Wildland Fire Research

Overview and Highlights

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EPA, Wildland Fire and Smoke

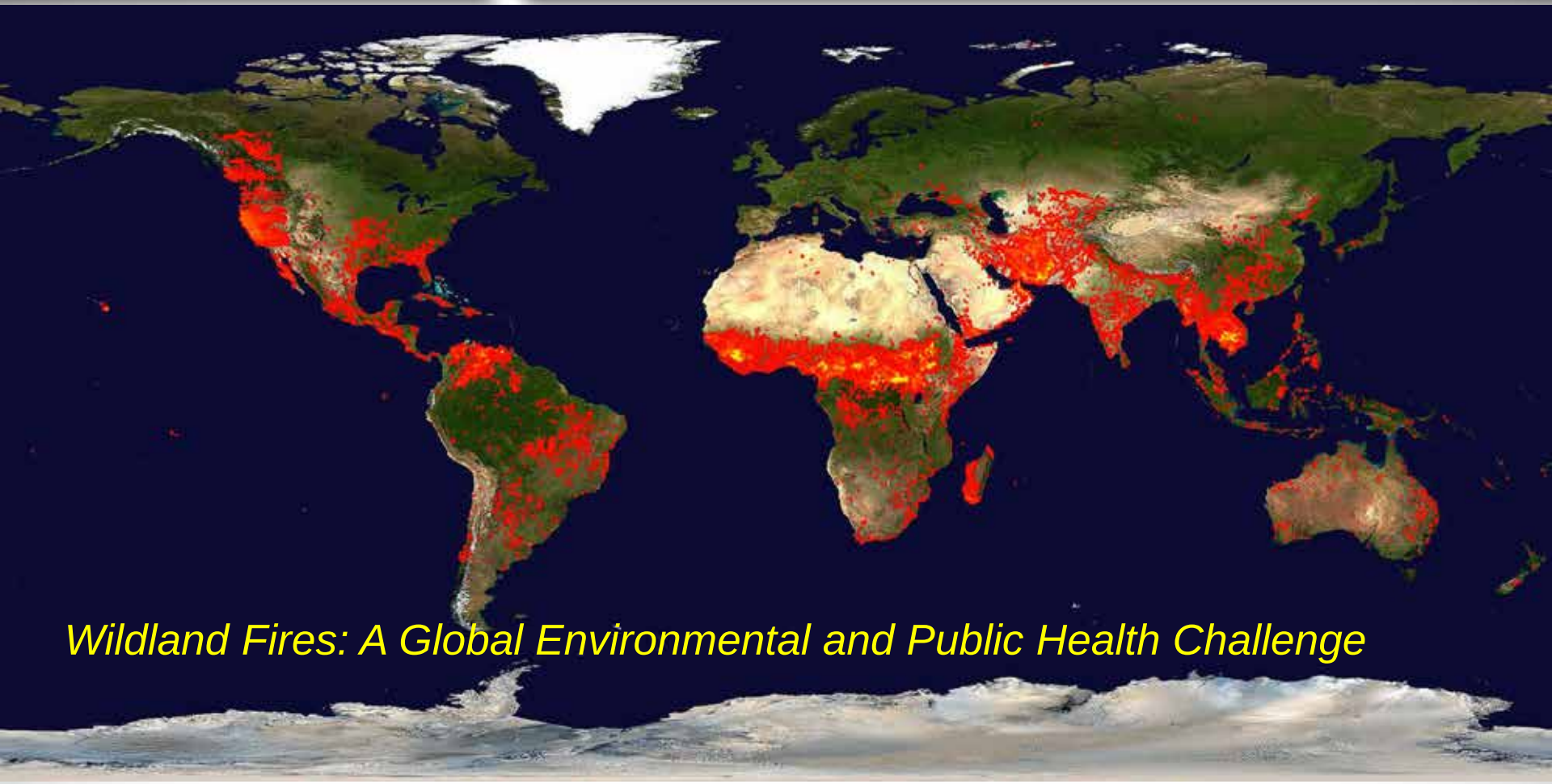
- The mission of EPA is to protect human health and the environment
- Wildland fires are a national challenge impacting population health and ecological health through complex multi-media pathways
- While there are ecological benefits, uncontrolled wildfires and use of prescribed burning for fire control and agricultural cycling are increasingly raising questions related to potential impacts on:
  - Ambient air quality
  - Land management
  - Water quality
  - Effects of ecosystem services
  - Public health
- The magnitude and frequency of these events is expected to worsen with our changing environment


