Rekindling Native Fires

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SHARON LEVY

Just up the hill from the old Lyons homestead, in what is now Redwood National Park, stand a group of majestic tan oak trees, their broad bases hollowed and blackened by fire. Amelia Lyons tended these trees by burning out the undergrowth around them, and like generations of Hupa women before her, she was rewarded with an abundant crop of acorns. Long after her death, the ground is littered with hundreds of small brown globes dropped by the trees. But without Amelia's fires, the acorns are riddled with weevil holes.

Amelia survived the violent clashes between northern California Indian people and the white settlers who arrived here during the Gold Rush of the 1850s. In 1866 she married Jonathon Lyons, the first man to start ranching in the Bald Hills, a series of sunlit prairies on a ridgeline that runs east from the coast and its dark stands of redwood forest.

John McClelland, a fire management technician with the National Park Service (NPS), stands in the tan oak shade. Traces of the fire traditions of Amelia and her people continue to emerge as he and his colleagues work to clear off the army of skinny Douglas fir trees that have invaded the Lyons homestead since Indian burning was banished. He points out hazel bushes growing at the edge of the tan oak stand, which native women burned to induce growth of strong,

US Forest Service personnel set this controlled burn on the Orleans District of Six Rivers National Forest, on the Klamath River in northwestern California, in October 1995. The fire was intended to bring new growth of beargrass, a plant used by Indian basket weavers. In an era of fire suppression, Indian people carrying on the weaving tradition struggle to find usable plant material. Photograph: Sharon Levy.

Baskets belonging to Lori Smith, a contemporary weaver of Yurok and Wailaki heritage. Two of the baskets, a woman's ceremonial basket cap (left) and trinket basket (center), belonged to Smith's great-grandmother and are about 150 years old. Smith used these baskets as a reference as she learned to weave in the traditional way. The acorn mush bowl (right) was woven by Smith herself. The dark brown is spruce root, and the blonde strands are beargrass. Photograph: Sharon Levy.

straight new shoots for basket weaving (California Indians used baskets, rather than pottery, for cooking and collecting food). Amelia set fires to tend the hazel as well as the tan oaks; now there's not a single flexible, young stick on the plant that a weaver could use.

The meadow where the Lyons family settled had been created and maintained by Indian people wielding fire. Settlers who saw the Bald Hills in the early 1850s described "prairies of rich grass...the finest tracts of country in California...where elk roamed in bands of hundreds, or perhaps thousands." Today, many nearby coastal meadows have been swallowed by forest. The balds where Amelia, Jonathon, and their sons ran sheep have shrunk but still exist—because the family kept burning them as late as 1930, when the California Division of Forestry called a halt to intentional burning. Like the US Forest Service (USFS) and NPS, the agency began to do its aggressive best to stop any wildfire, natural or humanmade.

After decades of fire suppression, the NPS has come full circle. In 1992, Redwood National Park staff began setting prescribed fires in the Bald Hills, with the aim of preserving the meadows that have been part of this landscape for centuries before white settlement. They'd like to burn all the balds once every three to five years; in good years they've

Lori Smith, a basket weaver of Yurok and Wailaki heritage, works on a new basket. Photograph: Sharon Levy.

burned up to 2000 acres of prairie and oak woodland. (Some years, when firefighting crews are called away or weather conditions aren't right, they can't burn at all.) In the aftermath of the flames has come an increase in native species diversity, a drop in fuel loads, and a reduction in the numbers of some invasive exotic plants.

Through trial and error, and despite the obstacles of limited funding and a maze of bureaucratic requirements that must be negotiated before each burn, the park's staff are trying to rediscover Indian land management. "We try to mimic native burning, but we don't know precisely how often or when they burned," says McClelland. From records left by anthropologists who talked with native people at the turn of the last century, and from interviews with living elders, researchers know some of the reasons native people burned: to stimulate hazel growth, to control weevils that could infest the acorn crop, to keep the meadows open and bring new forage for game animals.

The NPS is bringing flames back to a number of parks, including Yosemite, Sequoia, and Lassen, where a policy of "fire use"—letting lightning-sparked fires burn as long as they don't threaten developed areas—has been introduced. The National Fire Plan of 2000 recommended a number of actions to reduce fuel loads in western forests, including prescribed burns. But the fire plan made no mention of native burning. Computer models designed to analyze fire history and ecology still interpret only lightning strikes as "natural" sources of ignition.

Some researchers, and many native people, argue that by ignoring the history of indigenous burning, land managers are missing out on ancient knowledge that can help show the way out of a very modern fire dilemma.

