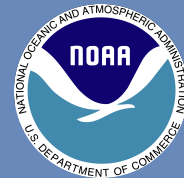


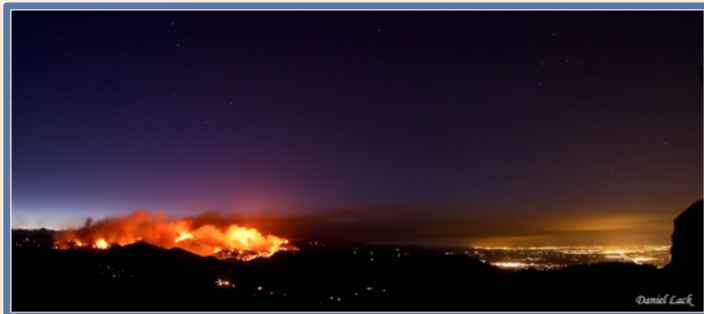
The Impact of **Wildfires** on Climate and Air Quality

An emerging focus of the
NOAA ESRL Chemical Sciences Division



Motivation: The “New Normal” for Wildfires

- A warmer and drier climate is expected to lead to more frequent and more intense fires near or within populated areas.
- Widespread burning in summertime —and even springtime—is rapidly becoming the “new normal” in the American West.



Wildfires Affect Climate. Wildfires release large amounts of carbon dioxide, black carbon, brown carbon, and ozone precursors into the atmosphere. These emissions affect radiation, clouds, and climate on regional and even global scales.

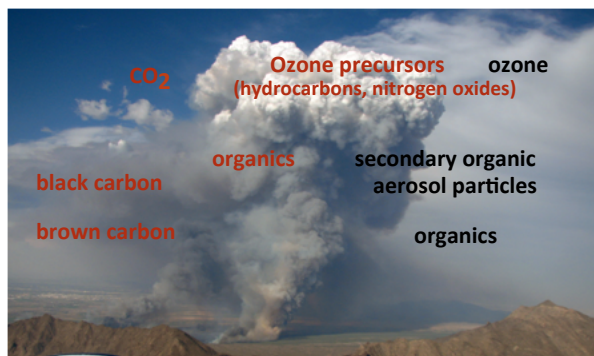
Wildfires Affect Air Quality. Wildfires also emit substantial amounts of volatile and semi-volatile organic materials and nitrogen oxides that form ozone and organic particulate matter. Direct emissions of toxic pollutants can affect first responders and local residents. In addition, the formation of other pollutants as the air is transported can lead to harmful exposures for populations in regions far away from the wildfires.

What is Needed? Information is needed on:

- Emissions, especially from different source materials
- Transport and chemical transformation in fire plumes
- Evolution and dynamics of fires and fire plumes

Why?

- To understand the effects on climate, air quality, and ultimately public health
- Inform decisions on when and where to allow burning



direct emissions → other pollutants formed downwind

Why NOAA? Why CSD?

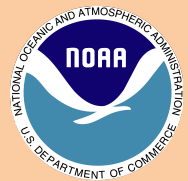
- CSD has unique capabilities—both its world-class personnel and state-of-the-art instrumentation—to characterize the gases and particles emitted by fires.
- CSD has a long history of success in research to study air quality and climate *together*—just what is needed for understanding the complex atmospheric effects of wildfires.
- CSD expertise in laboratory, modeling, and measurements can give a comprehensive picture of wildfires and their effects on climate and air quality.
- In FIREX, CSD will lead field and laboratory studies of wildfire emissions and chemistry using a chemically instrumented NOAA research aircraft and other measurement platforms [see back page].

Expected Payoffs

- Improved understanding of fire emissions and chemistry
- Quantitative assessments of fire pollutants that could affect human health

FIREX: Fire Influence on Regional and Global Environments Experiment

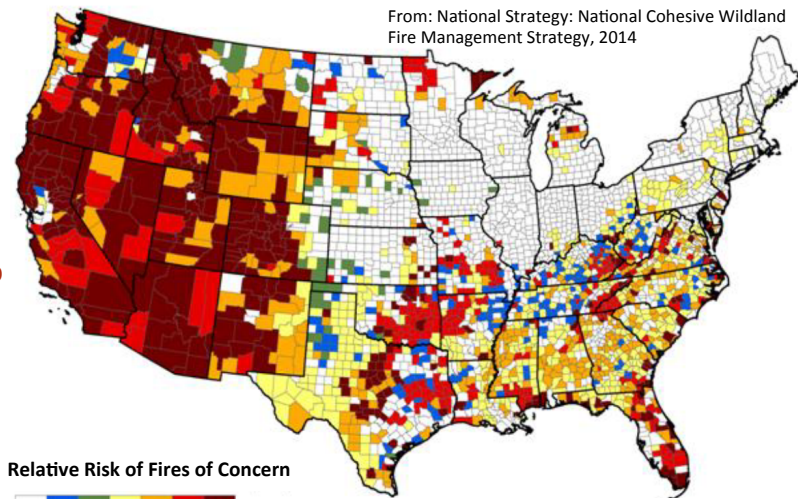
An Intensive Study of Climate & Air Quality Impacts of Western North America Fires
NOAA Field and Laboratory Studies during 2016—2019



The Issue

The combination of a warmer, drier climate with fire-control practices over the last century has produced a situation in which we can expect more frequent fires and fires of larger magnitude in the U.S. West and Canada.

- Fire suppression practices have led to a buildup of fuels in forests, a breakdown in natural forest ecology, and increased risk at urban-wildland boundaries. As a result, new policies now allow burning where possible.
- Climate change will sharpen the problem. The area burned is projected to at least double for every degree of warming.

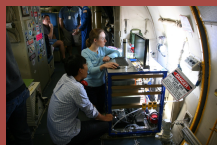


Note: A fire of concern is great than 1 square mile in extent and requires two weeks or more to contain

NOAA's Policy-Relevant Research to Address the Issue

The ESRL Chemical Sciences Division is leading the FIREX multi-year experiment, which will:

- include laboratory, field, and modeling research;
- culminate in an extensive field study during the peak fire season of 2019 (July—August) using a chemically instrumented NOAA research aircraft to measure trace gases and particles.



The range and payload of NOAA's WP-3D aircraft are essential to simultaneously study wildfire emissions and downwind aging, and to carry the suite of gas-phase and aerosol particle measurements needed to quantify climate and air quality impacts.

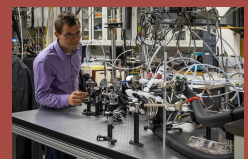
Some Key Science Questions for FIREX

- What kinds of gases and particles are emitted by fires? (Toxics? Unusual compounds?)
- How do the specific emissions change with different types of fuel?
- How does smoke impact the atmosphere and climate?
- What takes place as fire emissions are transported, diluted, and exposed to chemical oxidants?
- How do fires influence ozone formation? Can we improve predictions of whether a fire will cause exceedances of the Federal ozone standard?



Fire Science Laboratory experiments

- Development and testing of new instrumentation
- Lab experiments on chemical transformations



FIREX: Science Crucial in a Future of Increased Wildfires

The results of the FIREX studies will provide the scientific basis for:

- improved fire weather analysis to aid first responders and fire managers;
- quantitative assessment of population exposures to toxics from fires;
- measures of air quality impairment from ozone and primary or secondary particles;
- improved understanding of fires as sources of brown and black carbon;
- better descriptions of fire dynamics and transport on local to regional scales;
- better estimates of the impacts of fires on climate;
- assessments of satellite-based techniques for detecting fires and characterizing their chemistry.