"Wildfire" SC State


Winter Wheat Burn, WA


Colorado Springs, CO

Wildland Fires & Emissions
Global Public Health Challenge



Global Fire Map 2/20/2016 – 2/29/2016

URL: lance-modis.eosdis.nasa.gov/cgi-bin/imagery/firemaps.cgi

A National Concern

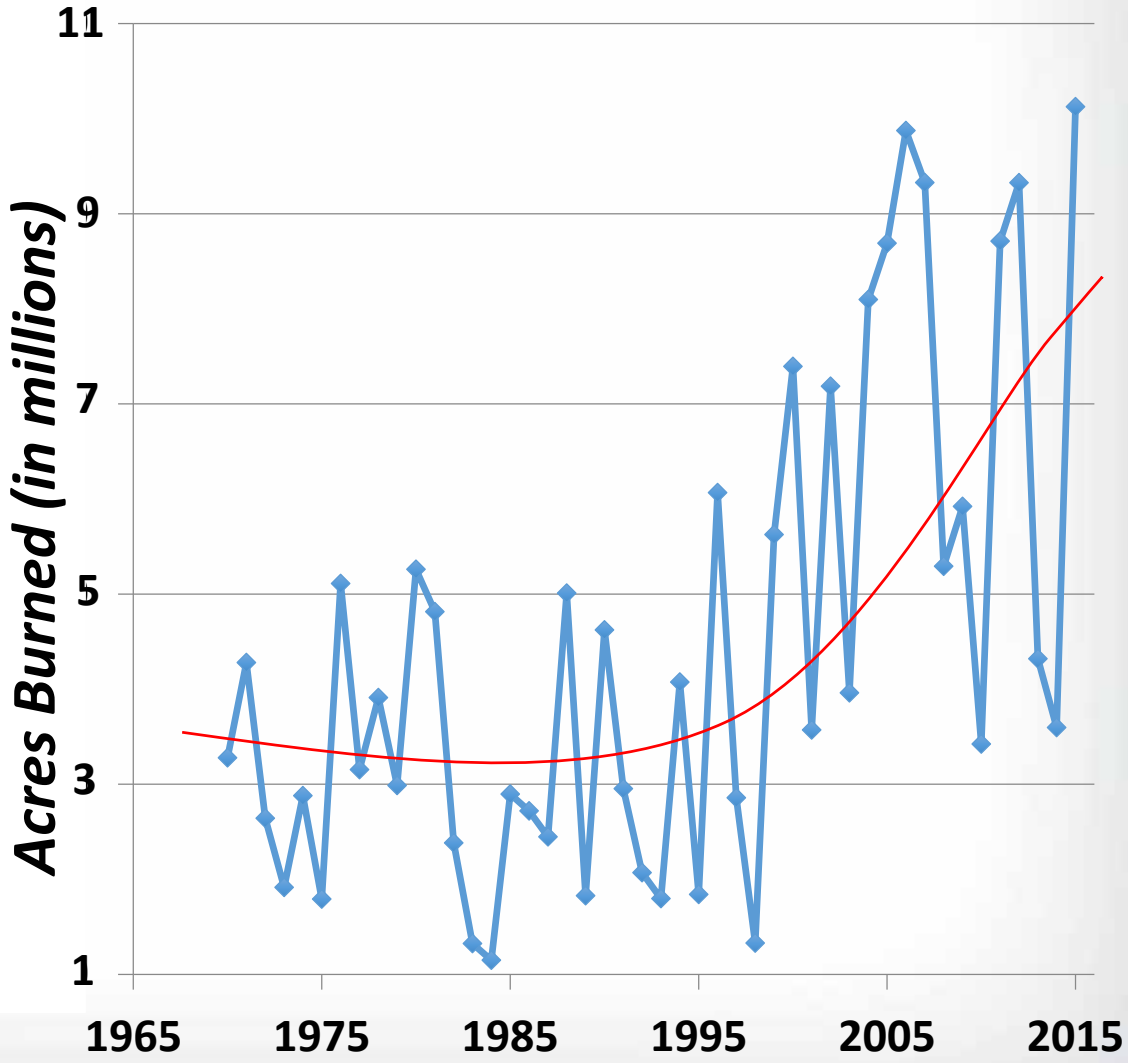
Increased acreage burned

- According to NIFC data, 9 of 10 years with the largest acreage burned have occurred since 2000, including the peak year in 2015

