

OREGON PUBLIC HEALTH DIVISION • OREGON HEALTH AUTHORITY

WILDFIRES, AIR QUALITY AND HEALTH

With a flash of lightning, a wildfire can be ignited and quickly dominate the environment, blanketing towns with a dark haze and choking both wildlife and people. The 2013 wildfire season in Oregon started earlier than most, and, as this issue goes to press, shows little sign of abating. To date in 2013, >69,000 acres of Oregon Department of Forestry-protected land have gone up in flames — more than twice that of the last five years combined (Figure) — and we're not out of the woods yet.^{1,2} As people gasp for fresh air, some may turn to you for advice. This *CD Summary* reviews the basics of wildfire smoke composition and its health effects, and offers information on appropriate mask use.

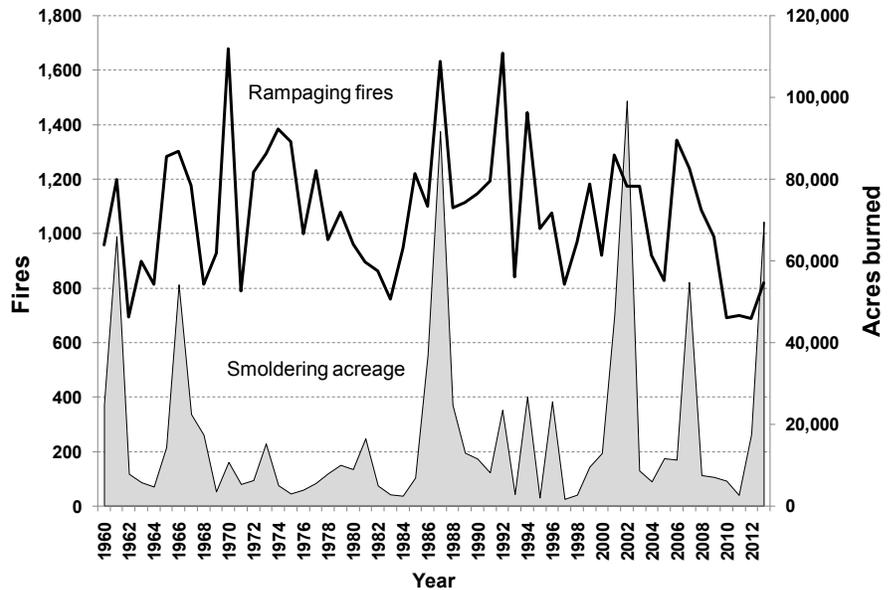
WILDFIRE SMOKE

The content of wildfire smoke varies with the type of vegetation burning, moisture level, fire temperature, wind and other weather-related factors, and the stage of burning. Depending on these variables, wildfire smoke comprises a complex mixture of particulate matter, carbon dioxide, carbon monoxide, water vapor, hydrocarbons and other organic chemicals, and various trace minerals. For the general public, the principal pollutant of concern from wildfire smoke is "particulate matter" — by which is meant the mixture of solid particles and liquid droplets that is suspended in the air.

HEALTH EFFECTS

Health effects of particulate matter (PM) are related to the particulate size. Airborne particles of diameter $\leq 10 \mu\text{m}$ (PM_{10}) usually irritate only the eyes, nose, and throat. Particulates from wildfire smoke tend to be of diameter $< 2.5 \mu\text{m}$ ($\text{PM}_{2.5}$), so they can be inhaled deeply into the lungs, causing more substantial health problems, especially for those with preexisting health conditions.³ The duration and concentration of smoke exposure, along with patient age and degree of sensitivity, play an important role in determining

Figure. Fires and acreage burned, Oregon Department of Forestry-protected lands, 1960–2013.*



*Oregon Department of Forestry data through 19 Aug 2013

whether or not someone will suffer smoke-related health problems.*

Even in healthy individuals, wildfire smoke can cause:

- eye irritation and dryness;
- persistent cough, phlegm, wheezing, scratchy throat, irritated sinus, headache;
- shortness of breath; and
- pulmonary inflammation.

Exposure to wildfire smoke can affect more seriously those with pre-existing respiratory conditions such as respiratory allergies, asthma, and chronic obstructive pulmonary disease (COPD). In addition to the above symptoms, such persons may experience:

- fatigue;
- chest pain or discomfort;
- exacerbation of their respiratory conditions; and
- reductions in lung function.