Setting fires so good things grow

The US campaign of fire suppression has proven far too successful: Forests across the country are choked with thick undergrowth and downed logs, and fire-

Where there's smoke, there's germination

American Indian people planted their tobacco only in places that had recently burned. "We now know that native tobacco seeds must be exposed to smoke or charred wood to trigger germination," says Jon Keeley, an ecologist with the US Geological Survey. "Native people recognized that these fire-dependent plants required smoke."

The scientific community did not begin to understand the ecological power of smoke until the late 1980s. Hannes de Lange was then a graduate student at the University of Stellenbosch in South Africa, working to protect false heath, a threatened plant from a unique fire-adapted habitat called the fynbos, on the west side of the southernmost tip of Africa. The false heath seeds stubbornly refused to germinate until Lange tried exposing them to smoke. Then, at last, the plants sprouted in abundance.

Several researchers were soon working to discover just what components of smoke awaken dormant seeds. In 1998, Keeley and C. J. Fotheringham published an account of their experiments showing that nitrogen dioxide (NO_2) can trigger germination in the seeds of several plants of the California chaparral.

NO_2 is not the only chemical key in smoke that can unlock dormant seeds. Other researchers have triggered germination using Liquid Smoke from a grocery store, a concoction that contains no nitrogen oxides. Recently, a group headed by Kingsley Dixon of Kings Park and Botanic Garden in West Perth, Australia, isolated an organic molecule from smoke—butenolide—that can trigger germination at very low doses.

"Butenolide is the key agent responsible for the remarkable postfire germination events that occur in nature," says Dixon. "It germinates all known smoke-responsive species that we've been able to test."

Butenolide germinates the seeds of many plants, including some, like lettuce, that have no association with fire. No one disputes that it is likely to become an important tool in horticulture, but Keeley questions whether it's really the substance that kick-starts fire-adapted plants in nature.

Many California chaparral plants will sprout only in the first year following a fire. Seeds then go dormant and don't sprout until another blaze passes through. Yet Dixon and his colleagues have shown that butenolide can work at tiny doses—on the order of parts per trillion. "Those levels of butenolide are likely to remain in soils for years after a fire," says Keeley. "If butenolide is the key, how do those plants maintain dormancy?"

Dixon believes his new discovery will have important applications in restoration ecology, especially in habitats affected by a history of fire suppression. "This is good news for land managers—it is now feasible, for the first time, to manage germination and recruitment of many rare and endangered species from fire-prone environments," he says. In wildlands at the edge of urban areas, where smoke from prescribed burns can impact thousands of people, applying butenolide to the soil might prove to be an important alternative way of keeping smoke-dependent plant populations healthy. This idea has yet to be field tested, since only small amounts of butenolide have been synthesized to date. Dixon believes it's a promising approach, and that using synthesized butenolide will be an affordable option, since only trace amounts are needed to stimulate dormant seeds.

adapted trees—like the California black oak and the ponderosa pine—are being eclipsed by species like Douglas fir and grand fir that thrive in the deep shade of unburned forest. When blazes do start in these altered forests, they burn hotter and spread farther than they did in presettlement times. Even an army of firefighters, backed by air drops of fire-retardant chemicals, can't do much to stop these infernos.

The scientific community has long debated the question of whether, and how much, Indian burning altered the American landscape. The maverick anthropologist Omer Stewart argued as early as 1952 that Indian people had shaped ecosystems throughout the continent with fire. By the 1960s, another maverick, the fire ecologist Harold Biswell, was proving that sequoia forests need flames, not protection from all fire, to survive. But it took many years for these ideas to penetrate two entrenched dogmas, that wildfires are always a threat to nature, and that human beings never influence their environments until they settle down and start to farm.

For California Indians, the question of fire was a no-brainer. "Our kind of people never used to plow," a Karuk woman told the ethnologist J. P. Harrington in 1929. "All that they used to do was to burn the brush, so that some good things will grow up. They do not set the fire for nothing, it is for something that they set the fire."

Kat Anderson, an ethnoecologist at the University of California–Davis, has been working with native people from the Sierra Nevada since 1986. "Elders say the most important reason for burning is to keep down the brush, to prevent catastrophic fire," she reports. "They're very concerned with protecting the big trees, and they know that in many places it's too dangerous to burn now, unless the undergrowth is thinned out."

Anderson has found a mass of documentary evidence to support claims of widespread native fires in presettlement California. There are numerous mentions of Indians setting landscape fires in the diaries of early settlers. Photos of 19th-century California Indian women often show them working on baskets, using long straight shoots of beargrass, redbud, sourberry, or hazel. Contemporary native weavers say that these young branches must be collected in

This fire was lit by Cyrus Rostron (left) and Edwin Pamkal (right) near Korlorrbirrahda, a small Aboriginal settlement in Arnhem Land, Australia. Aboriginal fires here are so frequent that even those set at the hottest, driest time of year flicker out within a day, illustrating the powerful management impacts of traditional burning. Photograph: Brett Murphy.

their first or second year of growth after a plant is burned. Museums hold some of the plant shoots Indian women collected in the years after the Gold Rush, straight and strong, still intact in tidy bundles more than a century later.

