



CALIFORNIA
AIR RESOURCES BOARD

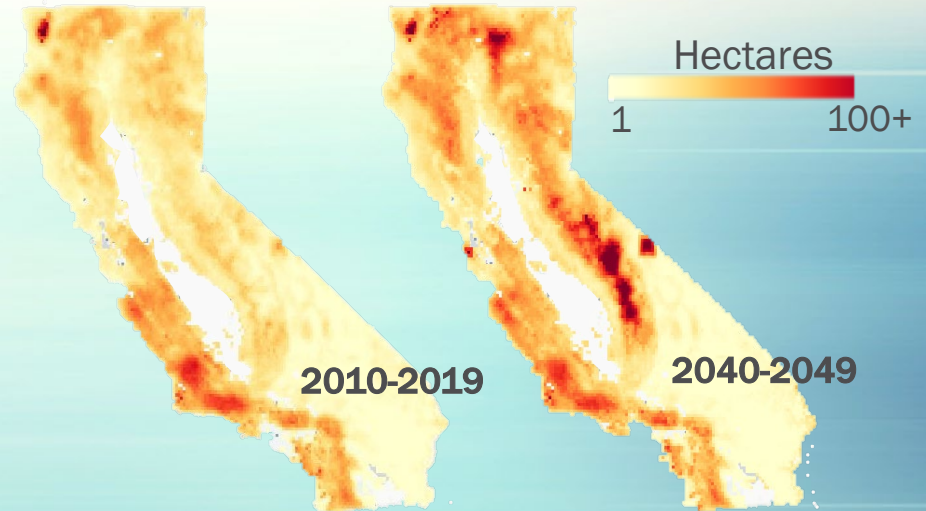
**Assessing Air Quality and Public Health Impacts
of Wildfire:
Impacts on Health**

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Wildfire-related PM Exposures

- Millions of Californians exposed to wildfires in 2018
- Wildfires: more frequent & intense with climate change

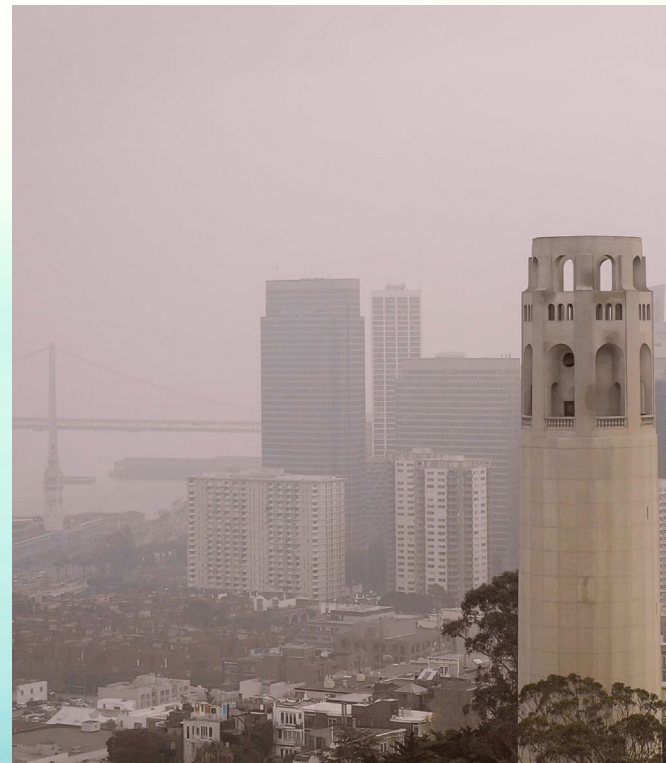
Forecast Average Annual Area Burned



Source: CalAdapt.org

How are wildfire exposures measured for health studies?

- Monitored PM
 - Carbon Monoxide
 - Toxic compounds
 - Formaldehyde, Acrolein, Benzene
- Smoky versus Non-smoky days
- Satellite data
- Models



What are some of the concerns when measuring exposures to wildfire?

