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A TRAILBLAZING PLAN TO FIGHT CALIFORNIA WILDFIRES

Throughout the twentieth century, federal policy focussed on putting out fires as quickly as possible, but preventing megafires requires a different approach.

By Nicola Twilley August 19, 2019

As megafires become the new normal, prescribed burns give trees breathing room and prevent the worst damage.

Photograph by Kevin Cooley for The New Yorker

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Before Terry Lim handed me an aluminum flask filled with a blend of gasoline and diesel and asked me to set fire to the Tahoe National Forest, he gave me a hard hat, a pair of flame-resistant gloves, and a few words of instruction. “You want to dab the ground,” he said. “Just try to even out the line.”

The line was a low ridge of flame, no more than a foot high, creeping toward us through the forest. In front of it, the ground was springy, carpeted with a dense layer of pine needles and studded with tufts of grass. Specks of sunlight shimmered in the deep, almost kaleidoscopic green, bouncing off lime-colored ferns and conifer boughs. A foot-long alligator lizard skittered in front of me, pausing to pump out a couple of quick pushups before vanishing into the brush. Beyond the line, the ground was black and silent. Silhouettes of large trees loomed out of a sallow gray haze.

The lit cannister of fuel I was holding, known as a drip torch, had a long, looped neck that emitted a jaunty quiff of flame. I took a deep breath, and ducked my way through the scrub to the far end of the line. Then I walked back, dotting the tip of the torch’s neck to the forest floor a few feet in front of the flames, as if I were tapping out a message in Morse code. The dots and dashes ignited small fires, which joined up so rapidly that at one point I set fire to my boots. A swift, panicky battering with my gloved hands smothered the flames before any damage was done.

The main fire was advancing into the wind, so it moved slowly and stayed close to the ground. But my new flames had the wind at their back and quickly jumped across the gap separating them from the original front, transforming the line's ragged edge into a wall of flame. It was mesmerizing and thrilling, and I couldn't wait to do it again. As the afternoon wore on, I began setting my ignitions farther away from the line, in order to consume the forest faster. I started to anticipate how terrain would affect the pace of fire: open stretches of pine needles caught instantly, but I learned to place my dabs in tight clusters near saplings and denser shrubbery.

I wasn't really supposed to be setting the forest on fire. That was the job of the United States Forest Service crew whose work I was there to observe. Their task was to carry out a prescribed burn—a carefully controlled, low-intensity fire that clears duff and deadwood, reducing the risk of a catastrophic wildfire. But the crew were temporarily occupied by what they called "a slop-over event": a rogue ember had leaped across a trail that acted as a firebreak at one edge of the burn, sparking a half-acre blaze so hot that standing within a few feet of it made my chest hurt. While the crew used chainsaws and hoes to create a new firebreak, it fell to me to insure that no part of the line got ahead of the rest. If flames are allowed to break ranks and surge forward, they can whirl around and start running with the wind, burning more intensely and smokily than the prescription allows.

It took the team more than an hour to fully contain the slop-over. Then they returned to the line with their drip torches. By the end of the day, they had set fire to a hundred and twenty acres of forest. As Lim walked me out of the woods, through the gray-gold twilight of the burn zone, he gave a satisfied sigh. "See, now that's nice," he said. "The trees have breathing room."

The contrast between that day's prescribed burn and the uncontrolled blaze that the crew had rushed to extinguish epitomizes California's spiralling problem with fire. Throughout the twentieth century, federal policy focussed

on putting out fires as quickly as possible. An unintended consequence of this strategy has been a disastrous buildup in forest density, which has provided the fuel for so-called "megafires." The term was coined by the Forest Service in 2011, following a series of conflagrations that each consumed more than a hundred thousand acres of woodland.

Megafires are huge, hot, and fast—they can engulf an entire town within minutes. These fires are almost unstoppable and behave in ways that shock fire scientists—hurling firebrands up to fifteen miles away, forming vortices of superheated air that melt cars into puddles within seconds, and generating smoke plumes that shroud distant cities in apocalyptic haze. Centuries-old trees, whose thick bark can withstand lesser blazes, are incinerated and seed banks beneath the forest floor are destroyed. Without intervention, the cinder-strewn moonscape that megafires leave behind is unlikely to grow back as forest.