Increased impact on urban areas

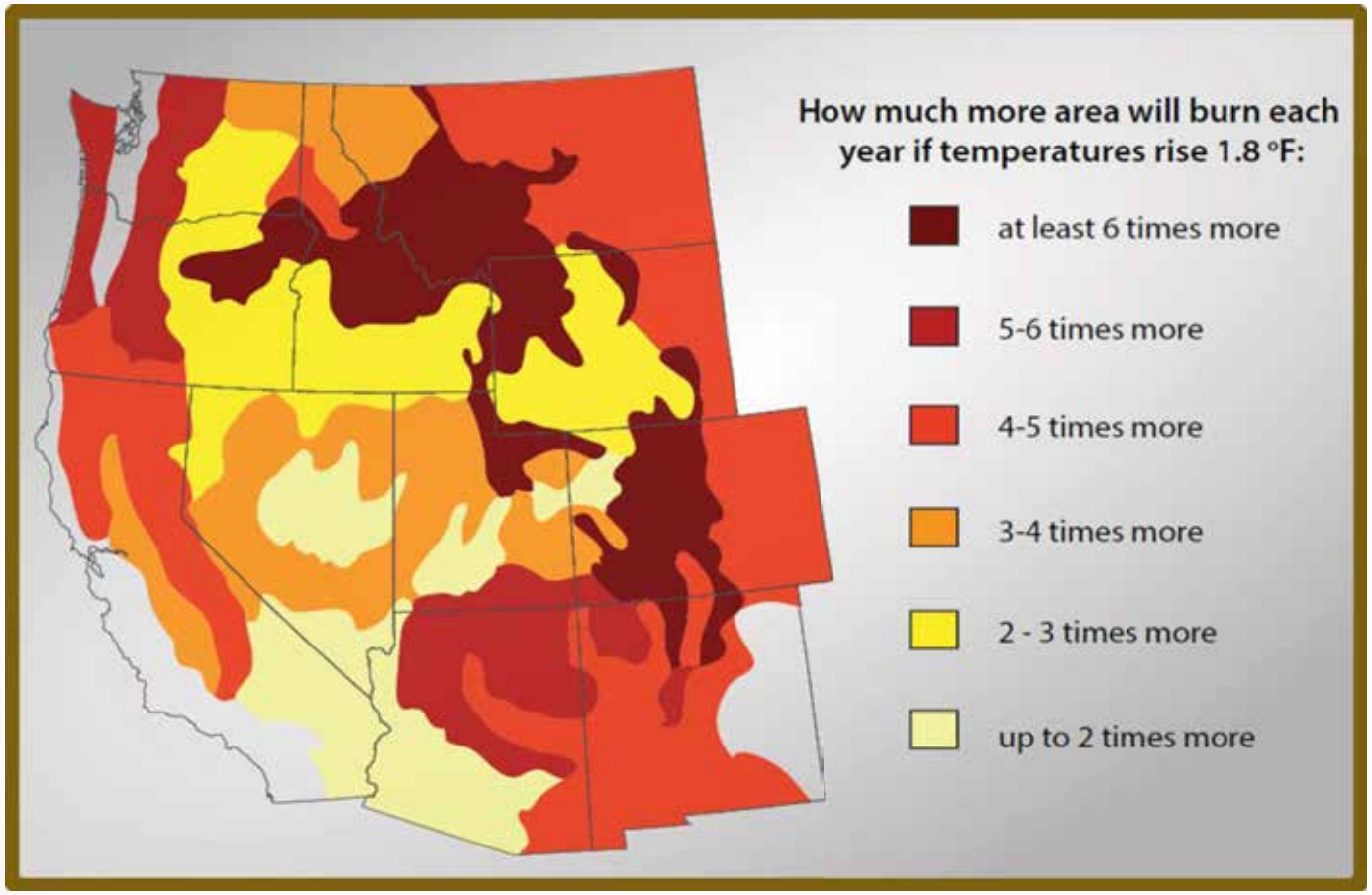
- 10% of all land with housing are situated in the wildland-urban interface
- 38.5% of U.S. housing units (Radeloff et al. 2005)

>$1 billion every year to fight wildfires



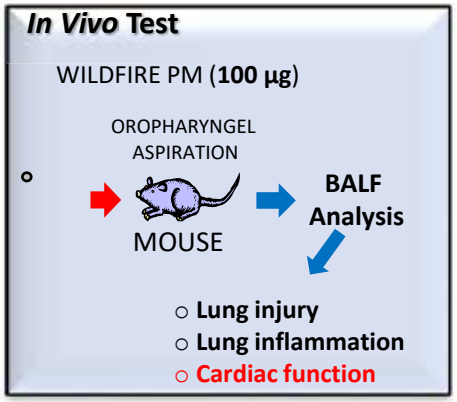
Adapted from https://www.nifc.gov/fireInfo/fireInfo_stats_totalFires.html

Higher Global Temperatures will Increase Burn Areas in the West

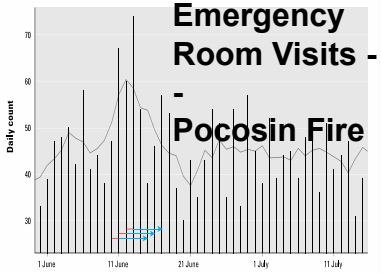


National Research Council

Various Facets of Wildland Fire



Smoke Toxicology



EPA ACE Wildland Fire Research

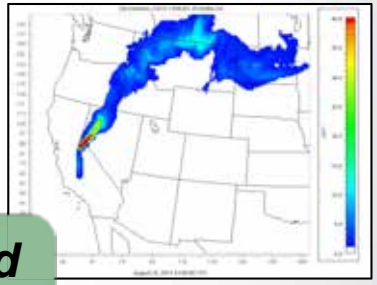
Smoke Exposure (Monitors/Sensors)