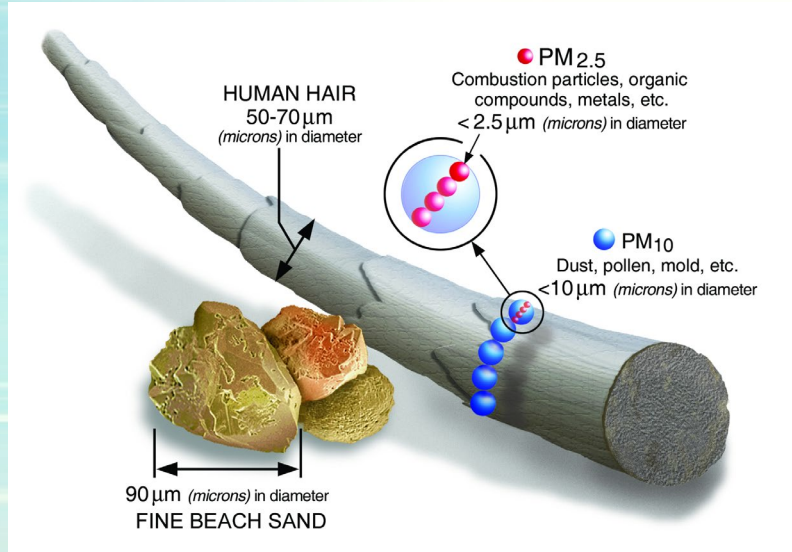
- Difficult to determine the exposure
 - Distance
 - Wind direction
 - Time outdoors
 - Infiltration indoors
 - Evacuations
- Components of wildfire smoke unknown
 - Stage of the fire is important
 - Materials combusted contribute to exposures
 - Wildfire contributes to PM2.5

PM Exposure is a Well Researched Public Health Concern

- Why are we concerned about PM?
 - Lots of evidence for health impacts
- If PM_{2.5} ↓ to background levels, could prevent (annually) about:
 - 7,200 premature deaths
 - 1,900 hospitalizations
 - 5,200 emergency room visits



Additional Evidence of PM's Negative Health Impacts



- Strong evidence for increased:
 - Asthma attacks
 - Respiratory symptoms
- Probable association with:
 - Work loss days
 - Restricted activity days
 - Adverse brain effects

What is known about the Health Effects of Wildfire Smoke

- Association with negative respiratory health impacts
 - Asthma and COPD
 - Hospitalizations and emergency department visits
 - Medication use
- Evidence for increase respiratory infections-pneumonia and acute bronchitis
- Recent evidence of possible association with all-cause mortality
- Cardiovascular outcomes are inconsistent

Who are the most vulnerable to wildfire smoke impacts?

- Children and the Elderly
- Those with pre-existing disease
- Socially isolated/low income
- Those with outdoor exposures
- Additional exposures
 - Ozone
 - Traffic



Occupational Studies of Wildfire Impacts in Firefighters

- Short-term impacts
 - Lung function decreases
 - Respiratory symptoms
- Long-term impacts
 - Increase risk of hypertension
- Increase in post-traumatic stress symptoms



Photo Courtesy of CAL FIRE

Protection of Occupational Workers from Wildfire smoke

- CalOSHA emergency regulation to protect workers from wildfire smoke
- Outdoor workplaces where the AQI is 151 or greater
- Process of identification, communication, mitigation
- Reduce exposures by filtered air enclosures, relocation, providing respirators
- Wildland firefighters are exempt
- <https://www.dir.ca.gov/dosh/Worker-Health-and-Safety-in-Wildfire-Regions.html>

How is Air Quality Reported?

AQI colors

EPA has assigned a specific color to each AQI category to make it easier for people to understand quickly whether air pollution is reaching unhealthy levels in their communities. For example, the color orange means that conditions are "unhealthy for sensitive groups," while red means that conditions may be "unhealthy for everyone," and so on.

Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0 to 50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51 to 100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151 to 200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201 to 300	Health alert: everyone may experience more serious health effects.
Hazardous	301 to 500	Health warnings of emergency conditions. The entire population is more likely to be affected.

Protecting Your Health

- Updated guidance from State & Federal agencies for:
 - Public health officials, schools, homeowners, & employers
- Filtration
- N-95 respirators
- Clean Air Shelters



WILDFIRE SMOKE
A GUIDE FOR PUBLIC HEALTH OFFICIALS
REVISED 2019

Guidance for Schools During Wildfire Smoke Events
California Environmental Protection Agency
California Environmental Health Hazard Assessment
Office of Environmental Health Assessment

Improving Indoor Air Quality

- Before the event, determine optimal settings for the heating, ventilation and air conditioning system (HVAC) to keep smoke from entering schools. If possible, minimize efficiency-based controls (e.g., economizers). During smoke events, turn the system "Off" or "Fan Only" and close all doors, base doors and windows.
- Do not add to indoor air pollution. Do not use labor-saving devices or built-in vacuums or cleaners. Fragrances, scented candles and air fresheners that use volatile oils, as well as any cleaning activities that use solvents.
- Use portable air cleaners in classrooms if available. For a list of air cleaning devices that comply with California's smoke-sensitizer rule, see the following link: [California Air Resources Board's list of California Certified Clean Air Devices](#).
- As an alternative to outdoor lunch or recess, create a clean air-lounge in a large room with as few doors and windows as possible, such as a gym or cafeteria. To the extent possible, prevent smoke from entering the room and maintain the best air quality possible. Ensure that the room has adequate heating/cooling for the duration of the event.

