

# Wildfire smoke linked to thousands of premature deaths every year in California alone

July 8 2024, by Rachel Connolly and Michael Jerrett

## Wildfires can be a large source of health-harming PM<sub>2.5</sub>

During big wildfire years, California's average level of fine particulate matter, or PM<sub>2.5</sub>, can almost double. Air pollution research shows PM<sub>2.5</sub> can harm human health.

 Non-fire sources  Fire-only sources

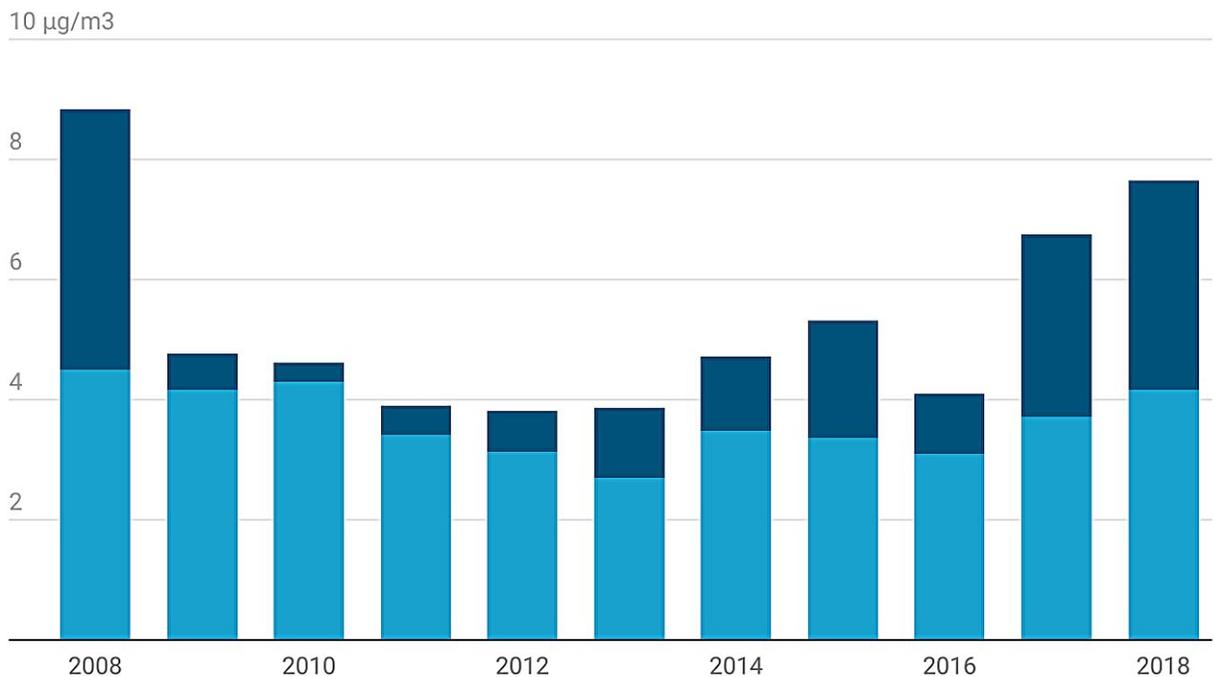


Chart: The Conversation/CC-BY-ND • Source: Rachel Connolly, et al., 2024 • Created with Datawrapper

Credit: The Conversation

When wildfires rage, the immediate threat is obvious—but smoke from the fires actually kills far more people than the flames.

As fires become more frequent, that smoke is leading to a [public health crisis](#).

In a new study published in the journal *Science Advances*, we found that [wildfire](#) smoke likely contributed to [more than 52,000 premature deaths](#) across California alone from 2008 to 2018, with an [economic impact](#) from the deaths of more than US\$430 billion.

Previous studies have examined the short-term health risks from wildfire smoke, but few have assessed how exposure to wildfire smoke over years adds up to shorten human lives.

Wildfire risk and severity have grown as [the climate has changed](#) and as [more people have moved into the edges of wildland areas](#), increasing the risk that they will start fires. Years of putting out all wildfires have [also kept small fires](#) from clearing out the undergrowth, meaning the fires that do escape have more fuel to burn.

