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Environment

By Paul Tolmé

Will Global Warming Cause More Wildfires?



The first study to investigate how climate change will affect wildfire intensity in a specific region of the country forecasts more frequent flames for California

Even by fire-prone California standards, the inferno of October 2003 was stunning. The firestorm charred 740,000 acres, destroyed 3,600 homes, killed 24 people, caused thousands more to flee and cast a black pall over Los Angeles and San Diego. It was the nation's most destructive fire since 1991, when a conflagration in the hills outside Oakland burned 3,400 homes.

As this year's fire season rages on, residents of California and other arid states should brace themselves for possibly even worse conflagrations. According to a recent study, catastrophic fires such as these will become ever more common as a result of global warming. "Warmer, drier and windier weather promotes wildfires, and these are all conditions that will result from climate change," says researcher Margaret Torn of the Lawrence Berkeley National Laboratory in Berkeley, California.

Torn is one of the authors of "The Impact of Climate Change on Wildfire Severity: A Regional Forecast for Northern California," published in May in the journal *Climatic Change*. The study is one of the first to predict how global warming will affect wildfire intensity in a specific region of the country. Torn and fellow Berkeley Laboratory researcher Evan Mills, along with U.S. Forest Service investigator Jeremy Fried, looked at not only the weather changes that will affect wildfires but also factored in the firefighting effort likely to be employed in the future.

Their predictions show that the number of "runaway" fires (the small proportion of blazes that escape initial firefighting efforts and go on to ravage large areas) will double in northern California when carbon dioxide doubles in the Earth's atmosphere—a threshold climate scientists expect the planet to cross later this century. This increase of 114 runaway fires yearly will kill more people, destroy more property and wildlife habitat, worsen air and water quality, cause floods and mudslides on destabilized hillsides and drive up the costs of firefighting and insurance. In addition, increased fires will change the ecology of northern California, as grasslands and scrub forests replace tree stands.

"Fire is a natural disaster that affects the financial climate as well as the geophysical climate," Mills says. The study does not estimate the added cost of fighting these fires, but notes that California already spends more than \$250 million annually and any increase in expenditures would be "substantial."

The report should set off alarm bells across the western United States, especially in areas that are warmer and drier than northern California. "California is a fairly wealthy state," says Mills. "The potential for runaway fires could be much greater in states that have fewer resources to knock down fires."

Despite their grim assessment, the researchers stress that their estimates for runaway fires are conservative. That's because the study does not include factors such as increased lightning strikes, a proliferation of fire-prone grasslands and more pine-killing beetle infestations—all of which are predicted by other climate change models.

In the desert Southwest, for instance, invasive cheat and red brome grasses are expected to proliferate and cover what is now barren ground between sagebrush and other scrub plants, according to a study published in 2000 in *Nature*. The authors write that flames will race through these dry grasses, causing

fires in a region where sparse vegetation previously limited runaway blazes. Moreover, these fire-prone grasses will wipe out native species.

Warmer temperatures also are expected to lead to greater bark beetle infestations in western forests, where such outbreaks already are being blamed for increased fires. The beetles bore into trees and lay eggs. Healthy trees can fight off the pests by secreting pitch to plug the insects' holes, but drought weakens the ability of trees to recover, leading to massive die-offs that turn evergreen forests into reddish-brown tinder stands. Mountain pine beetles are attacking the lodgepole pine forests of the higher-elevation Rockies, while the western pine beetle has inundated ponderosa forests that cover the foothills of the West.

Possibly the starkest example of the devastation caused by global warming-induced beetle infestations is taking place on Alaska's Kenai Peninsula. Since the 1970s, Alaska's mean temperature has risen by 5 degrees in summer and 10 degrees in winter. In response, beetles have proliferated and wiped out 95 percent of the spruce on the peninsula, killing 38 million trees in a forest the size of Connecticut. Researchers are calling it North America's largest-ever insect infestation, and forestry officials worry that it is just a matter of time before a catastrophic wildfire strikes.

As the continent warms, North America will experience "an earlier start to the fire season, and significant increases in the area experiencing high to extreme fire danger," according to the United Nations' Intergovernmental Panel on Climate Change's (IPCC) 2001 report, "Impacts, Adaptation and Vulnerability."

People in other countries should prepare for more flames as well. The IPCC report predicts more fires around the planet, and these flames will encourage the growth of grasslands and vegetation "that in turn exacerbates this risk."

In Australia, Kevin Tolhurst of the University of Melbourne predicts warmer temperatures and increased vegetation will lead to more intense fires, such as a blaze that burned for 60 days in 2003, blackening much of Victoria. And health officials should prepare to see more patients, warns Paul Epstein of Harvard Medical School's Center for Health and Global Environment.

He points to figures from the Centers for Disease Control which suggest that the fires that ravaged Florida in 1998 yielded a 91 percent increase in emergency-room visits for asthma, a 132 percent increase for bronchitis and 73 percent for chest pain.

All of this is sobering news in California. "Having a Los Angeles or Oakland fire more frequently, that's really frightening," Torn says.

Paul Tolmé lives in Colorado, another wildfire-prone state.

A Deadly Combination

Amphibians and Fire

Torrent salamanders thrive in the frigid, clear streams that bubble through mature forests in Pacific Northwest mountains. About three inches long, they hunt bugs at water's edge and are recognizable by their bulbous black eyes, short tails, brown backs and orange-yellow bellies. Because of their sensitivity to heat and water quality, wildfire can wreak havoc on these delicate, endemic amphibians by flooding streams with sediment and raising water temperature. "You have isolated populations surviving in old-growth stands, so when a fire comes through it can wipe them out," says Bruce Bury, a herpetologist with U.S. Geological Survey's Forest and Rangeland Ecosystem Science Center in Oregon.

Bury is studying the effects of wildfire and prescribed burns on amphibians in the mountains of southern Oregon and northern California. Although fire appears to harm stream amphibians such as torrent salamanders and tailed frogs, terrestrial amphibians such as the Pacific giant salamander live underground during the fire-prone hot summer months and thus appear

protected. Prescribed burns set in cooler months when giant salamanders are most active, however, could roast these amphibians, he says.

The effect of fire on amphibians needs much more study, Bury says. People should be concerned about these oft-ignored species, he explains, because the animals warn of environmental dangers, and what's bad for the salamanders is bad for other species, too, such as salmon. "These amphibians are like salmon—they need cool, clean water," says Bury, who is wrapping up a three-year study. "The small headwaters they inhabit are like arteries. If your arteries are clogged, you are going to die."—*Paul Tolmé*

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