Six of the ten worst fires in California's history have occurred in the past eighteen months, and last year's fire season was the deadliest and most destructive on record. More than a hundred people were killed, and more than seventeen thousand homes destroyed. Experts have warned that this year's fire season could be even worse, in part because record-breaking rains early this year spurred the growth of brush and grasses, which have since dried out, creating more fuel. Governor Gavin Newsom proclaimed a wildfire state of emergency in March, months before fire season would normally begin.

The tools and techniques capable of stopping megafires remain elusive, but in the past few decades a scientific consensus has emerged on how to prevent them: prescribed burns. When flames are kept small and close to the ground, they clear the leaf litter, pine needles, and scrub that fuel wildfire, and consume saplings and low-level branches that would otherwise act as a ladder conveying fire to the canopy. With the competing vegetation cleared out, the

remaining trees grow larger, developing a layer of bark thick enough to shield them from all but the hottest blazes. California's state legislature recently passed a bill earmarking thirty-five million dollars a year for fuel-reduction projects.

"And yet no one is actually burning," Jeff Brown, the manager of a field station in the Tahoe National Forest, told me when I visited him there recently. Although prescribed burns have been part of federal fire policy since 1995, last year the Forest Service performed them on just one per cent—some sixty thousand acres—of its land in the Sierra Nevada. "We need to be burning close to a million acres each year, just in the Sierras, or it's over," Brown said. The shortfall has several causes, but, some fifteen years ago, Brown set himself the almost impossible task of devising a plan for the forest he helps maintain that would be sophisticated enough to overcome all obstacles. Now he is coördinating an urgent effort to replicate his template across the Sierra Nevada.

The Sagehen Creek Field Station, where Brown is the manager, lies twenty miles north of Lake Tahoe, in the eastern Sierra Nevada. It was established in 1951 to conduct fishery and wildlife research, and is part of the University of California, Berkeley. Its amenities include a dozen radio-linked meteorological towers, snowpack sensors, tree-sap monitors, and a stream-depth gauge. It is not open to the public, but some twenty small red cabins are occupied by an ever-changing assortment of visiting researchers, student field-trippers, and even artists-in-residence.

In pre-Colonial times, California's forests burned regularly, thanks to lightning strikes and fires deliberately set by Native Americans.

Photograph by Kevin Cooley for The New Yorker

When I drove there, in May, there were still patches of snow in the shade, but the banks of Sagehen Creek were dotted with the first buttercups of spring. I

followed a rutted dirt road for a couple of miles through the forest, arriving at a simple shingled cottage, where Brown lives with Faerthen Felix, the station's assistant manager. From here, they help oversee the Sagehen Experimental Forest, nine thousand acres of mountain meadows, alkaline fens, and pristine streams surrounded by dense stands of Jeffrey and lodgepole pine.

Brown, who is in his mid-sixties, is a former competitive triathlete, ski patrolman, and river-rafting guide, and he has the rugged look and expansive manner of a lifelong outdoorsman. When I visited, he was taking two filmmakers on a tour of the station. He led us out into a clearing and unrolled a map on the forest floor. In the distance, three young does picked their way through the undergrowth. Behind us was a shed with an underground window onto the next-door stream, for the observation of spawning trout. Over the decades, dozens of insect, bird, and other forest-dwelling species have been studied and monitored at Sagehen, and the station's records constitute one of the longest-running and most detailed data sets on the Sierra. "We're the best-inventoried forest in the western United States," Brown told me.

As he led us through the trees, Brown pointed out that we were following an old railroad bed. Sagehen was clear-cut in the mid-nineteenth century to help build the railways and mines of the gold-rush era. (Sutter's Mill, where the first gold was discovered, in 1848, is less than a hundred miles away.) After loggers felled the large trees, smaller ones became fuel for locomotives, and the eastern slopes of the Sierra are so dry that there are still stacks of cordwood left over from the eighteen-eighties. Nearby, Brown bopped up and down on pine needles that coated the ground. "See this?" he said. "These go down ten inches deep in places."

When Brown and Felix arrived at Sagehen, in 2001, they saw their responsibility as straightforward: to keep this assiduously catalogued patch of wild Sierra forest unchanged, for future generations of researchers. Only

gradually did they grasp that the forest they had inherited was in terrible shape. During their first summer at the station, there were three big wildfires nearby, and Brown realized that all that dry wood and all those pine needles could easily go up in flames. Then, in 2004, scientists who had conducted research at Sagehen gathered for a belated celebration of its fiftieth anniversary. Several had not returned in decades, and expressed shock at how dense the forest had become.