WILDFIRE SMOKE
Considerations for California's Public Health Officials

Protecting Yourself from Wildfire Smoke

People impacted by wildfire events should protect themselves – especially children, the elderly, pregnant women and people with heart or respiratory conditions. These sensitive groups are advised to limit outdoor activities, especially when the Air Quality Index (AQI) reaches "Unhealthy for Sensitive Groups." Air quality has been reaching "Unhealthy," "Very Unhealthy" and even "Hazardous" levels in some places over the past week. Even healthy people may experience symptoms in smoky indoor air environments. Pets also can be affected by unhealthy air and should be brought indoors, if possible.

Check air quality reports

Be Ready for Wildfires

AIR QUALITY INDEX

AQI	Health	Take these actions to protect your health
0-50	Good	Air quality is satisfactory, and air pollution poses little or no risk.
51-100	Moderate	Unusually sensitive people should consider reducing prolonged or heavy outdoor activities.
101-150	Unhealthy for Sensitive Groups	People with respiratory conditions, the elderly and children should limit prolonged outdoor activities.
151-200	Unhealthy	Everyone should limit prolonged outdoor activities.
201-300	Very Unhealthy	Everyone should avoid prolonged outdoor activities. People with respiratory conditions, the elderly and children should avoid all outdoor activities.
301-400	Hazardous	Everyone should avoid all outdoor activities. People with respiratory conditions, the elderly and children should remain indoors.

CARB Research: Wildfire Health Impacts in Rhesus Macaques

- Infant monkeys in outside enclosures unintentionally exposed to wildfire smoke (Miller, UC Davis)
- As adolescents & young adults:
 - Impaired immune function
 - Changes in lung structure
 - Reduced lung function



© CNPRC, UC Davis

CARB Research, in progress: Wildfire Emissions



- Understanding and mitigating wildfire risks (Goldstein, UC Berkeley)
 - Mobile measurements (in-house research with UC Berkeley & UC Riverside)
- NASA aircraft: investigating wildfire emissions & downwind air quality (Blake, UC Irvine)

CARB Research: Short-term PM Exposure

- White paper: reviewing short-term PM exposure impacts
- Short-term exposure of PM_{2.5}, including wildfire on work loss days
- Air monitoring in AB 617 communities
 - Localized pollutant exposures
- Determine if need to address short-term exposures



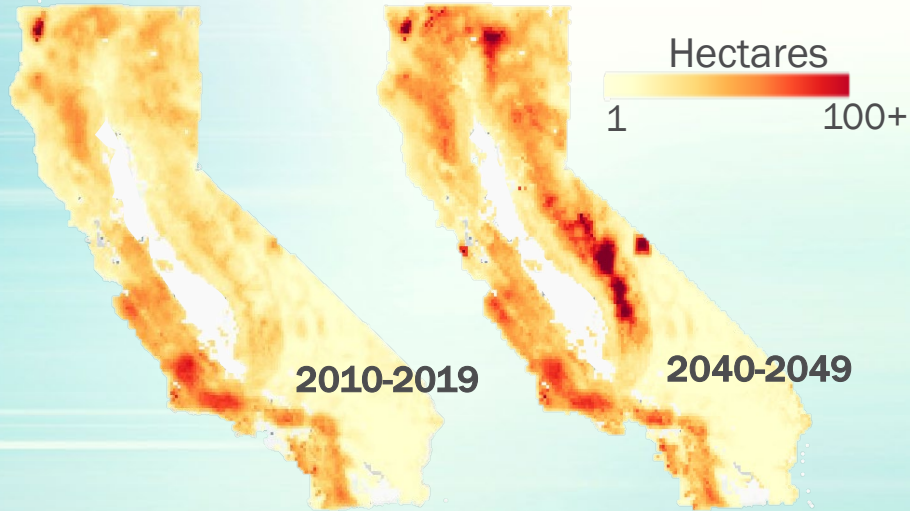
Conclusions



- PM2.5 impacts well known
- Limited studies on wildfire smoke
 - Respiratory effects seen
 - Cardiovascular effect just being studied
- Children and the elderly vulnerable
- Limited occupational studies
 - Short-term lung function declines

Areas of Concern

Forecast Average Annual Area Burned



Source: CalAdapt.org

- Wildfire risks increase with increased climate change
- More studies on wildfire impacts needed
- Long-term occupational studies

Thank you