Based on baskets made by contemporary weavers, Anderson has estimated that a single Indian village in presettlement times would have used hundreds of thousands of straight branches to make baskets used for cooking, collecting acorns and grass seeds, and carrying babies. Walk into the woods of the Sierra Nevada today, and you will still find stands of basket plants like redbud and sourberry. In most places the bushes have not burned for years, and their branches are gnarled and hardened, useless to a weaver.

By the 1970s, weavers from the Yurok and Karuk tribes, who live along the Klamath River, not far from the Bald Hills, were having a difficult time finding usable plants in a landscape where every wildfire was suppressed. Keeping the basket-weaving tradition alive had become a matter of cultural survival. Native women scoured the places where loggers had burned slash, searching for new sprouts of basket plants. Sometimes they took matters into their own hands and dropped a strategically placed match.

"When I lived up the Klamath, a lot of times you'd hear the engine roaring out of Orleans to put out a forest fire," remembers Kathy McCovey, a Karuk tribal member and archaeologist for Six Rivers National Forest. "My husband would say, 'That's my grandma out burning.' The little old ladies would walk along and see a spot that looked right and set a fire. It's a real pain in the butt to go through all the paperwork required for an approved, prescribed fire. It's easier to just drop a match. But now we have such a fuel load that the fires burn too hot."

McCovey has been advocating for Indian basket weavers for years and has seen a real change in the attitude of forest managers. Twenty years ago, most USFS officials were skeptical of any management strategy that was not directly aimed at increasing the timber cut. The agency has become much more supportive of lighting controlled burns to manage hazel and beargrass, and McCovey is now one of the organizers of an award-winning Forest Service program called Following the Smoke, in which volunteers help Karuk weavers to clear excess fuels from areas designated for burns and then learn about the basket-weaving process. Still, few prescribed fires actually take place. "The windows for burning are so limited," says McCovey. "Often we can't go through with

a planned fire because the fuel moistures are too low and the temperatures are too high. And when conditions are just right, we can't go ahead because the fire crews are away fighting wildfires."

Fire suppression backfires

Fire suppression is a very tough habit to break. Ecologists now understand that excluding fires from western forests has led to dangerous accumulations of fuel and is unhealthy for key fire-adapted tree species, including lodgepole pine and giant sequoia. Still, state and federal agencies continue to pour millions of dollars and work hours into fighting fires every summer. This past fire season, more than 8 million acres of wildlands burned in the United States. In 2003, the most recent year for which full statistics are available, federal agencies spent $1,326,138,000 on fire suppression efforts, and close to 5 million acres burned.

Many fire-fighting organizations still have the same marching orders they did 30 years ago: Put out every fire, as fast as possible. Conflicts with endangered species protections, air quality regulations, and fears of liability stymie plans to use controlled burns to reduce the fuel overload. Even some native people whose survival may depend on restoring fire can't see a way to get off the suppression merry-go-round.

In the remote Yukon Flats region of interior Alaska, fire suppression has made it increasingly difficult for native Gwich'in people to use their traditional means of subsistence—hunting for food and trapping for furs. Before the state government cracked down on the practice in the 1950s, the Gwich'in routinely burned along creeks and wetlands to create fresh forage for moose, muskrats, and waterfowl. Now, says David Natcher, an anthropologist at the Memorial University of Newfoundland who has worked with the Dendu Gwich'in, native people are caught in a conflict between their dependence on fire-fighting jobs—the only source of paid work in this part of Alaska—and their need for flames in the boreal forest.

Natcher found that moose, one of the primary sources of food, are moving away from the Dendu Gwich'in community of Birch Creek in the aftermath of 50 years of fire suppression. The animals are moving east, into areas that have burned more often. Studies confirm the Gwich'in belief that fires bring food for the moose: one ecologist's estimate is that one year after a fire this land produces about 200 kilograms (kg) per acre of browse, a level that declines with time between burns. Boreal forest stands that have not burned for 25 years hold less than 10 kg per acre of browse.

Natcher is working with native elders in the Yukon Flats, recording their memories of traditional burning patterns—a trove of knowledge that he believes must be preserved. "These guys know the land," he says. "They know if there's been a heavy frost, fires won't get out of control. They know if there's a mosaic of burned patches on the ground, a new burn won't flare too hot and become a sweeping crown fire."

Across the border, in the Canadian Yukon, some native groups who've regained control of their lands want to work toward burning again in the traditional way, planning prescribed burns based on indigenous knowledge rather than the standards of the US or Canadian Forest Service. Natcher believes that a collaboration between native people and government agencies is the best way to move fire management forward. Prescribed burns designed to reduce the fuel load in local forests could keep fire crews busy for some time to come and increase forage for moose at the same time.

