

# Wildland Fire Research: Tools and Technology Development

New scientific tools are needed to better quantify and predict the impact of smoke from wildland fires on public health. EPA research is supporting the development of new air quality monitors to measure wildfire emissions, advancing modeling capabilities to understand the impact of wildfires on air quality, and improving wildfire emissions inventories.

Air quality managers are particularly interested in reliable and accurate tools and technology that can be used to assess the impacts of wildland fires. Improved emissions data and models can be used to better assess the contribution of wildland fires to air pollutants and air toxics that are regulated under the Clean Air Act.

Research questions that guide the science to develop new emissions and modeling tools include:

- Does the smoke from differing kinds of vegetation found throughout the country (oak, pine, chaparral and peat) produce different types and levels of pollution?
- How does the intensity of a fire affect the emissions of air pollution and the greenhouse gases and black carbon that contribute to climate change?
- What is the estimated smoke exposure for people near fires, and how does it relate to observed health effects?
- How do prescribed burns contribute to air pollution concerns?

# Air Pollution Sensor Systems

Researchers are working to develop and evaluate air pollution sensor systems that can be deployed during active fires and prescribed burns to provide more robust smoke emissions data. Light-weight sensors have a great advantage in that they can be placed on location of a fire event or in balloons and other aerostats to measure air pollution at different locations and altitudes in the fire zone. Sensors are being tested for their ability to measure emissions, including air pollutant concentrations and the dispersion of smoke plumes.

## Wildfire Emissions and Emissions Inventories

Measuring emissions from wildland fires is important to advancing our understanding of the impact of the fires on air quality and public health. The 2014 National Emissions Inventory <<https://epa.gov/air-emissions-inventories/national-emissions-inventory-nei>> is the first recent national fire inventory to provide estimates of both flaming and smoldering components of wild and prescribed fires involving varied fuel types. Laboratory and field studies are being conducted to provide more wildfire data to the emissions inventory.

### Research Highlights:

- Laboratory and field studies are providing measurements to improve fire emissions estimates for volatile organic compounds, particulate matter and emissions from flaming and smoldering fires that can be added to the National Emissions Inventory.
- Studies are being conducted to specifically evaluate and improve prescribed fire emissions data.

- A cropland burning national emission inventory is conducted to regularly update the National Emissions Inventory.

# Modeling

Models are being used to quantify the different impacts from fire on air pollutants. Researchers are using new emissions data to improve the capabilities of models, such as EPA's Community Multiscale Air Quality Model (CMAQ) <<https://epa.gov/cmaq>>, to track and evaluate smoke emissions on air quality. The findings can be used to better protect public health and support relevant regulatory demonstrations.

## Research Highlights:

- Studies are evaluating plume rise differences for flaming and smoldering components of wild and prescribed fires.
- Evaluations are being conducted using photochemical models of fire plume chemistry related to ozone and fine particulate matter.
- Research is ongoing to better understand the optical properties of the chemical components of smoke to allow for better representation of plume chemistry evolution. A variety of projects as part of the STAR grant on Particulate Matter and Related Pollutants in a Changing World <[https://cfpub.epa.gov/ncer\\_abstracts/index.cfm/fuseaction/recipients.display/rfa\\_id/594](https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/recipients.display/rfa_id/594)> is supporting this research and will help provide better information about the optical properties of particles for models.
- New approaches are being developed and evaluated to differentiate wild and prescribed fire impacts on air quality and populations using a photochemical grid model.

- Approaches are being explored to use prescribed fire permits to forecast prescribed fire impacts in Georgia. This research is supported by the STAR grant on Dynamic Air Quality Management

<[https://cfpub.epa.gov/ncer\\_abstracts/index.cfm/fuseaction/display.abstractdetail/abstract/9704/report/0](https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractdetail/abstract/9704/report/0)>.

Last updated on February 24, 2025