The local district ranger at the time was worried, too, and asked Brown whether she and her team could help reduce the forest's fuel load by doing some thinning—something the Forest Service does either by sending in loggers with chainsaws or by using a backhoe-like machine called a masticator, which shreds anything in its path. Brown was horrified at the suggestion. Like many staunch environmentalists, he was suspicious of the agency, because part of its remit is to generate revenue by logging timber like a crop. "To my mind, the Forest Service was the enemy, because if you cut down one tree you were doing something wrong," he told me.

Elsewhere in the Sierra Nevada, conditions were much the same—overstuffed forests, stripped of big old trees and filled with smaller ones crammed together—and global warming amplified the risk of disaster with each passing year. The average temperature on a summer day in California is 2.5 degrees Fahrenheit hotter than it was in the nineteen-seventies, and in the same period there has been a fivefold increase in the acreage consumed by wildfire. Fire seasons have been getting longer and more severe since the nineteen-eighties. Brown realized that doing nothing was no longer an option.

When the conquistador Juan Rodríguez Cabrillo sailed three ships along the coast of California, in September, 1542, and became the first European to set foot in the state, he reported seeing a great pall of smoke drifting over the landscape. As the ethnobotanist M. Kat Anderson has documented, indigenous tribes traditionally set fire to the forest at a variety of

intervals, for a variety of reasons: to create better habitat for elk; to encourage the growth of edible or useful plants, such as mushrooms or chia; and to minimize the risk of fire. Precontact California burned constantly but rarely disastrously. In her book "Tending the Wild," Anderson writes, "Legends about destructive fires reflect the almost universal belief among California Indian tribes that catastrophic fires were not a regular, natural occurrence but rather a rare punishment."

In 2004, one of Brown's colleagues at Berkeley, a fire scientist named Scott Stephens, came to Sagehen and took samples from the stumps of huge trees cut down during the gold-rush era. Examining tree rings and scorch marks, Stephens was able to construct a record of fires dating back to the sixteen-hundreds. His findings confirmed that, in pre-Colonial times, Sagehen burned regularly. Those fires sometimes occurred naturally, from lightning strikes, but they were also deliberately set by Native Americans. The consensus now is that the entire Sierra Nevada burned every five to thirty years.

"The Washoe tribe used to hang out here in the summer, and then light it on fire in the fall, on their way out for the winter," Brown told me. "Especially near the creek—they wanted fresh willow shoots in the spring for basket-making."At Sagehen, some of the drier, south-facing slopes seem to have burned as often as every two years. Not only did the forest's native species evolve to survive fire; several of them actually require it in order to thrive. Lodgepole pinecones do not open until heated by fire. Black-backed woodpeckers dine almost exclusively on seared beetle larvae.

Brown began to see the outlines of an opportunity to reduce Sagehen's risk of a catastrophic wildfire, by working with the Forest Service and scientists at Berkeley to figure out how to implement prescribed burns. At the local Forest Service office, an eager young silviculturist, Scott Conway, was assigned to the project. When I talked to Conway, he recalled, "Somebody told me, kind of

under their breath, 'Sagehen is never going to happen, don't get involved.' And, of course, I immediately took that as a challenge."

There were plenty of reasons to suppose that Brown's attempt would fail. One was the mutual mistrust between the Forest Service and environmentalists who object to public land being used as a lumberyard. After the passage of the National Environmental Policy Act, in 1969, conservationist groups became adept at using its protections of threatened species and habitats as a basis for lawsuits to bring logging to a halt.

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In the early nineties, "The Sierra in Peril," a Pulitzer Prize-winning series of reports that appeared in the Sacramento *Bee*, spurred Congress to commission studies on California's forest ecosystems. As a result, the Forest Service revised its policies to allow prescribed fire as well as thinning. However, the agency had very little experience in designing and conducting prescribed burns in the American West. The Sierra Nevada's mountainous terrain and dry, Mediterranean climate make controlling even a planned fire challenging, and a century's worth of fire suppression had left forests so flammable that the smallest spark might trigger an inferno.