Smoke Epidemiology

Public Health

Biomass Emissions Factors & Speciation

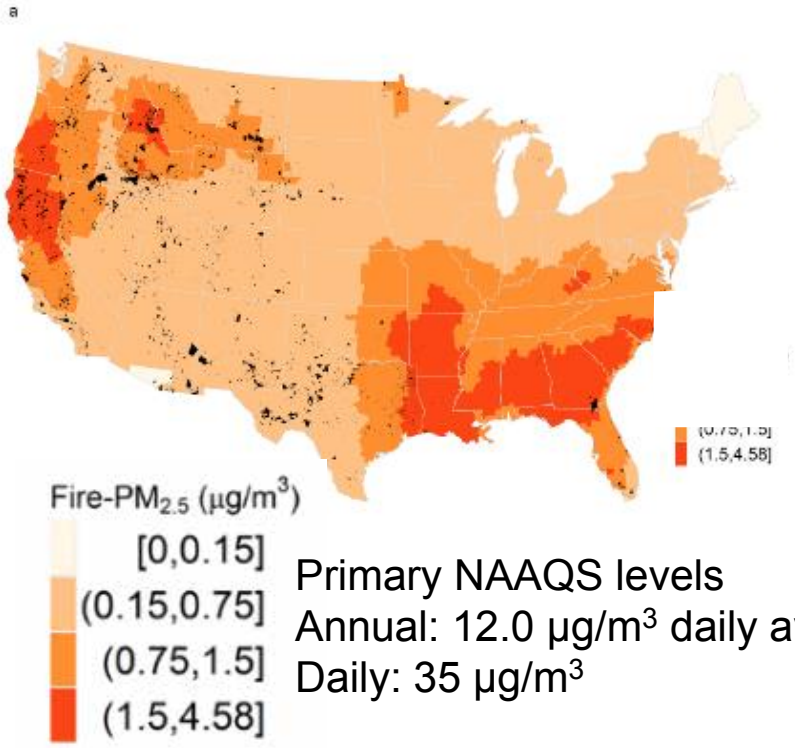
Smoke Emissions and AQ Impacts Modeling



Air Quality Impacts: Near and Far

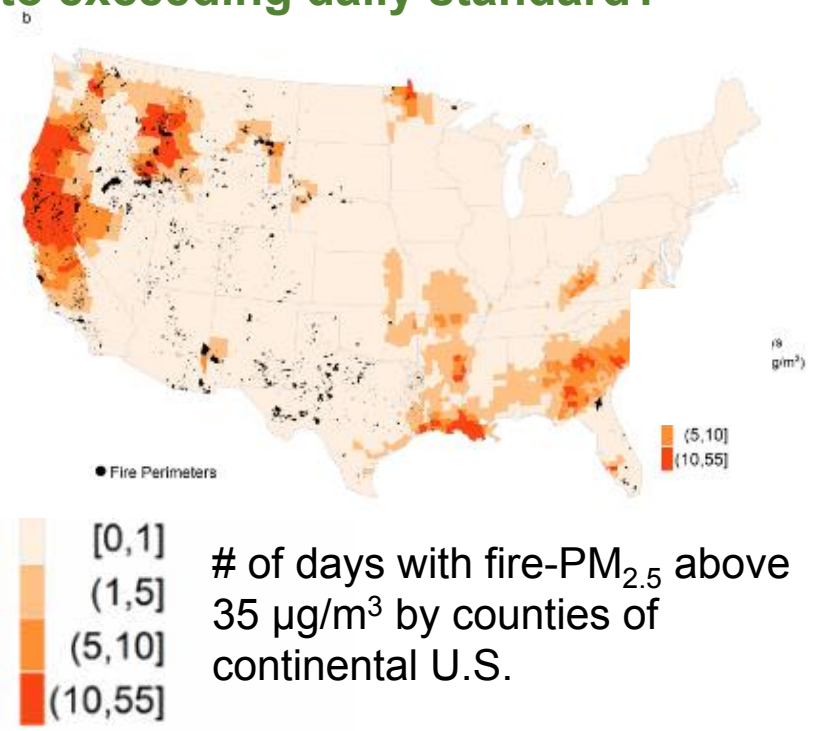
2014 National Emissions Inventory: ~32% of $PM_{2.5}$ emissions resulted from wildland fires

Annual average daily fire-$PM_{2.5}$ footprint for U.S. counties



Primary NAAQS levels
Annual: 12.0 µg/m^3 daily avg.
Daily: 35 µg/m^3

How much does smoke contribute to air quality and how often does it lead to exceeding daily standard?



# of days with fire-$PM_{2.5}$ above 35 µg/m^3 by counties of continental U.S.

Source: Rappold AG, et al. Environ Sci Technol 2017

Health Effects Linked to Smoke from Wildland Fires

Health effects known or suspected to be caused by wildland fire smoke

(Source: Studies reviewed in Liu et al 2015)

- All-cause mortality
- Asthma & chronic obstructive pulmonary disease (COPD) exacerbations
- Bronchitis & pneumonia
- Childhood respiratory disease
- Cardiovascular outcomes
- Adverse birth outcomes
- Symptoms such as eye irritation, sore throat, wheeze and cough

Who's at Risk from Smoke?

