

# The Health Effects of Wildland Fires

Jane Q. Koenig

**H**ealth effects of wildland forest fires are similar to those associated with urban air pollution. The most common air pollutant from wildland fires is fine particulate matter (PM). However wildland fires are known to emit several other notably toxic air pollutants such as carbon monoxide, aldehydes, nitrogen oxides (NO<sub>x</sub>), and polycyclic aromatic hydrocarbons (PAHs).

Adverse health effects include respiratory illness in children and elders, cardiovascular events such as heart attack and stroke, decreased lung function, asthma aggravation, emergency department visits, hospitalization, bone marrow abnormalities, respiratory and cardiac symptoms, and airway inflammation.

Public health concerns involve two populations: the firefighters themselves and the residents living near enough to the fires to experience increased levels of pollutants.

Residents at the most risk include infants, pregnant women, the elderly, people with pre-existing diseases or with certain genetic variations, and people who exercise heavily.

A study by University of Washington School of Public Health graduate Christine Betchley (MS, 1993) found reduced pulmonary function among forest firefighters in Washington and Oregon. She measured lung function in 76 subjects before and after shifts at a prescribed

fire (one ignited by management actions to meet specific objectives). Other studies have seen similar findings when studying fire crews.

It is harder to study the health effects for people living nearby. Natural disasters come without warning and don't give researchers time to marshal a scientifically sound study. One attempt was made in 1999 by the Centers for Disease Control and Prevention. Mott *et al.* reported on health effects of a fire in Hoopa, California, the fifth-largest wildland fire in the US that year. The investigators used numbers of hospital visits and self-reported symptoms as the health outcomes. Hospital visits were 50 percent higher than normal, and 63 percent of the patients reported increased respiratory symptoms.

In 2003, southern California was inundated with a rash of wildfires, which produced heavy smoke that affected large populations. Because a Children's Health Study (Kunzli *et al.*, 2006) was already underway in the area, scientists could obtain scientifically valid data from children who had already completed health effects evaluations. Risks of nose, eyes and throat irritations; cough; bronchitis; cold; wheezing; and asthma attacks, medication use, and physician visits increased with the number of reported smoky days.

Data from fires in Southeast Asia offer additional information on health effects. During the summer of 1997, brush fires spread through Southeast Asia as land was cleared for developments. Tan *et al.* (2000) studied healthy male army recruits in Singapore who spent hours exercising outdoors. Blood samples showed an increase in abnormal neutrophils, a type of white blood cells that can indicate underlying respiratory inflammation. This finding was replicated in rabbits exposed to similar concentrations of particulate matter in the lab.

In 2002, Sastry reported the results of another study on the health effects of wood smoke. During a period when average PM increased sixfold, daily mortality from heart attacks increased in a dose-related fashion.

The most vulnerable populations are the young and the elderly. Census data show that 6 percent of Washington's population is 5 or younger, and 11 percent is older than 65. The Washington State Department of Health estimates that 24 percent of this older population has cardiovascular disease and 9 percent of the total Washington state population reports they currently have asthma.

This means that more than a quarter of the population of Washington State belongs to groups known to be susceptible to adverse health effects from wildland fire smoke. Previous experience shows that these are populations less likely to be able evacuate their homes for reasons ranging from logistical to psychological. Public health preparedness planning can address wildfires, as well as other types of emergencies that require evacuation. ■

## Author

Jane Q. Koenig, PhD, Professor in the University of Washington's Department of Environmental and Occupational Health Sciences, studies respiratory and cardiac health effects of air pollution.

## Wildfires & Climate Change

The threat of Northwestern wildfires was called out in a 2007 report from the Pew Center on Global Climate Change, titled *Regional Impacts of Climate Change: Four Case Studies in the United States*. In the Northwest, the report describes wildfire conditions fostered by a combination of earlier snowmelt and warmer summers. Other factors include thunderstorms and lightning strikes, livestock grazing, logging roads, and diseases such as spruce budworm. The report is at [www.pewclimate.org/publications](http://www.pewclimate.org/publications).

## Resource

Naeher LP, Brauer M, Lipsett M, Zelikoff JT, Simpson CD, Koenig JQ, Smith KR. Wood-smoke health effects: A review, *Inhalation Toxicology*. 19(1):67-106, January 2007.