Brown and the rest of the Sagehen planning team decided to pursue a strategy that had recently been developed by a Forest Service scientist at its Rocky Mountain Research Station. Affectionately known as SPLAT, for Strategically Placed Landscape Area Treatment, the technique involves clearing rectangular chunks of forest in a herringbone pattern.This compels any wildfire to follow a zigzag path in search of fuel, travelling against the wind at least half the time. The SPLATs function as speed bumps, slowing the fire enough that it can be contained, while allowing the Forest Service to get away with treating only twenty to thirty per cent of any given landscape.

The SPLAT technique had been tested only in flat grasslands in Utah, and adapting it to the mountainous topography of Sagehen proved tricky. When fire travels uphill, it preheats the ground in front of it, often doubling its velocity; fire usually moves downhill more slowly, but a lit pinecone rolling down a slope can easily ignite new areas. Topography also affects other factors that determine the pace of a fire, such as wind speed, rainfall, and soil-moisture levels. Scott Stephens and one of his doctoral students embarked on a multiyear study to gather all the landscape data needed to model fire behavior at Sagehen.

Adapting the SPLATs to Sagehen's terrain took four years. Then, just as the plan was being finalized, a paper was published documenting the unexpected decline of the American pine marten at Sagehen. The marten, a member of the weasel family, is not endangered, but its population levels are seen as a useful proxy for forest health. Soon, the Sagehen planning team heard from Craig Thomas, the director of the environmental group Sierra Forest Legacy, which has a long history of litigation against the Forest Service. Thomas asked them to redesign the project, with an eye to protecting marten habitat.

Thomas, a small-scale organic farmer in his seventies, told me that he was astonished when the Sagehen group, especially the Forest Service, seemed open to the idea. "Instead of getting their backs up, they jumped in with both

feet," he said. Conway recalled his own response a little differently. "I was, like, really?" he said. "It meant a bunch of complexity, and making this project, which was already really too long, much, much longer." Still, as Thomas recalls, Conway "went away and read every marten ecology paper in existence by the time the next phone call happened. And I went, Ah, this is somebody I think I want to work with."

So in 2010 the team, which had now been working together for six years, began planning all over again, this time with an even larger group of collaborators and a more expansive goal. "It started as science, but it became diplomacy," Brown told me. "How could we get all these people—groups that didn't trust each other, were actively suing each other—to a consensus on what was best for the forest?"

Brown secured grants, hired a professional facilitator, and brought together loggers, environmental nonprofits, watershed activists, outdoor-recreation outfits, lumber-mill owners. Sometimes there were upward of sixty people at meetings. Scientists from all over the region presented the latest findings on beaver ecology or the nesting behaviors of various bird species. To categorize Sagehen's diverse terrains—drainage bottoms with meadows and those without, north- and south-facing slopes, aspen stands with conifer encroachment—working groups hiked almost every yard of the forest.

Arriving at a consensus took years of discussion, but, in the end, the strategy the team decided on turned out to mimic the way fire naturally spreads. For instance, fire burns intensely along ridges and more slowly on north-facing slopes. Martens, having adapted to these conditions, rely on the open crests to travel in search of food and mates, while building their dens in shadier, cooler thickets. Following the logic of fire would create the kind of landscape preferred by native species such as the California spotted owl or the Pacific fisher—a mosaic of dark, dense snags and sunlit clearings, of big stand-alone trees and open ridgelines connecting drainages. Conway then led an effort to

formulate a detailed implementation plan whose treatments varied, acre by acre, according to the group's predictions. Some areas were to be left as they were, some were to be hand-thinned with a focus on retaining rotting tree trunks, and some were to be aggressively masticated and then burned.

Typically, a Forest Service project takes two months to plan. Sagehen had been in the works for nearly a decade, but Brown eventually achieved the impossible: a plan that everyone—environmentalists, scientists, loggers, and the Forest Service—agreed on. Then, three days before the group was due to sign off on the plan, there was yet another hitch: in one of the units of Sagehen that were scheduled to be burned, a Forest Service employee discovered a nesting pair of goshawks—raptors that are federally protected as a sensitive, at-risk species.

This time, it was the conservationists who compromised. "I could have said, 'O.K., this area is now off limits, and if you don't believe me I'll sue your ass,' " Craig Thomas recalled. But, after some discussion, he agreed to stick with the plan. He knew that burning might make the birds leave or fail to fledge young, but, he told me, "the collaboration effort and what we had accomplished together mattered more."

