Wildland Fires and Reducing Smoke Exposure

Wildland fires are becoming more common in Nebraska and surrounding states and there is increasing need to understand how to protect your health from increased smoke exposure. Two types of wildland fires exist: uncontrolled wildfires and controlled, prescribed burns used for ecosystem management.

Smoke from wildland fire lowers air quality and may cause health problems. Recommended steps to reduce or limit your exposure to smoke have been developed by the wildland fire science community, in partnership with public health and air quality officials. Below are some questions and answers that explain the challenges of the growing wildfire problem in the central United States, why prescribed burning takes place, and what you can do to limit smoke exposure if it occurs in your community.

Two types of wildland fires exist — prescribed burns (pictured above) and wildfires. While both produce smoke, prescribed burns can reduce the intensity of wildfires in the long run.

The growing concern about wildfires

Q: What are the growing costs of our changing wildfire system?

A: The 2018 wildfire season was reported to cost a record $24 billion in the U.S., primarily because of the destruction of homes and infrastructure, along with firefighting costs. As wildfires become increasingly common, these costs are expected to rise. The severity, timing, size, duration, and location of uncontrolled wildfires are highly unpredictable and often result in severe impacts to communities and the environment that extend beyond the duration of the wildfire. Exposure to smoke and reduced air quality are among the most widespread impacts for communities.

Q: How do wildfires affect air quality?

A: Wildfire smoke is a mixture of air pollutants that consist of over a thousand of different compounds. The three major air quality concerns during wildfires are particulate matter (regulated in two size categories: PM_{10} and $PM_{2.5}$), ground level ozone (O_3), and carbon monoxide (CO).

The principal impact of smoke on air quality is from particulate matter, especially very fine particles referred to as $PM_{2.5}$. These small particles are suspended in smoke and can be inhaled deeply, which affects the function of the lungs, heart, and blood vessels. During wildfires, the National Ambient Air Quality Standards (NAAQS), established by EPA to protect public health and the environment, are often exceeded, leading to unhealthy air quality conditions for healthy and at-risk populations. The duration of air quality impacts from wildfires can last hours to several weeks as wildfires can be difficult to suppress.

Q: Nebraska has only had one major wildfire year in recent history (2012). Why should I be concerned?

A: Wildfires are changing in the Great Plains and multiple states have experienced unprecedented wildfire years. Scientists expect this trend to continue. Four of the 10 largest wildfires in the continental U.S. occurred in the southern Great Plains from 2010 to 2018. Texas' 2006 East Amarillo wildfire is the largest wildfire in the continental U.S. on record and burned nearly 1 million acres in 24 hours. More than 50% of the total area burned by wildfires in the continental U.S. occurred in the Great Plains in 2011, and multiple states reported record increases in area burned by wildfires over the last decade.

Large increases in volatile woody fuels across the Great Plains create wildfire conditions that surpass fire suppression capabilities. For these reasons, wildfire is expected to drive wildland fire across the Great Plains into the 21st century.

Why prescribed burns are conducted

Q: Why burn native prairie ecosystems?

A: A prescribed burn is a systematic, planned fire used to meet specific land management objectives and conserve the wildland prairie ecosystem. For example, the Flint Hills ecoregion of Kansas is the last remaining intact tallgrass prairie ecoregion in North America. Tallgrass prairie once occurred throughout the interior of North America, stretching from southern Canada to the Gulf of Mexico, from central Nebraska to Indiana.

The U.S. Forest Service identifies prescribed fire as a best practice for conserving grassland (and forest) ecosystems and preventing the occurrence of large wildfires. Without prescribed fire management, the little remaining tallgrass prairie will be lost to woody dominated ecosystems, with observed declines in rancher livelihoods, grassland wildlife, water resources, and increased wildfire danger.

Q: How do prescribed fire managers plan and manage smoke?

A: The main goal of smoke management is to improve dispersion of smoke plumes and minimize smoke exposure to downwind communities. Smoke dispersion models allow burn managers to target atmospheric conditions in which smoke is expected to rise high into the atmosphere and rapidly disperse out of the area and away from smoke-sensitive areas.

Prescribed burn managers have access to this information through most local National Oceanic and Atmospheric Administration (NOAA) fire weather websites, or the National Weather Service's fire weather page. Most prescribed burns in the Flint Hills occur in March and April and are strongly influenced by dominant south prevailing winds. Even smoke traveling far distances tends to become more concentrated near ground level overnight and in the mornings due to changing atmospheric conditions.

For burns to be safe and effective, weather and wildland conditions must be ideal. When these conditions occur, many landowners take advantage of the opportunity to burn. But air pollution from the wildland burns may affect local residents, as well as downwind communities.