As fires are becoming a regular occurrence in all of our lives, it's important for communities to understand that the health risk from smoke pollution is rising, too.

## Health risks

Decades of air pollution research have shown how exposure to [fine particulate matter](#), or PM<sub>2.5</sub>, can [harm a person's long-term health](#).

PM<sub>2.5</sub> is a mixture of small particles, each only a [fraction of the width of a human hair](#). It [comes from a variety of sources](#), such as vehicle tailpipes and factory emissions, as well as from other sources, including

fires. The particles are so tiny, they can travel deep into the lungs and even enter the bloodstream.

Inhaling PM<sub>2.5</sub> can cause short-term respiratory health problems in vulnerable populations, such as people with asthma and older adults. It also leads to long-term harm by contributing to the formation of [chronic diseases](#), including atherosclerosis, asthma, decreases in lung function and diabetes. One reason this happens is the body's inflammatory response to inhaling air pollutants.

Wildfire smoke contains a stew of chemicals. A growing body of research indicates that wildfire PM<sub>2.5</sub> may have unique physical and chemical components that increase toxicity. For example, a study from the University of California, Davis, showed that wildfire smoke [caused more inflammation in the lungs](#) of rats than PM<sub>2.5</sub> from other sources such as cars and industry. This makes the pollutant [potentially more harmful to human respiratory health](#) compared with the typical PM<sub>2.5</sub> that people are exposed to in urban environments.

## **The problem with wildfire smoke**

We examined the long-term health damages from breathing wildfire smoke. The results, from over a decade, suggest that in years with lots of fire activities—2017 and 2018, for example—wildfire smoke contributed to more than 10,000 deaths annually in California. For comparison, about [4,000 people die in California from traffic accidents](#) each year.

Even though most fires are in rural, forested areas, smoke can travel hundreds or thousands of miles. So the health effects are widespread through population centers.

For example, California's [Rough Fire of 2015](#) burned more than 150,000

acres in a mostly rural area of Fresno County, but most mortality impacts in that year were west of the fire in a more populated area of the county and throughout the San Joaquin Valley. In 2018, the year the town of Paradise and several other communities burned, wildfire smoke may have [killed as many as 12,000](#) Californians prematurely.

To conduct this analysis, we looked at annual estimates of wildfire smoke PM<sub>2.5</sub> by ZIP code based on wildfire activity. Unlike most past studies, we looked specifically at exposure to PM<sub>2.5</sub> from wildfires. This allowed us to account for that potentially increased toxicity of smoke.

Then, we used a dose-response estimate for the relationship between wildfire-specific air pollution and [premature deaths](#). Dose-response estimates are derived from [epidemiological studies](#) that relate air pollution levels to survival. For this study, we adjusted an existing dose-response estimate to account for potential increased toxicity from wildfire smoke.

## How to stay safe

These findings suggest that society needs [to invest in coordinated forest management](#), wildland-urban interface management and [climate change mitigation](#), all of which could yield significant public health benefits through reducing the frequency and severity of wildfires and smoke exposure. We will also need to invest more to adapt to the worsened smoke by providing safe areas in schools and other public buildings.

Here are some tips for limiting how much smoke you inhale on days when the wind is carrying wildfire smoke your way:

- **Stay indoors:** On heavy smoke days, don't go outside, and close your windows. Turn on an air purifier, if you have one. If you don't have one, considering purchasing one with a HEPA filter.

The California Air Resources Board has a [list of certified air filters](#). If you smell smoke, or know there is a fire nearby—even if you can't see it—check a resource such as the [EPA and Forest Service's AirNow Fire and Smoke Map](#) or the [PurpleAir map](#) to get a sense of whether it's safe to be outdoors.

- **Wear a protective mask:** If you do go outside, wear a protective mask, such as an N95 if possible. If you don't have access to an N95, a surgical mask will help too.
- **Avoid exercising outdoors on smoky days:** [Strenuous activities such as exercise draw more air into the lungs](#)—and with it, PM<sub>2.5</sub>. Exercising also causes your heart and respiratory system to work harder. If you exercise, do so inside in a place with filtered air.
- **Stay informed:** You can follow state and federal air quality agencies in your region on their websites and social media platforms and sign up for alerts when available.

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