* Oregon's Department of Environmental Quality maintains an up-to-date map of air quality ratings, including $\text{PM}_{2.5}$, across the state at www.deq.state.or.us/air/index.aspx.

CDC assessed the health consequences of a five-day wildfire that consumed hundreds of thousands of acres in southern California during October 2007. Compared to the 20 preceding weekdays, while the wildfire raged, visits to the Emergency Department for dyspnea increased from 48.6 to 72.6 per day, and visits with diagnoses of asthma increased from 21.7 to 40.4 per day.⁴

Other health-related concerns — e.g., carbon monoxide poisoning or increased risk of cancer — are sometimes surfaced by members of the general public. In general, the long-term risks from short-term smoke exposures are thought to be low. Urban fire fighters exposed to smoke over an entire working lifetime have about a three-fold increased risk of lung cancer. Persons with cardiovascular disease who are exposed to wildfire smoke may experience chest pain and cardiac arrhythmias with relatively low levels of carbon monoxide.⁵



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REDUCING EXPOSURE

The safest thing to do is to avoid exposure to the wildfire smoke if possible. Those who are sensitive to smoke should evacuate the smoky area. For those who cannot evacuate the smoky area, strategies to decrease exposure to smoke include: staying indoors whenever possible; using air conditioners on recirculation in homes and when driving in a vehicle; using mechanical air cleaners; and minimizing other sources of exposure to airborne particulate matter — such as smoking tobacco,[†] use of wood-burning stoves, burning candles and vacuuming.

MASK OR NO MASK

During and after a wildfire, you will commonly see masked people around the community. You might want to know the following about masks: (1) the types of masks that are available; (2) the level of protection afforded by each type of mask; and, (3) what to tell your patients about masks.

Wet bandanas covering the mouth, surgical masks, dust masks, and N95 respirators offer differing levels of protection from wildfire smoke. A wet bandana, and surgical and dust masks can reduce exposure to large particles from wildfire smoke, but their capacity to filter PM_{2.5} is limited; for these reasons, they provide little protection, especially for those who are most sensitive to wildfire smoke.

N95 respirators are made from filtering material certified by the National Institute for Occupational Safety and Health to remove 95% of fine particulates, but only if the respirator is

[†] or anything else, for that matter

fitted well to the wearer's face. So the fit is all-important: if the mask doesn't fit properly, air with all its particulate matter gets in around the sides of the mask and is inhaled by the hapless wearer, perhaps worse off for the false

Sensitive Populations

Certain population groups may be more sensitive to wildfire smoke exposure. These individuals may suffer more severe short-term and chronic effects. Groups that are more sensitive to wildfire smoke exposure include:

- Persons with asthma or other respiratory disease*
- Persons with cardiovascular disease
- Persons ≥65 years of age
- Children, even those without any pre-existing health illness
- Smokers, especially those who have smoked for several years

*persons with asthma should have an "asthma action plan" www.nhlbi.nih.gov/health/public/lung/asthma/asthma_actplan.pdf

sense of protection. Those who are erroneously confident in the protective power of their masks may well spend more time outdoors, thereby increasing their exposure to smoke. To ensure that an N95 mask fits correctly, an individual must be "fit tested" — something not typically offered along with an N95 respirator at the local hardware store.

Even healthy adults may find that the increased effort required for breathing makes wearing an N95 mask difficult and uncomfortable. Wearing a properly fitting mask necessarily increases resistance to air flow, thereby increasing

the work of breathing and often the heart rate. Therefore, breathing through an N95 mask for a long period of time poses a theoretical risk for those with preexisting cardiovascular or lung disease; such persons should attempt to wear an N95 mask only under the supervision of a clinician.

Be prepared to inform inquisitive patients about the different types of masks, the levels of protection that they provide, and the pros and the cons of each.

FOR MORE INFORMATION

- Oregon Health Authority information on wildfires: <http://public.health.oregon.gov/Preparedness/Prepare/Pages/PrepareForWildfire.aspx>
- DEQ air quality data: www.deq.state.or.us/aqi/index.aspx
- Oregon Smoke Information: <http://oregonsmoke.blogspot.com/>

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4. CDC. Monitoring health effects of wildfires using the BioSense system — San Diego County, California, October 2007. *MMWR* 2008;57:741–7.
5. California Office of Environmental Health Hazard Assessment. Wildfire smoke: A guide for public health officials. 2008. Available at http://oehha.ca.gov/air/risk_assess/wildfire8.pdf. Accessed 22 Aug 2013.