Yet many native people oppose a new "let-burn" policy that would allow lightning fires to burn. They need fire-fighting jobs to make a living, even though they know a lack of fire is depleting local wildlife populations. "It's a Catch-22," explains Natcher. "Resources are in a state of decline due to fire suppression, but they can't afford to give up fire-fighting now, when they have to travel farther and farther to harvest a moose."

Lessons from fires Down Under

At the close of a blazing hot day, late in northern Australia's long dry season, Cyrus and Lindsey Rostron touch burning branches to the grass. They're still young—13 and 11 years old—but they're busy learning from their older brothers and uncles how to take care of their home country, along the remote Cadell River in Arnhem Land, a vast stretch of Aboriginal land in the Northern Territory. Fire is their most basic tool; it's also outrageous fun. Cyrus and Lindsey dance among the slow-moving flames, while their older relatives look on with affectionate approval.

This Aboriginal fire is the antithesis of a North American controlled burn. Instead of a flurry of paperwork and a troop of uniformed, gear-laden firefighters, there are two adults and two kids lighting the grass because they happen to be here and the place looks ready to burn. The flames creep along the ground, rarely reaching high enough to scorch the leaves of the eucalyptus trees.

David Bowman, a fire ecologist at Charles Darwin University, stands grinning in the firelight. For several years now, he's studied the effects of indigenous fire in one of the last places on the planet where native people have been able to continue their traditional ways of burning uninterrupted. Using modern tools like GPS, satellite imagery, and aerial photography, he's shown that areas managed by Aborigines are more biologically diverse and far more resistant to intense flames than nearby areas that have been uninhabited since the time of European colonization.

One dramatic example is the fate of the fire-adapted cypress pine, which is dying off across much of its range. "If cypress pines were people," says Bowman, "we'd talk about an epidemic. If you go to nearby places where no Aboriginal people have been living for 50 years or so, you can fly along in a helicopter and count dead cypress pines. They're just scattered all over the landscape." The Rostron's home turf still harbors abundant, healthy cypress pines, evidence of the local people's skillful use of fire.

Vast expanses of the Northern Territory suffer from problems similar to those in the western United States. Thick vegetation grows up during the rain-drenched months of November through

Joshua Rostron set this blaze while hunting for kangaroos. Aboriginal people traditionally use fire to drive kangaroos toward waiting hunters, but this blaze played no role in the hunt itself. "I'm sure similar fires would have been lit had [Rostron] been walking through that country for whatever reason," says Brett Murphy, a graduate student working with fire ecologist David Bowman. Photograph: Brett Murphy.

February. With the lapse of Aboriginal burning in most areas, heavy accumulations of fuel build up. When lightning storms strike late in the dry season, these places burn hot and flames spread much farther than they did when Aboriginal clans lived scattered across the landscape. Most Australian land managers believe the only answer to these increasingly intense blazes is to set controlled burns early in the dry season, reducing the fuel load before it becomes flammable as tinder.

Bowman has found that the Rostrons light most of their fires late in the dry season, at what is considered the most dangerous time of year. Yet the flames stay relatively cool, clearing out undergrowth but sparing the trees. Because Aboriginal people burn often, maintaining a patchwork of charred areas that are cleared of fuel, their fires die out within a day, even in the scorching heat of October. Frequent burning is a far more powerful protection against intense, catastrophic blazes than the most high-tech, modern fire-fighting equipment.

"Nature, independent of humans, created flammable ecosystems," says Bowman. "Prehistoric humans tamed these natural fires. Modern people deny this historical and evolutionary reality. As a result, fire has become feral, and a serious management problem."

The Aboriginal people here, the Bininj, face some problems that parallel those of the distant Gwich'in. The Rostrons are among a small minority that have stayed on their traditional land rather than live in the overcrowded town of Maningrida, one of several Arnhem Land settlements that have sprung up since the days of colonization. The Djelk Rangers, a group working to teach young people about the bush and encourage them to once again start managing their ancestral lands, is struggling to restore traditional burning to long-abandoned areas.

The federal agencies that supply the Djelk Rangers' shoestring budget strive to impose a white vision of fire management, advocating burns early in the dry season. This approach may be best in overgrown country with heavy fuel loads. But air drops of incendiary devices in the early dry season threaten to distort the ancient pattern of fire in the few places where people like the Rostrons have been able to maintain it.

Bowman holds no illusions that the modern world can return to an indigenous style of land management. But he believes that knowledge of Aboriginal burning can provide crucial inspiration for managers grappling with the daunting problems of fire in today's wild lands. "In the past, humans forged a sustainable relationship with fire," he says. "Finding new ways to achieve that is the hard challenge we face now."

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