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Firefighters in Lake Elsinore, California, battled a wildfire in 2018 that burned more than 9,300 hectares.

ENVIRONMENT

Scientists to set a massive forest fire

Data from planned blaze in Utah could help to improve models of how wildfire smoke spreads.

BY ALEXANDRA WITZE

Sometime in late June, if all goes to plan, a helicopter will hover above a thickly forested slope in Utah and set it ablaze. The goal is to clear out dead conifer trees to allow quaking aspen (*Populus tremuloides*) to regain a foothold in this high-altitude national forest. But the blaze could also help scientists to better understand wildfires.

As flames and smoke rise, an interdisciplinary research team will use drones, radar and other equipment to track how the 900-hectare burn spreads. "We're setting up an experimental situation to look at fire in ways we don't normally," says Nancy French, a wildfire scientist at Michigan Technological University in Houghton.

The Fire and Smoke Model Evaluation Experiment is a rare chance for researchers to study a large fire from start to finish (S. Prichard *et al. Atmosphere* **10**, 66; 2019). It is part of a broader push to gather data from wildfires in western North America as they happen. Starting in July, the National Oceanic and Atmospheric Administration (NOAA) and NASA plan to fly research aeroplanes over more than a dozen naturally occurring wildfires in the region, collecting data on how smoke plumes rise from a blaze.

Both studies aim to improve forecasts of where smoke will spread, affecting people's homes and health. "This is the first time we're targeting fires so comprehensively," says Carsten Warneke, an atmospheric chemist at the NOAA Earth System Research Laboratory in Boulder, Colorado, who helps to lead the second project.

The timing is right. In 2018, wildfires ravaged large swathes of California, obliterating records for the state's deadliest, largest and most damaging blazes. The same year, hundreds of wildfires burnt in British Columbia, Canada, sending eye-stinging, lung-burning smoke over much of western North America. (The US National Science Foundation funded research flights over about 20 wildfires that summer, to study how the smoke chemistry evolved over time; those data are still being analysed.)

BURNING CURIOSITY

Breathing in wildfire smoke can worsen asthma and chronic heart and lung diseases, and can cause other health problems. Just as meteorologists have improved their predictions of severe weather in recent decades, fire scientists are now trying to improve their predictions of how smoke spreads so that people can prepare themselves, says Susan Prichard, a forest ecologist at the University of Washington in Seattle. "We need to understand how the fire behaves and how it interacts with the atmosphere to create a smoke plume," she says.

That's the inspiration behind the Utah experiment. Although US Forest Service officials will start that fire, it's expected to burn intensely enough to mimic a natural wildfire. Researchers plan to monitor every step — from mapping the type and number of trees that will burn, to measuring how much of that fuel actually gets consumed during the fire. "We're going to collect an unbelievable amount of data," says Roger Ottmar, a fire scientist with the US Forest Service in Seattle and one of the project's leaders.

Tripods laden with instruments will videotape the flames and measure the temperature as the forest burns. Laser and radar equipment will probe the shape and density of the smoke plume as it rises, while a series of drones will attempt to fly directly into the plume.

"It's ambitious, there's no question about it," says Marty Alexander, a fire behaviour researcher who is retired from the Canadian Forest Service and who helped to organize a large prescribed-burn experiment in the Northwest Territories in the late 1990s (B. J. Stocks *et al. Can. J. For. Res.* **34**, 1543–1547; 2004). "It takes a lot of guts to light a line of fire."

Data from the Utah project should help smoke modellers to improve their understanding of how plumes form and evolve. The detailed inventory of the fuel on the ground should reveal how the quantity of fuel burnt translates to smoke produced, says Warneke. The amount of smoke, and what noxious chemicals it contains, depends on the types of trees or shrubs that are burning.

Studying that smoke will be the focus of the NOAA–NASA project, known as FIREX-AQ. It will use two NOAA planes and two NASA aeroplanes — including a far-ranging DC-8 — to fly over wildfires in the western United States and above prescribed burns in the southeastern part of the country. The planes will carry sophisticated instruments to measure the composition of the smoke plumes. "We'll have pretty much every chemical measured that you can think of," says Warneke.

The team also has a drone that will explore smoke at night-time — when its chemistry changes, and it cools and sinks, meaning that people can more readily breathe it in.

NASA will keep its DC-8 available into the autumn, when the Utah team is planning a second burn in the national forest. The plane will fly over and measure that burn as it happens — providing an eye in the sky in addition to the many on the ground. ■