When the Sagehen Forest Project tested its fire regimen on two five-acre plots, the results were striking: a bespoke application of thinning followed by a prescribed burn reduced fire risk just as efficiently as the Forest Service's standardized SPLATs, while also preserving more wildlife habitat and producing a higher yield of usable timber. The remaining trees seemed to respond well to fire, too; sensors that monitor levels of ethylene gas, which plants exhale when they're under stress, showed that the forest relaxed almost immediately post-burn.

But, despite the success of the project, enormous challenges remain. The Forest Service struggles to muster the resources and the staff necessary to

burn safely. The California Air Resources Board restricts prescribed burns to days when pollution is at acceptable levels and the weather likely to disperse emissions from fire. In practice, this means that burning can occur only during a few weeks in the spring. In summer and autumn—the seasons when forests would burn naturally—the state's air usually falls foul of the Clean Air Act. These are also the months that are most prone to uncontrollable wildfires, whose smoke is far more damaging to human health than that from prescribed fire. But, perversely, because wildfires are classified as natural catastrophes, their emissions are not counted against legal quotas.

Not only did the Sierra Nevada's native species evolve to survive fire; several of them actually require it in order to thrive.

Photograph by Kevin Cooley for The New Yorker

The window of time available for prescribed burns is further reduced by the stringent requirements of staffing, weather, and conditions on the ground, so that, in effect, there are just a few days each year when the Forest Service can set fires—nowhere near enough time to burn at the required scale. Even at Sagehen, large tracts of forest that should have been treated with fire remain untouched. When I made a second visit there and hiked through the forest with Brown and Faerthen Felix, he gestured ruefully as we passed through an area that seemed reasonably uncluttered. "We thinned this section years ago," he said. "We just haven't been able to burn, so it's a mess."

He pointed a few hundred feet ahead, to a couple of piles of spindly logs, two stories high. They represented another challenge. "These aren't big enough to go to a mill to be processed into boards," Brown said. "Ideally, we'd chip them and drag them down the road to burn for fuel and power, but the math doesn't add up." Traditional logging fells the biggest, most salable trees, but those are the ones that Sagehen's strategy is designed to spare. Thinning produces timber that has no value as lumber. Brown was resigned to simply burning these woodpiles, but air-quality restrictions had prevented him from

doing even that. So the logs just sat there, increasing the risk of wildfire.

Brown has begun working with a group of researchers at U.C. Santa Cruz to imagine the outlines of a timber industry built around small trees, rather than the big trees that lumber companies love but the forest can't spare. In Europe, small-diameter wood is commonly compressed into an engineered product called cross-laminated timber, which is strong enough to be used in multistory structures. Another option may be to burn the wood in a co-generation plant, which produces both electricity and biochar, a charcoal-like substance used to replenish soil. Brown has also been talking to a businessman who hopes to burn waste wood to heat an indoor greenhouse-aquaculture operation. His vision is to provide organic vegetables and shrimp to buffets in Las Vegas, and then to interest California's cannabis farmers in using shellfish-dung-enriched biochar as fertilizer.

Throughout California, creative efforts are being made to tackle the obstacles that have slowed implementation of the Sagehen plan and now hamper its replication elsewhere. Regional air-quality officials have been brought into collaborative projects, in the hope that they will permit more flexibility. New state legislation has allocated millions of dollars to hire full-time burn crews, and will also require California's air board to quantify emissions from wildfires, in order to reverse the incentive against prescribed fire. To help entrepreneurs build business plans for monetizing small-diameter timber, Forest Service scientists are trying to quantify how much of it will be removed from forests.

Across the region, the Forest Service is devising projects to thin and burn on the Sagehen model. Meanwhile, Brown has helped launch the largest forest-restoration venture yet undertaken in California: the Tahoe-Central Sierra Initiative. It encompasses an enormous swath of forest that extends as far north as Poker Flat, level with Chico, and as far south as the American River, level with Sacramento. Brown's goal is to return fire to three-quarters of a

million acres in the next fifteen years.

Achieving this will require a radical acceleration of the process that took place at Sagehen. Scott Conway has been exploring ways of using artificial intelligence to synthesize satellite data and aerial laser imaging into precise, three-dimensional maps of the more than a million acres that make up the Tahoe National Forest. With a grant of $1.3 million dollars from the Moore Foundation and the support of Silicon Valley startups, he has begun work on creating an open-access platform currently called the California Forest Observatory. Information that required years of on-the-ground counting and analysis at Sagehen—tree diameter, forest structure, fuel load—should soon be almost instantly accessible. Currently, the fire-risk map used by the California Department of Forestry and Fire Protection doesn't include weather data and hasn't been updated to show burned areas since 2005. The prototype Forest Observatory will incorporate fresh satellite imagery on a daily basis.