Wildland Controlled Burning

During March and April, expanses of the Great Plains are burned to help preserve the tallgrass prairie. The burns help to control invading plants, such as Eastern redcedar, sumac, and dogwood, and provide better forage for cattle.

Prescribed burning also lowers the risk of wildfires.

Q: What is a prescribed burn association?

A: A prescribed burn association (PBA) is a group of local stakeholders, often landowners, who get together to conduct a prescribed burn. A successful burn needs people trained in proper burn techniques and the right equipment. With PBA membership, a landowner looking to set up a prescribed burn gains access to equipment (provided by membership fees or grants) and volunteers with training and experience to help the landowner conduct the burn. Over 60 prescribed burn associations exist in the states of Nebraska, Kansas, Oklahoma, and Texas, and are recognized for having one of the highest safety records in prescribed fire implementation.

Q: Do Nebraska landowners need a permit to burn?

A: Yes, any landowner needs to get a permit before conducting a burn. Nebraska law prohibits burning "for the purpose of clearing land" without one. Fire chiefs have forms approved by the State Fire Marshal that a landowner can fill out with details such as when and where the landowner wants to burn. Once approved and signed by the local fire chief, the landowner has a burn permit. Other states have different requirements.

Potential health impacts and what you can do

Q: Can wildland smoke affect my health?

A: Smoke from wildland fires is a mixture of gases and coarse and fine particles produced when wood, vegetation, and other organic materials burn. In addition to the large amounts of particulate matter (PM), fire releases gases that can contribute to the formation of ozone.

The biggest health threat is from $PM_{2.5}$, which describes particles that are 2.5 micrometers and smaller, that can enter through our respiratory system and can contribute to lung and heart disease. Recent studies show that long-term exposure to $PM_{2.5}$ can age blood vessels and lead to the buildup of calcium. This increases the likelihood of cardiovascular events like heart attack and stroke.

Some immediate effects of breathing wildfire smoke:

- Coughing
- Breathing problems
- Stinging eyes
- Scratchy throat
- Runny nose
- Irritated sinuses
- Wheezing
- Shortness of breath
- Chest pain
- Headaches
- Asthma attack
- Tiredness
- Fast heartbeat

Q: How often do air pollution exceedances and violations occur in Nebraska due to smoke?

A: Air pollution ($PM_{2.5}$) exceedances are calculated over a 24-hour or annual averaging period. Nebraska rarely has smoke related exceedances during the spring prescribed fire season – sometimes it may have one exceedance in a given year, but other years it has zero. Because exceedances are rare, they typically don't have a significant enough impact to result in a violation, since violations are calculated using three years of air pollution data.

Because the eighth highest value for each of three years is used when determining compliance with the federal standard, there have been no regulatory violations. However, when a short-duration exceedance occurs, it can and does have public health impacts. Because the source of the smoke is predominantly from outside Nebraska and the frequency of these episodes has not resulted in violation of the standards, Nebraska currently has no regulatory recourse to address these exceedances.

Q: How would wildfire make air quality worse?

A: Wildfire can result in large amounts of smoke for prolonged periods of time, lasting days to weeks. In addition to increased exposure to particulate matter from burning vegetation, a wildfire can burn structures, which increases exposure to toxic chemicals. Wildfires also cause mental health concerns and physiological stress.

Studies consistently show a variety of respiratory-related health effects and also show evidence of cardiovascular-related health effects in response to wildfire smoke exposure. There is limited research about the implications of prolonged smoke exposure on health, during these times individuals should seek guidance from public health officials.

Q: Are there times of day when smoke tends to be worse?

A: The amount of area burned and weather patterns cause smoke levels to differ. For both wildfires and prescribed fires, smoke concentrations tend to be higher in the overnight and morning hours. Air mixing by midday tends to move the smoke along and aloft.

Q: Who is at the highest risk for breathing wildland smoke?

A: Large amounts of smoke can make anyone sick. However, most healthy adults will recover quickly from smoke exposure and will not suffer long-term health problems.

The risk of breathing fine particles in smoke varies throughout your lifetime. The risk is usually the greatest for the very young, older adults, and those with existing respiratory conditions.

Sensitive groups are at greater risk of health effects from breathing fine particles in smoke or polluted air, and may have serious symptoms.

People in these groups should limit their exposure to wildfire smoke:

- Children. Their airways are still developing and they breathe more air per pound of body weight than adults;
- Pregnant women;
- People with pre-existing respiratory and cardiovascular disease (COPD, asthma, heart disease).

If you are in one of these groups, talk to your primary healthcare provider about your exposure. Check the air quality index (AQI, discussed later) each day for the air quality forecast and information about ways to reduce exposure.

