



# Tapping into Science and Technology to Battle **Wildfires**

A Wildland Fire Sensors Challenge, emissions studies, and toxicity experiments are among the research projects under way at EPA's laboratories to address the impacts of wildland fires.

**The U.S. Environmental protection Agency (EPA) is applying its expertise** in air quality research, modeling, and technology development to address the increasing threat of wildland fires to public health and the environment. Working with other federal, state, and local organizations, EPA is providing the science to address the air quality and environmental issues related to wildland fires, which includes wildfires and controlled fires.

Fires cause property and economic damage, destroy local wildland, and can result in loss of life and health problems. Air pollution from wildfires, controlled fires and other biomass burning is now estimated to contribute to 40 percent of the air pollutant particulate matter emitted in the United States. Fire season impacts many states and the West, South and Southeast in particular. An average of five million acres of wildlands have burned each year over a 30-year period

from 1985 to 2015, according to the National Interagency Fire Center

As wildfires increase in frequency, size, and intensity due to drought and other environmental changes, firefighters and people living near or downwind from fires are put at greater risk. A large body of scientific evidence shows that fine particulate matter (PM<sub>2.5</sub>) from smoke is harmful to respiratory and cardiovascular health, especially among more vulnerable populations, and contributes to other health problems and health care costs.

### Wildland Fire Sensors Challenge

A major research project by EPA and five other federal partners is the Wildland Fire Sensors Challenge, which seeks to stimulate technological innovation in the private and public sectors to develop more accurate, lower-cost, and lower-maintenance air sensor systems that can be quickly and easily deployed to monitor pollutants in wildfire smoke.

Emerging technologies, including miniaturized direct-reading sensors, compact micro-processors, and wireless data communications, provide new opportunities to accurately detect air pollution from wildfires. These new monitors will improve the ability of air quality managers, health care providers, and others to assess potential health risks from wildland fire smoke and help communicate public health information to those who may be impacted by fires.

Sensor developers, researchers, and others interested in participating in the Challenge must submit a written preview of their air sensor prototype by Nov. 22, 2017. If the solution is accepted, then participants are expected to submit their prototype for testing by Jan. 5, 2018. The challenge will award \$60,000 in cash prizes and laboratory test reports will be provided to those whose prototypes are evaluated.

The Sensors Challenge is part of a comprehensive wildland fire research effort by EPA that has four main areas of focus:

1. Understanding the health impacts, particularly as they relate to different fuel sources and combustion phases, and development of effective wildfire health risk communications tools to protect the public.
2. Improving tools and technology used to estimate wild and controlled fire impacts on air quality, including development of monitors for quantifying fire exposures and fire emissions inventories and modeling wildland fire plume and transport and chemistry.
3. Protecting water supplies, native species, and ecosystems and key infrastructure from impacts resulting from wildfires.
4. Characterizing direct and indirect impacts of wildland fires on climate and evaluating the impacts from drought and increased temperatures on wildfire incidence and conditions.

Highlights of some of the research projects under way are mentioned below.

### Going Mobile with Wildfire Health Risk Information

EPA researchers are developing a mobile phone application, called Smoke Sense App, to provide people impacted by wildfire smoke with information on air quality and ways that they can protect their health from smoke exposure. People who use the app can access resources such as the Air Quality Index, which shows current and forecasted air quality and a map that shows current fire locations and smoke plumes. EPA researchers will use data gathered from the Smoke Sense App to conduct a study to determine how information on air quality and the health risks of smoke influence behavior. EPA is beta testing the app and anticipates making it available on Google Play store in 2017.

