



CLIMATE

# BURN NOTICE





With climate change turning up the temperature and the state in a four-year drought, wildfires are scorching California like never before. A team of biologists looks in the “nuke zone” to find clues that can help forest managers handle the heat.  
**By Jane Braxton Little** | Photography by Ken Etzel



#### **FIT FOR DUTY**

A juvenile Hairy Woodpecker, recently fledged, sits aloft on an ashen tree. It most likely hatched somewhere in this burnt forest.



### At 3 p.m. on August 17, 2013, a hunter's

illegal campfire crept out of control near Yosemite National Park. The fire spread through dry underbrush along Jawbone Ridge, licking up the trunks of ponderosa pines, searing and scorching until entire treetops burst into flames, flinging sparks and glowing needles skyward. On August 21 the fire, now known as Rim, went on a rampage, exploding over rocks and leaping the Tuolumne River, torching stands of centuries-old pines and plantations of young trees in a red-hot rage that blackened more than 125 square miles in just two days. By the time it was finally extinguished on October 25, the Rim fire had consumed 402 square miles of forest, an area 11 times the size of Manhattan.

Eight months later Ryan Burnett surveyed the scene from a crest overlooking the Tuolumne watershed. Ridgetop after ridgetop was covered with dead trees, some with needles scorched rust from the heat, others singed bare. Not a single green tree stood in the vast and bleak vista. And yet, a green patch of miner's lettuce crept up a hillside; scarlet paintbrush poked out of the ashy gray dirt; a Lazuli Bunting zipped among the dead mountain mahogany; an American Kestrel hovered over burnt and brittle treetops—all astonishing, spectacular proof that fire creates even as it destroys.

Scientists have long known that fire is a primary force in shaping ecosystems. But because of its destructive power—incinerating homes, habitat, and valuable timber—frightened lawmakers and land managers have driven a campaign designed to control fire at all costs. Thus, for more than a century, fires were suppressed in California's Sierra Nevada and throughout the West. And while this reduced historic levels of smoke and burned acreage, it left forest ecosystems critically out of balance. Without the cleansing fires that reduce ground fuels and kill some vegetation, many forests grew thick with trees and overcrowded with brush, a tinderbox that only made the landscape more vulnerable.

In those conditions, fire, naturally, has reasserted itself, and the number of wildfires in the West has grown by an average of about seven per year since the mid-1980s. At the same time, forests are burning both earlier and later in the season and with much greater severity than 100 years ago, a U.S. Forest Service study found. And a changing climate is predicted to bring further increases in the incidence of wildfire, say California experts. Temperatures in the Sierra are expected to rise an estimated 10 degrees Fahrenheit over the next century and the snowpack to melt almost a month earlier. That is, if there is snowpack. Last winter the Sierra was virtually snowless, dramatically compounding the effects of the state's fourth year of drought. Researchers predict a combination of higher temperatures, increased evaporation, and reduced precipitation that could, in 70 years, more than double burned areas in California.

Haunted by this steady escalation of western wildfires, scientists and land managers say the

need to better understand how fire affects the landscape is becoming increasingly dire. Burnett, Sierra Nevada director of Point Blue Conservation Science, a nonprofit organization based in Petaluma, California, is trying to answer some of the questions. He is leading a research team into the post-fire "nuke zone," looking at birds and species diversity for clues that can help inform better forest management. "More and more, the past is becoming irrelevant as we advance to the no-analog future climate," he says.

What his team and others are finding calls for a radically different approach to managing forests, before and after they burn.

### A week prior to visiting the site of the

Rim fire, Burnett, 41, was slogging through grimy soot 300 miles to the north. Lean and lanky, with an athleticism that made him a high school baseball standout, he loped up a hillside near Humbug Summit at the northern end of the Sierra just south of Lassen Volcanic National Park. The 2012 Chips fire, named for a tributary to the Feather River where it started, burned across 119 square miles of pine and fir forest in the Lassen and Plumas national forests. Now, 18 months later, the soil was soft and pliant under a light cover of pine needles.

The flames that roiled through this overcrowded stand set the stage for a suite of fire-dependent plants and animals that began showing up almost immediately. Here, and after almost every forest fire, the bugs arrive first—more than a dozen species. Alerted by infrared-sensing organs in tiny pits in their thoraxes and guided by delicate smoke detectors on their antennae, bean-sized black fire beetles flew in from as far as 30 miles away. Other beetles were drawn to the fire by the chemical-rich smells billowing out of the burning trees. Whatever the alert, beetles and other insects were in pursuit of mates. Soon the woods filled with a sound like munching carrots as they bored tunnels in still-smoking trees to lay their eggs. Later, bark beetles and a variety of fungi would claim those passages for their own propagation purposes.

