NEWS IN FOCUS

FRED GREAVES/REUTERS

Firefighters in California have faced a historic fire season in 2018, and climate models predict that wildfires will become more common and intense.

EPIDEMIOLOGY

Scientists scramble to study wildfires' health effects

Blazes have created natural experiments in nearby towns and a monkey-breeding colony.

BY SARA REARDON

Record-setting wildfires have burnt through northern California over the past month, blanketing huge swathes of the western United States in a smoky haze and destroying an area larger than London. Now scientists are hoping that the fiery summer will help them determine whether exposure to wildfire smoke damages health over the long term.

Finding answers is becoming more urgent because the behaviour of wildfires — in the United States and elsewhere — is expected to shift in the coming decades. Climate models predict that many more people worldwide will be exposed to toxic smoke as these blazes become more common and intense. US wildfires already produce about one-third of the country's particulate-matter pollution, airborne particles that are small enough to enter and damage human lung tissue[1].

"When we think about climate-change policy and cost–benefits, if we don't include human-health impacts we're not getting an accurate assessment," says Michelle Bell, an environmental-health researcher at Yale University in New Haven, Connecticut. "The line between natural and anthropogenic air pollution has blurred in terms of wildfires."

One of the reasons researchers know so little about wildfires' effects on health is that epidemiological studies of air pollution typically do not distinguish between the sources of pollutants that people breathe in. The sensors used in such research measure only the size of particles in the air, making it hard to link ▶

a specific health impact to diesel exhaust, wood smoke or any other source of pollution. That is especially true of wildfires, which consume trees, buildings, synthetic materials and anything else in their path.

"It is a crazy mix of chemicals," says Christopher Migliaccio, an immunologist at the University of Montana in Missoula. "You have no idea how that mixture interacts within the human body to know what the real culprit is."

But Migliaccio is attempting to sort out just that. In 2017, a wildfire 13 kilometres from Seeley Lake, Montana, exposed the town of 1,600 people to nearly 30 times the level of particulate matter considered safe by the US Environmental Protection Agency (EPA). The fire burned for 70 days. After it subsided, Migliaccio and his colleagues collected blood and measured respiratory function in 100 volunteers, whom they plan to track for years.

Early data from the study suggest that the fire harmed the people's lungs and immune systems, Migliaccio says, and those effects persist even a year later. The researchers are now collecting data from residents of two other towns in western Montana. Historical trends suggest that at least one of the three towns will be exposed to a wildfire each year, which will allow the team to compare participants' physiology and health before and after a fire.

Another group of scientists — this one at the University of California in Davis (UC-Davis) — is tracking the physical and mental health of people who were exposed to a series of 250 fires last year in California's Napa and Sonoma valleys that caused US$85 billion in damage. The scientists are going door-to-door to recruit volunteers, and more than 2,000 households have responded, says UC-Davis environmental epidemiologist Irva Hertz-Picciotto. The team is also collecting placentas and cord blood from women who were pregnant during the fires, to determine the chemicals to which their babies might have been exposed.

CALIFORNIA NATIONAL PRIMATE RESEARCH CENTER

Wildfire smoke could harm young monkeys.

Researchers are also beginning to untangle how the composition of material burnt during a wildfire affects the body. Smoke from burning pine needles damaged the DNA of mice in a recent EPA study more than did smoke from burning plastic; burning eucalyptus was the most toxic to immune cells found in the animals' lungs[2]. The UC-Davis researchers are collecting ash given off by the 2017 fires in northern California to analyse its chemical composition and to look for links to specific health effects in their volunteers.

Across town, at the California National Primate Research Center, the results of a natural experiment could provide crucial data on fires' effects on children. In August, smoke from the Mendocino Complex fire — a blaze that has burnt some 186,000 hectares in California — drifted 320 kilometres south to the research centre, which is home to an outdoor colony of primates bred for research. About 2,000 animals, including roughly 500 infant rhesus macaques, were exposed to potentially toxic smoke levels over 10 days.

Lisa Miller, a respiratory immunologist at UC-Davis, and her colleagues have collected blood samples and other data from the infant monkeys. They're looking for links between smoke exposure and the long-term respiratory damage that is often seen in children exposed to air pollution. "We knew for decades that early exposure results in long-term changes" to kids' lung function, Miller says. "What we don't understand, particularly for paediatric populations, is what exactly changed."

The group's previous data suggest that exposure to wildfire smoke can harm young monkeys. In 2008, animals at the centre were exposed to smoke from a wildfire 320 kilometres away. Animals that were infants at the time ended up with smaller, stiffer lungs and weaker immune systems than those of monkeys born the next year[3].

Once the researchers determine how exposure to smoke harms the lungs and immune systems in people and monkeys, it could become easier to prevent or treat the damage. There is no time to waste, says Hertz-Picciotto. "Now that this is becoming more common, it should be possible to prepare and reduce the amount of suffering." ■

1. Rappold, A. G. *et al. Environ. Sci. Technol.* **51**, 6674–6682 (2017).
2. Kim, Y. H. *et al. Environ. Health Perspect.* **126**, 017011 (2018).
3. Black, C. *et al. Am. J. Respir. Cell. Mol. Biol.* **56**, 657–666 (2017).

RESEARCH POLICY

South Africa pushes science to improve daily life

Sweeping policy changes aim to refocus research efforts to tackle issues such as poverty.

BY SARAH WILD

South Africa's science system is set for its biggest shake-up in 20 years, amid proposed legislation changes that aim to make research efforts better serve citizens and address problems such as poverty and unemployment.

Policymakers in the government's department of science and technology are updating the 1996 legislation document that governs the country's science, technology and innovation activities and agencies. A final draft, seen by *Nature*, shifts the focus of South Africa's science sector towards business-led innovation that tackles societal problems and expands the economy. It also reaffirms a key government goal of boosting total research and development (R&D) spending from 0.8% to 1.5% of gross domestic product (GDP) in the next decade. On 5 September, the document was approved by the government's cabinet. It will now be referred to Parliament, where it will be open for public comment before being signed into law.

"If we don't make an impact on the lives of South Africans, then we don't deserve to exist," says the country's science minister, Mmamoloko Kubayi-Ngubane, of her department. Kubayi-Ngubane has overseen the drafting of the latest legislation and was appointed this year by President Cyril Ramaphosa, who took over in February and is widely seen as more pro-science