Perhaps Sagehen's most important legacy is cultural: persuading the Sierra's warring stakeholders to conceive of forest management in ways they had previously rejected. Three of California's national forests have recently mandated allowing wildfire to spread in areas where it will be beneficial. Forest Service employees will have to file paperwork to justify putting out a fire that has started, where previously any decision not to extinguish a fire was ground for disciplinary investigation.

Attitudes among conservationists have evolved, too. In July, I joined Craig Thomas, the former director of Sierra Forest Legacy, for a hike along Caples Creek, in the Eldorado National Forest, just south of Lake Tahoe. "I would take those out," he said, pointing at two lovely little cedars nestled in the shade of an enormous sugar pine, their crowns just grazing its lower branches. They posed an existential threat to the larger tree, offering fire a fast track up to the canopy, and a lack of sunshine and nutrients had left them stunted.

Thomas, a man who once spent much of his time suing the Forest Service, told me that he recently became certified to operate a chainsaw.

The Illilouette Creek wilderness area, in Yosemite National Park, is encircled by granite peaks that create a natural firebreak. Because it is so unlikely that any fire could spread beyond them, the National Park Service, in 1972, made the decision not to suppress wildfire within the basin's fifteen thousand acres. Since then, thanks to more than a hundred and fifty lightning ignitions, almost every acre, excepting bare rock and the creek itself, has burned at least once—some in small, pocket blazes, some in larger, more intense conflagrations. The resulting landscape provides a glimpse of what California's forests ought to look like—how they will look if Brown's Sagehen strategy succeeds.

In June, I visited Illilouette with Katya Rakhmatulina, a doctoral student who works with Scott Stephens studying the hydrological effects of wildfire. On a two-mile hike to one of three monitoring stations she maintains there, we passed perhaps only a hundred and fifty feet of what most people would consider picture-postcard Sierra Nevada forest—dark-green, conifer-packed woods with a rust-colored carpet of fallen pine needles. The rest was a surprising patchwork of landscapes: rush-filled meadows, crisscrossed with fallen logs; large, sunny grasslands punctuated by a few big trees; copses of young pines and willows; and recently burned expanses, where the ground was brownish black, spattered with delicate pink flowers and adorned with carbonized trunks, gleaming and sculptural.

Rakhmatulina was going to the station to rewire some cables that had been detached by bears. While she attempted to reboot the station's instrumentation, she told me about her research and the ways that fire affects groundwater supply. Having more trees in the landscape depletes water resources—like having more straws in a drink. Furthermore, pine needles and bark on the forest floor can form a resinous layer that prevents snowmelt and

rainwater from sinking in and building up groundwater reserves.

More than sixty per cent of California's water supply originates in the Sierra Nevada, so anything that can preserve and increase that resource ought to be of immense value to the state's residents. Brown says that he sees California's water utilities and agribusiness as future converts to his cause and imagines a day when forest restoration could be paid for by a couple of extra cents on everyone's water bill.

I left Rakhmatulina to her tangle of wires and wandered back through the basin. Long vistas extended in all directions, allowing views of snow-covered mountains. The "forest" felt more like a lightly wooded park—it has an average of fifty trees per acre, compared with the four to five hundred that are typical elsewhere in the Sierra Nevada—and I began to realize that saving these forests will require a profound adjustment in our sense of what nature looks like here. The dark, dense, wild forests of European fantasy translate, in the drier conditions of California, to a landscape that is both dying and deadly—but how many of us are ready to make that perceptual shift? The picnickers, hikers, and mountain bikers who fill the parking lots of the Sierra Nevada each weekend, and the wealthy summer-home owners who prize the privacy of Lake Tahoe's emerald shores, will have to learn to appreciate more open, meadowlike environments. Logging jobs that have been lost could be replaced by new careers in fire management. Californians will have to forge a new relationship with their forest, and see the Sierra more as its native inhabitants once did—as a landscape that should be tended like a garden rather than harvested as a crop or protected as a wilderness. ♦

An earlier version of this article incorrectly stated the dollar amount granted by the Moore Foundation for the development of the California Forest Observatory.

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