The beetle eggs and larvae in turn drew Black-backed Woodpeckers, which arrived within weeks, many ravenous after traveling 75 miles or more. How they found this hot spot is a matter of scientific speculation, but the odds are on their excellent detection of smoke, which promises the rich reward of abundant food. One Black-backed can slurp up to 50 larvae a day. With plenty to eat, they excavated nests in closely grouped stands of fire-killed trees. After they raised their chicks in these hammered-out cavities, other woodpeckers and birds took them over in a symbiotic progression that eventually included small mammals.

Burnett halted at the sharp metallic *chek* of a Black-backed. Scanning the trees with binoculars, he found the bird a mere 10 feet away, clinging to the side of a charred fir and all but camouflaged by its soot-colored back. The giveaway was a luminous yellow cap—the male Black-backed's



### RUNAWAY FIRE

On August 17, 2013, a hunter's illegal campfire in a remote canyon of Stanislaus National Forest sparked a blaze that raged for nine weeks, charred more than 400 square miles, and cost \$127 million to extinguish. Named for the Rim of the World vista point, a scenic overlook on the drive to Yosemite, the Rim fire was fueled by severe drought and high temperatures. **Opposite:** In their role as excavators, woodpeckers are important ecosystem engineers in burned environments.







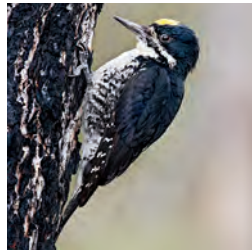




ROBERT ROYSE/BIA/MINDEN PICTURES/CORBIS

**Back in the early 20th century, when the** U.S. Forest Service declared war on fire, one of the first posters advocating prevention personified forest fire as the Grim Reaper riding an emaciated stallion through a magnificent old-growth forest while setting it ablaze. Smokey Bear soon took up the cause with his stern “ONLY YOU [can prevent wildfires]” admonition to generations of wide-eyed children. Along with responding to a primordial fear of fire, suppression policies contributed to the commercial timber logging that became the focus of Forest Service management in the West. Logging began increasing in the 1930s, peaking in 1989 at 13 billion board feet annually, enough to house today’s population of Houston.

Fire disrupts that stability. Scientists consider it a keystone ecological process, as essential as sunshine and rain. The flames that erase old-growth habitat for Spotted Owls and Pacific fishers stimulate fresh habitat for mushrooms, insects, and birds that have adapted to it over millennia. It's an intense yet short-lived process fed by flushes of nutrients and bursts of sunlight. The rush of species slacks off within a decade, but while it lasts, the landscapes left by intense burns like the Chips and Rim fires are some of the most sensitive of all forest habitats, says Richard Hutto, professor emeritus of biological sciences at the University of Montana. The scorched but standing dead trees in these so-called "snag forests" are so unique that Burnett and others have proposed



fffffffffffnfn

[illegible]

Opposite top: Ponderosa pines blackened by the Rim fire. Bottom: A juvenile Hairy Woodpecker searches for food in its new home. Fires that “nuke” forest vegetation can also affect the soil chemistry, suppressing the growth of some plants for years but releasing others in bursts of energy that renew the habitat. Right: Using his auditory repertoire of several hundred calls, Ryan Burnett monitors birds in five-minute point counts to assess the long-term health of habitat. The Black-backed Woodpecker’s call is a sharp, distinct *chek*.

Understanding the importance of burned habitat does not make fire any easier to live with. In California more and more people are threatened by its destructive potential. Insurance analysts estimate that two million homes in the state's forest areas are at risk. The safety of these residents adds to the pressure on politicians and land managers already contending with a long-term drought and the heightened fire danger that accompanies hotter, drier forests.

As scientists learn more about the role of post-fire habitat, they are stimulating a debate over how to treat burnt landscapes. Management has been almost exclusively driven by the timber industry's view: Log to salvage everything possible before the trees lose market value. The chainsaws typically fell anything that can be milled into a two-by-four. Whatever's left is removed, burned, or bulldozed so the area can be prepped for planting a future lumber forest.

CONTINUED ON PAGE 56



for species adapted to scorched habitat, the salvage pendulum “has swung way, way too far,” he says. Heavy equipment compacts the sensitive soil, thwarting the regrowth of plants from both roots and seeds. Removing the beetle-infested trees that attract a wide variety of birds produces effects that are “uniformly negative,” explains Hutto, because most timber drilling and gleaning species disappear altogether. “Trying to make a quick buck off the burned forests today is more like borrowing from the forests of the future.”

Some activists advocate leaving all burned forests untouched. The Center for Biological Diversity and the John Muir Project repeatedly file lawsuits to halt salvage logging. Others see it differently. Congressman Tom McClintock (R-CA), chair of the House Subcommittee on Federal Lands, proposed Rim fire legislation to waive environmental reviews that delay logging through “bureaucratic processes or the usual litigation filed by extremist environmental groups.”