At-risk populations include –

- Pregnant women and fetuses
- Children
- Older populations
- Populations with pre-existing respiratory disease
- Populations with pre-existing cardiovascular disease

27% of U.S. population is at-risk

Populations suspected to be at greater risk –

- Populations with chronic inflammatory diseases (e.g., diabetes, obesity)
- Women, African-Americans and populations with lower socio-economic status*

* *Cocco Liu J et al. Am J Epidemiol 2017*

Changing U.S. Demographic Increases Wildfire Smoke-Related Risk

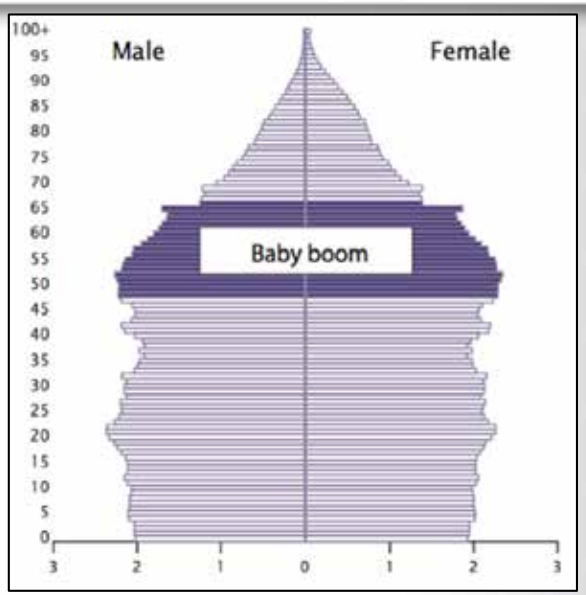
Changing U.S. Demographic

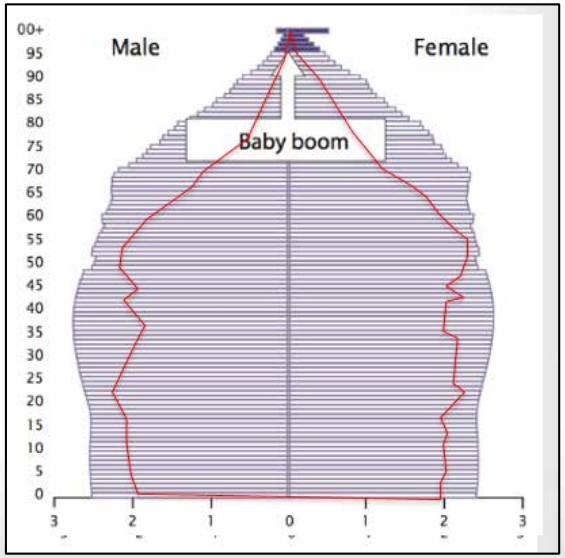
- U.S. population will continue to:
  - Grow
  - Median age will shift upward

Higher Prevalence of Chronic Diseases Conferring Risk to Wildland Fire Smoke

- Aging U.S. population with increasing prevalence of:
  - Heart-lung disease, obesity, diabetes