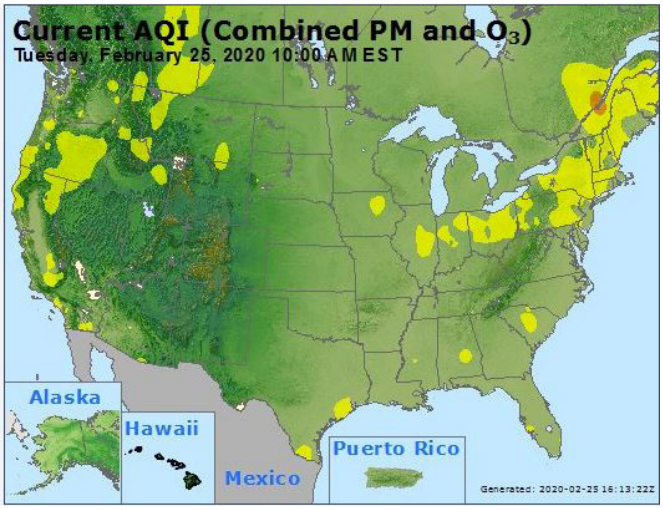
Q: How can I reduce my smoke exposure?

A: There are several ways you can stay informed and reduce your exposure to smoke:

Listen and watch for news or health warnings about smoke

Information and notices on smoke and air quality can be found at several different sources:

- Local air quality reports;
- U.S. Environmental Protection Agency's Air Quality Index (AQI); and
- Public health messages about safety measures on AirNow.



AirNow is one resource that can keep you up to date on the current air quality.

AQI Basics for Ozone and Particle Pollution

Daily AQI Color	Levels of Concern	Values of Index	Description of Air Quality
Green	Good	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Yellow	Moderate	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Orange	Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Red	Unhealthy	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Purple	Very Unhealthy	201 to 300	Health alert: The risk of health effects is increased for everyone.
Maroon	Hazardous	301 and higher	Health warning of emergency conditions: everyone is more likely to be affected.

AirNow also utilizes the Air Quality Index, which describes the level of air pollution with a color, a level of concern, and a description of what the air quality is like.

Keep pollutants out of indoor air

When outdoor air is unsafe, keep indoor air safer by avoiding these activities:

- Smoking;
- Using gas, propane, and wood-burning stoves and furnaces
- Using ventilation fans
- Spraying aerosol products;
- Frying or broiling meat;
- Burning candles or incense; and
- Using your vacuum cleaner unless it has a HEPA filter.

If smoke levels are high, staying indoors can reduce exposure. On hot days, run an air conditioner, but keep the fresh-air intake closed. If you do not have an air conditioner, seek shelter with a friend or family member, or in a public place like a library or mall, keeping social distancing guidelines in mind if CDC is recommending it.

Reduce physical activity to avoid breathing in air pollutants

Outdoor exercise can raise your risk of health effects because:

- You can increase your air intake as much as 10 to 20 times over your resting level;
- You can breathe more pollution deep into your lungs; and
- You may breathe through your mouth, bypassing the natural filtering of the nasal passages and delivering more pollution to the lungs.

If you are physically active, rest often and drink plenty of water.

Commute and travel with caution

- Never use your vehicle as a shelter — drive it to a safe location or leave the area;
- Always avoid driving into dense smoke over roadways;
- If driving is necessary, keep the windows and vents closed and use the "recirculate" setting on the air conditioning to keep smoke and air particles out of your vehicle;
- If you drive a newer model car, briefly open windows or vents when smoke levels are low to avoid becoming groggy from carbon dioxide buildup. Carbon dioxide levels can rise quickly in newer cars when vents and windows are closed and you use the recirculate setting; and
- Before you travel to a state park or wildland preserve check to see if any prescribed burns are planned.

Monitor respiratory symptoms

Wildland smoke can irritate your lungs, making breathing difficult and asthma symptoms worse.

- If you have asthma or another lung disease, follow your respiratory health management plan and your doctor's advice about medicines;
- If your symptoms worsen, call your doctor; and
- If you have moderate to severe heart or lung disease, considering staying with relatives or friends who live away from the smoke during a fire event.

Do not rely on dust masks for protection

- Paper "comfort" or "dust" masks commonly found in hardware stores trap large particles, such as sawdust, but do not protect your lungs from smoke;
- An N95 mask, worn properly, will offer some protection; and
- If you decide to keep a mask on hand, see the Respirator Fact Sheet provided by the Centers for Disease Control (CDC) National Institute for Occupational Safety and Health.

For more information

- "Wildfire Smoke: A Guide for Public Health Officials" is a guide that helps local public health officials be prepared for smoke events, adequately communicate health risks, and take measures to protect the public. This helpful resource is the product of a collaborative effort by scientists, air quality specialists, land managers, and public health professionals from federal, state and local agencies.
- The CDC offers additional information about smoke at: https://www.cdc.gov/disasters/wildfires/index.html.