Barnie Gyant, the U.S. Forest Service deputy regional forester for California, is trying to balance these positions and the science behind them in the nine Sierra Nevada national forests under his jurisdiction. The issues are almost existential, he says: “Do we want forests in the future? What do we want them to be? And how do fires contribute to their overall health?”

### Burnett's nuke-zone studies provide

a window into what those future forests can look like under a profoundly different fire regime. On his Chips fire bird count, he scrutinized one charred tree after another. Tilting his head to listen, he identified 13 different species in five minutes. And he described the birds he heard: Lazuli Bunting: “tiny turquoise torpedo.” Black-backed: “New Year's Eve noisemaker.” Lewis's Woodpecker: “flying slice of watermelon.”

Considering the data, Burnett and other scientists point to a series of recommendations they believe will not only protect fire-adapted species but also increase forest resilience to future fires in the face of changing temperatures and the Sierra's diminishing snowpack: Replace dense rows of conifer seedlings with plantings in clumps. Mix pines, firs, and hardwoods in mosaics planted across an open forest floor. Stagger tree planting over several decades to allow natural regeneration and multiple ages. And most important: Close

large patches of burned areas to logging, leaving charred trees for foraging and nesting. Burnett's research shows that nesting Black-backed Woodpeckers need roughly 133 snags per acre; current Forest Service guidelines mandate leaving four.

In short, the science calls for hands-off in the very places where forest managers have long believed their human touch renders the benefits of fire protection and income to local communities. This poses an enormous challenge for land managers like Gyant, the Forest Service's second-in-command in California. However well he understands the seminal sequence of bugs to Black-backs to healthy green forests, he sees megafires like the Rim as a management dilemma that only promises to get worse. Using natural regeneration to replant trees is slow; right now Gyant is looking at tens of thousands of federally owned acres bereft of even one cone-producing tree. How will these forests reseed them-

### 2015 FIRE SEASON HITS HOME

As of the end of July, nearly 36,000 wildfires—about 2,500 more than at this time last year—had consumed an estimated 5.6 million acres in the United States. That ever-rising tally includes a portion of Audubon California's 6,800-acre Bobcat Ranch, in Winters. The ranch, a mix of blue oak woodlands and rangelands, provides important habitat to a variety of birds, including the Lark Sparrow, Golden Eagle, and Lewis's Woodpecker, as well as black-tailed deer, black bears, and, of course, bobcats. At press time, a Northern California wildfire known as the Wragg fire was singeing Bobcat Ranch as it claimed more than 8,000 acres in Napa and Solano counties. A 2014 fire burned more than 3,500 acres of the ranch before being extinguished. Biologists will be watching closely as the habitat and wildlife evolves during the post-fire years to come.

—Emily Silber



Bobcat Ranch, 2014. Bulldozers were used to create firebreaks to fight last year's blaze.

selves if no seedling trees are planted, he asks. “If we want a forest there in the future, how will it happen? Just wind blowing seeds and birds dropping them?”

Although the nuke-zone data recommend distinct management changes, no one expects that to happen overnight, Burnett says. What's critical is to accept forest fire as a natural phenomenon and begin implementing policies that create healthier, more fire-resilient forests. “Entering this novel climate scenario is a unique opportunity—to look at forests through a climate-smart lens and listen to what the Black-backs are telling us about burned areas,” says Burnett.

Deep inside a Rim fire-charred canyon above the Tuolumne River, he trudged up a hillside to a stand of seared pines. Purple lupines were in full flower, a vast carpet shimmering against black trunks. Chainsaws whined from a neighboring ridgetop, where loggers were already falling snags on timber company property. From the traditional perspective, the fire left an unbalanced ecosystem. Small mammals were simply gone, and nesting Spotted Owls, too. Pacific-slope Flycatchers and other species loyal to nest sites flew among the denuded trees looking for the dense cover that was no longer there and would not be for years.

“We've lost habitat in places—lost those majestic conifers,” Burnett says. “But we gained something different often not valued by society.” He watched Olive-sided Flycatchers dash above the scorched canopy, catching boring beetles in midair. A Lazuli Bunting sang from a blackened branch, part of a brilliant blue invasion that made it the most common bird species within the Rim fire perimeter. White-headed Woodpeckers hammered over Burnett's head. The flames that eliminated the green forest had created a vigorous new habitat.

By the next spring the lupines would be gone. As quickly as this wildflower spectacle bursts into bloom, the post-fire habitat moves on. Oak and pine seedlings already pushing tiny green spikes through the soot would crowd out the flowers. Fox Sparrows and Dusky Flycatchers would replace the buntings. Deer and chipmunks would make their way back, and the forest would mature. That is its nature: scorched today, green tomorrow and tomorrow until, once again, it burns. ■

Contributing editor Jane Braxton Little also writes for National Geographic, Scientific American, Discover, and High Country News.