U.S. Population 2012





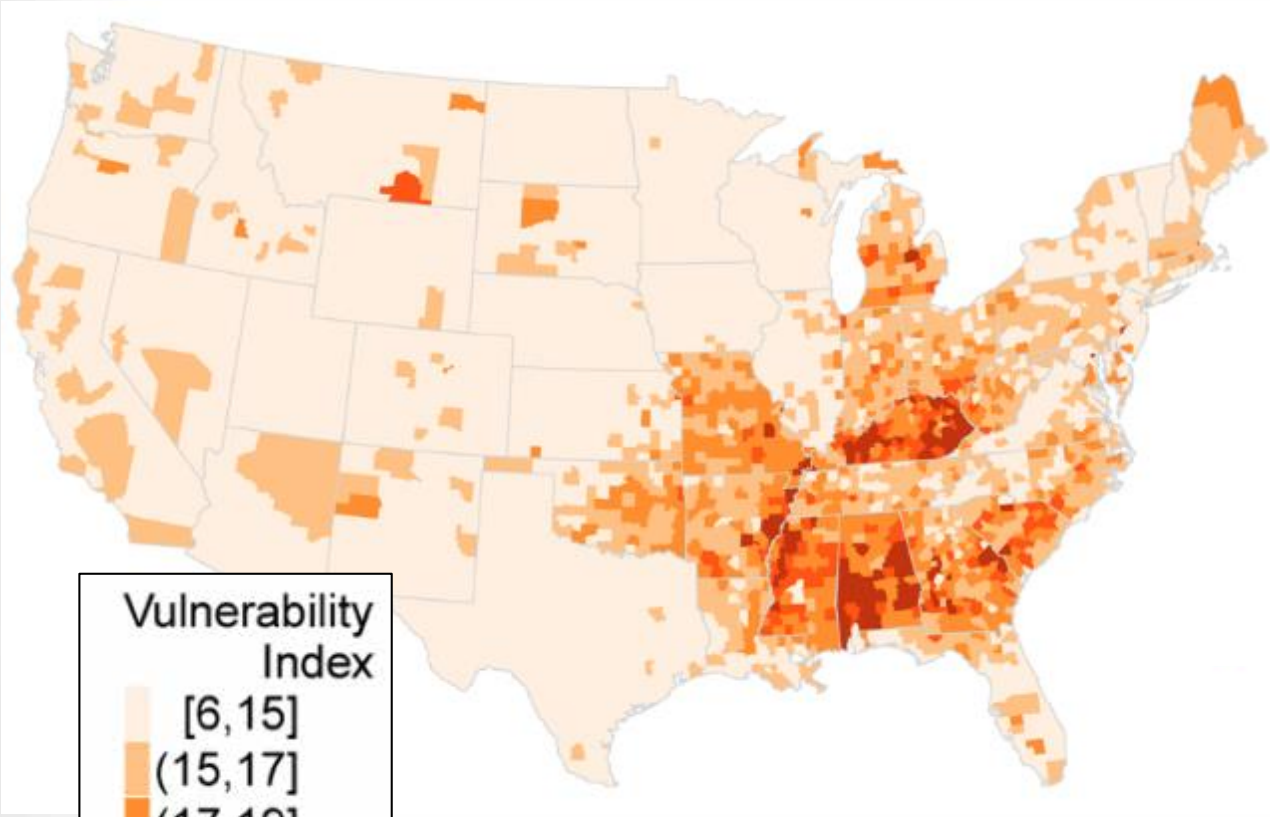
Projected U.S. Population 2060

(2012 U.S. Population – Red outline)

Source: Xu J, Murphy SL, Kochanek DK, Arias E. NCHS Data Brief No. 267, 2016

Community Health-Vulnerability Index

National map of community-health vulnerability index and air pollution awareness to adverse health effects



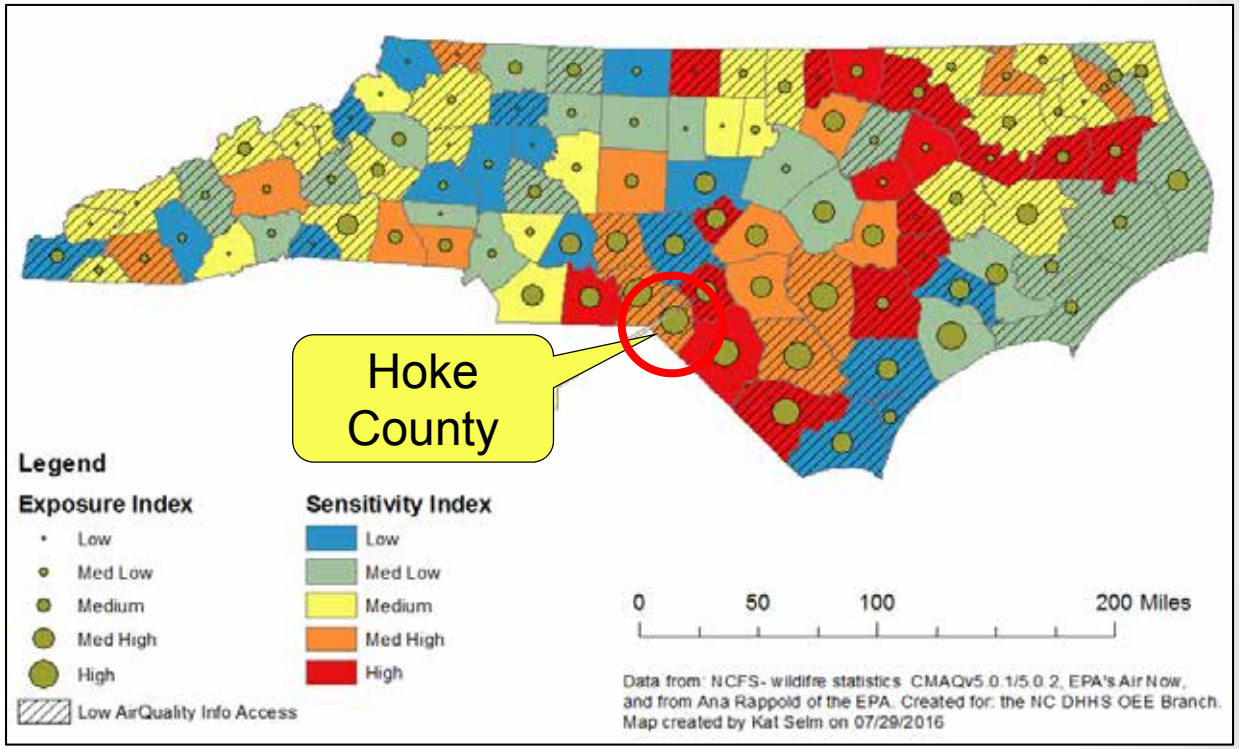
Factors of Vulnerability

- Peds & Adult Asthma
- COPD
- Obesity
- Diabetes
- Hypertension
- % population age 65+
- Income, education, poverty, unemployment

