MedicalXpress

Western wildfires reversed decades of gains from air pollution-fighting measures: Study

December 6 2023, by Cazzy Medley

Credit: Deep Rajwar from Pexels

The increasing number and intensity of wildfires in the Western U.S. are overshadowing other achievements at reducing emissions, aggravating air pollution and increasing disease and mortality, according to a new

study led by University of Maryland researchers.

Published on Monday in *The Lancet Planetary Health*, the paper analyzes the long-term relationship between mortality, black carbon—a sooty chemical emitted from wildfires—and $PM_{2.5}$, fine particulate matter that can be breathed into the lungs and spread through the body by diffusion into blood.

"Air pollution, particularly $PM_{2.5}$ pollution, stands as a globally significant environmental hazard, exerting profound effects on air quality, climate change and, most critically, human health. The sources of $PM_{2.5}$ pollution are intricate," said lead author and Assistant Research Scientist Jing Wei, who started this work at the University of Iowa and now holds a joint appointment in UMD's Earth System Science Center (ESSIC) and UMD's Department of Atmospheric and Oceanic Science (AOSC). "The recent surge in widespread wildfires in the U.S. has brought about changes in air quality, impacting human health, especially given the heightened toxicity of black carbon."

Both black carbon and fine particulate matter have been associated with a wide variety of diseases. Prolonged exposure to $PM_{2.5}$ has been linked to cancer, heart disease, asthma and birth complications. Less research has been conducted on the health impacts of black carbon, but the mortality risk is reported to be up to 10 times higher than $PM_{2.5}$. Together, the substances pose a major risk to human health.

Knowing this health impact, many countries have embraced efforts to decrease human-caused emissions that release these harmful chemicals. Legislation like the U.S. Clean Air Act helped lower fine particulate pollution substantially across the U.S. However, Wei found that the increasing wildfires in the Western U.S. considerably undermined the reductions in $PM_{2.5}$ achieved by the Clean Air Act.

Wei and his team used deep learning and aerosol measurements from both space and 1 kilometer above the surface over the continental U.S. to derive daily fine particles and black carbon concentrations from 2000 to 2020. Using this new dataset, the researchers assessed changes in mortality burden attributed to fine particle pollution (especially black carbon) during the last two decades. They focused on identifying any disruptions in the otherwise-decreasing trends that could be attributed to emissions from wildfires.

They found that $PM_{2.5}$ and black carbon decreased nationally by 22% and 11%, respectively, from 2000 to 2020, leading to a reduction in premature deaths of approximately 4,200 people per year.

However, since 2010, the decline in fine particles and premature deaths reversed in the western U.S. while remaining mostly unchanged in the eastern U.S. The researchers observed a 55% increase in $PM_{2.5}$ concentrations in the western U.S. over the study period, resulting in an estimated 670 excess deaths. Taking into consideration the greater toxicity of black carbon, this number rises to approximately 930, they said.

Across the U.S., the researchers found that the proportion of black carbon within $PM_{2.5}$ rose by 2.4% per year during the last two decades. This also indicates an increase in the relative toxicity of the fine particulate matter.

"While it sounds like a very small change, the mortality associated with the widespread smoke is a lot more than the number of direct fire casualties that have been widely reported in the media," said study co-corresponding author Zhanqing Li, a Distinguished University Professor with a joint appointment in ESSIC and AOSC.

The co-authors say that slowing climate warming—which would help

prevent wildfires—is integral to environmental protection tactics aimed at guarding public health.

"Reducing fire risk via effective policies, besides mitigation of climate warming, wildfire prevention and management, forest restoration and new revenue generation, can hold the potential to substantially improve air quality and public health in the coming decades," Wei says.

More information: Jing Wei et al, Long-term mortality burden trends attributed to black carbon and PM2.5 from wildfire emissions across the continental USA from 2000 to 2020: a deep learning modelling study, *The Lancet Planetary Health* (2023). DOI: 10.1016/S2542-5196(23)00235-8

Provided by University of Maryland