in 1612; in 1697, it had been scarred by fire.

The fire history of Flagg Mountain holds particular significance for a Native American community just a few miles away. The Indigenous ecovillage of Ekvñ-Yefolecv was founded, in 2013, to revitalize the language, culture, and stewardship practices of the Maskoke people, who were forcibly removed from central Alabama nearly two centuries before. At Ekvñ-Yefolec, children are fully immersed in the Maskoke language from birth, and the community practices traditional agriculture on the ten thousand acres that it owns. Marcus Briggs-Cloud, a Harvard-trained theologian with a Ph.D. in ecology, is the co-director and co-founder of Ekvñ-Yefolecv. He told me in an e-mail that the residents are also returning fire to longleaf-pine forests.

Burning is restorative not only for the ecosystem, Briggs-Cloud wrote, but for the community’s spiritual life. “Encapsulated in our language, stories, and ceremonial protocols is traditional

knowledge concerning cultural burning,” he wrote. In his view, Flagg Mountain’s fire-scarred stumps corroborate what his community already knew—that their ancestors used fire for centuries—and reinforce their sense of responsibility to care for the land. “We are so fortunate that these elder tree stumps still exist,” he said. “They are a tangible connection to an era just before our People were severely destabilized by colonization; even laying one’s hand on these stumps for a moment is a profound experience.” ♦



A weathered tree stump.

An earlier version of this article mischaracterized the history of dendrochronological studies around Flagg Mountain, the date of an account from a Virginia colonist, and the order in which researchers were standing in a photo.