Source: Rappold AG, et al Environ Sci Technol 2017

Community-Health Vulnerability Index Used in CDC-funded North Carolina Health Program

- Community-Health Vulnerability Index was translated for use in North Carolina
- Utilized CHVI to identify NC community most at risk to smoke health impacts
- Used CHVI to identify & add NC-specific layers (e.g., NC Forestry data)
- Engaged Hoke County stakeholders (e.g., local fire departments) with CHVI to discuss vulnerability to smoke health impacts



- CHVI discussion has given way to implementing prevention efforts, e.g. Smoke Sense

Courtesy of Lauren Thie NC Department of Public Health

Smoke Sense App

Aims of Smoke Sense:

- Measure the effect of wildfire smoke exposure on health and productivity
- Develop health risk communication strategies to improve public health outcomes

As part of this, researchers have developed a Smoke Sense mobile phone application to:

- Collect user input on how smoke events impact their health and daily activities, and
- Provide information about the smoke exposure and recommended health risk messages

Pilot Season

- 5,000+ individuals from across the nation made personal contributions by using the app over 50,000 times

Wildland Fire Sensors Challenge

Launched Wildland Fire Sensors Challenge in April 2017

- Intended to stimulate development of low-cost, light-weight, accurate, and easily deployable sensor technology that could be used by first responders and public health agencies during wildland fires
- Collaborative project between EPA, NASA, USFS, NOAA, CDC, NPS) and NGOs
- 9-month development window, testing and judging in 2018

Designing complementary projects with EPA Regional offices and other interested groups to field test sensors in a wildland fire scenario

Shifting Gears: Water Impacts

Wildfire Impacts on Water Resources

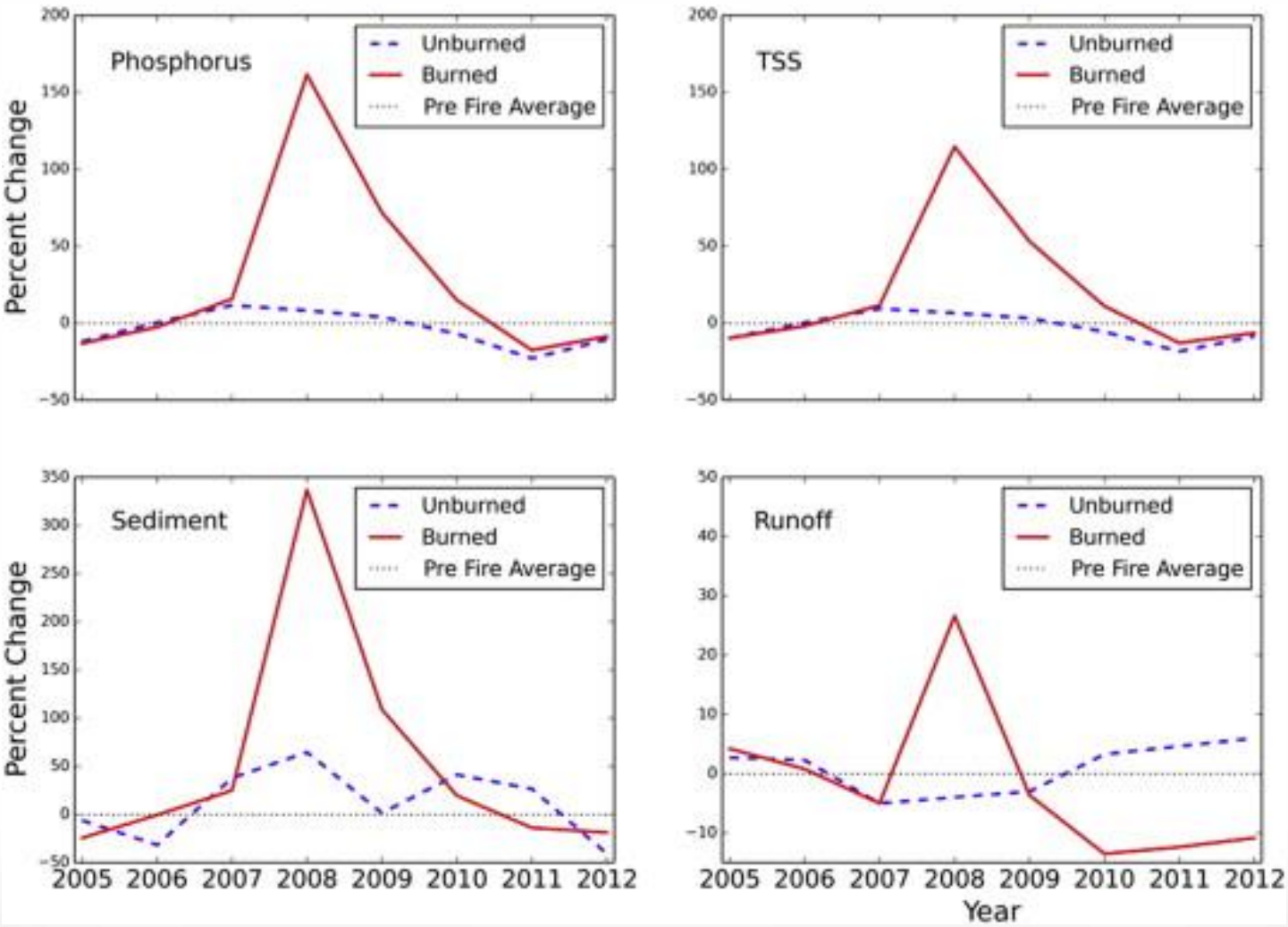
- Soil Erosion/Sedimentation/Turbidity
- Pollutant Mobilization
  - Low dissolved oxygen (DO)
  - Increased ammonia from fire retardants
  - Elevated phosphorus, metals, iron, manganese, and nitrate
- Hydrologic Impacts
  - Increased Flooding
  - Debris flow