### Assessing Community Risk to Wildfires

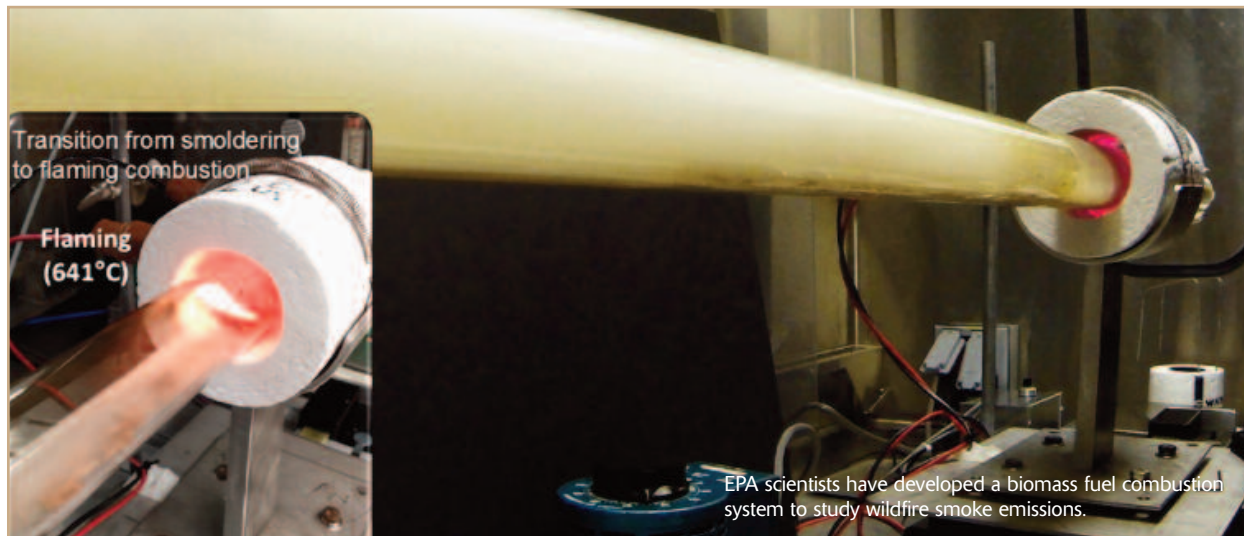
EPA is developing a Community Health Vulnerability Index that can be used to identify those communities most vulnerable to smoke exposure and help improve the ability of state, local, and federal organizations to protect public health when smoke spreads to communities. The tool is based on factors known to increase risk to health from air pollution and wildland smoke exposure, including:

1. prevalence rates for asthma in children and adults;
2. the percent of an aging population; and
3. indicators of socioeconomic status such as poverty, income, and unemployment.

Researchers estimate that 10 percent of the U.S. population (30.5 million) live in the areas where the contribution of fire-related PM<sub>2.5</sub> to the annual average ambient PM<sub>2.5</sub> was high and that 10.3 million individuals experience unhealthy air quality levels for more than 10 days due to smoke.

### Improving Air Quality Modeling with Wildland Fire Emissions Data

EPA is working with local stakeholders to conduct a study of prescribed burns in the Flint Hills of Kansas. The goal is to



establish a user-friendly air quality modeling and visualization tool set to help officials find solutions to the challenges of prescribed burns. Currently, EPA's modeling framework does not include emissions from diverse grasses specific to Flint Hills. To address this problem, the agency is using aerial plume sampling from a field study conducted in March 2017 to calculate more accurate and condition specific emission factors for tall prairie grass. Data from these experiments will be used to contribute to the correction or validation of current regulatory emission models.

### Comparing Toxicity of Wildfire Fuel Sources

To study the potential health effects of breathing wildfire smoke, EPA researchers have developed a novel combustion and smoke collection system that can mimic the combustion phases of a fire (flaming and smoldering). This system was recently used to compare the emissions from five different

fuel sources (red oak, peat, pine needles, pine, and eucalyptus) during the stages of a fire and study the effect of the resulting PM on lung toxicity in mice and mutagenicity in *Salmonella*. The study findings will provide the public with more information about local air quality during fire events and help air quality managers better protect public health.

### Cooperation and Collaboration

EPA works collaboratively on wildland fire science with other federal agencies, including the U.S. Forest Service, U.S. Department of Interior, National Park Service, U.S. Geological Survey, National Oceanic and Atmospheric Administration, and NASA, as well as states and local organizations. Through cooperation and sharing of scientific expertise, new scientific information and approaches are emerging that can be applied to improve health protection and address air quality issues related to wildland fires. **em**



### More Information

- Wildland Fire Sensors Challenge (<https://www.challenge.gov/challenge/wildland-fire-sensors-challenge/>)
- EPA's Wildland Fire Research (<https://www.epa.gov/air-research/wildland-fire-research-protect-health-and-environment>)

For more information on the research discussed in this column, contact Ann Brown, U.S. Environmental Protection Agency (EPA), Office of Research and Development, Research Triangle Park, NC; phone: 1-919-541-7818; e-mail: [brown.ann@epa.gov](mailto:brown.ann@epa.gov).

**Michaela Burns** is an Oak Ridge Associated Universities Contractor in Science Communications with EPA's Office of Research and Development. **Ann Brown** is the Communications Lead for EPA's Air, Climate, and Energy Research Program.

#### Disclaimer

The views and opinions expressed in this article are those of the author and do not represent the official views of the U.S. Environmental Protection Agency (EPA).