Courtesy of Jeff Peterson (Retired-Office of Water, EPA)

Wildfire and Drinking Water Systems

- Fire Impacts on Facilities
- Post Fire/Stormwater Impacts
  - Treatment Plants (pollutants mobilized, debris management)
  - Source Water Management (watershed stabilization, relocating intakes, dredging reservoirs, new water sources)

Wildfire and Surface Water Pollution



Source: Morrison KD *Modeling the impacts of wildfire on runoff…* J Env Man 2015

Fire + Rainfall =

Tree roots hold soil and rocks. When fires come through and damages trees, what happens when it rains?

Mudslides

2014 NCA: Key Findings: Extreme Events

- Average precipitation has increased since 1900
- Heavy downpours are increasing nationally
- Recent trend towards increased heavy precipitation events will continue even in regions where total precipitation is projected to decrease, such as the Southwest

Source: Alaska NPR https://www.alaskapublic.org/2013/05/13/couple-escapes-as-landslide-destroys-cabin/

Examples of Wildfire-Water Research

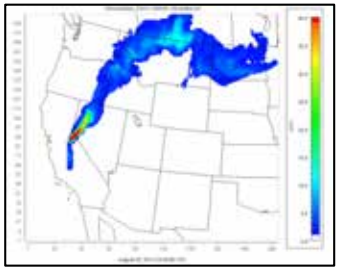
- Characterizing watershed vulnerability to wildfire-caused degradation of water quality
- Understanding impacts of wildfire on cold water refugia
- Forest health and water quality: assessment of how effects of disease and pests impact forest susceptibility to wildfire, and how these dead trees as fuel lead to water quality issues

Courtesy of Jeff Peterson (Retired-Office of Water, EPA)

A Few Highlights of Recent Activities

Wildland fire emissions

- Field and chamber work estimating emission factors and emission speciation; includes open burn test facility
- Field study in Flint Hills, KS region to characterize grassland emission factors



Improved AQ modeling of plume rise, transport, and chemical evolution

Ongoing toxicological studies

- Differentiate wildland fire smoke impacts human health from a typical urban air
- How different phases of combustion (flaming to smoldering) impact health

Monitors and sensors measuring fire exposures

- ACE wildland fire sensors challenge
- Leveraging research from other Federal agencies

Water

- Grants to evaluate fuel reduction practices on drinking water quality and associated modeling of drinking water utility management

Communication and outreach

- Smoke Sense App
- Pilot Social Science projects
- Smoke Ready Toolbox
- Wildfire Smoke: A Guide for Public Health Officials

Smoke Sense

Summary

EPA's multi-disciplined fire-related research aims to address needs identified by our Program, Regional Office and State partners as well as other stakeholder groups, like you.

Thank you

Baghdikian.Christina@epa.gov

EPA researchers lift a monitoring balloon to evaluate a prescribed fire in Camp Lejeune, NC

Resources for Protecting the Public from Smoke and Ash

Susan Lyon Stone
stone.susan@epa.gov

National Environmental Health Association
NEHA
Webinar
May 2, 2018

What Is the Air Quality Index?

- The Air Quality Index (AQI) is EPA's color-coded tool for telling the public how clean or polluted the air is
- It recommends steps people can take to reduce their daily exposure to pollution
- The AQI converts pollutant concentrations to a number on a scale from 0 to 500; generally a value of 100 is equal to the level of the short-term standard
- Cities and states use the AQI for reporting and forecasting air quality
- Metropolitan statistical areas with a population over 350,000 are required to report the daily AQI value (40 CFR Part 58 Appendix G)
- Reporting requirements:
  - Daily to the news media and a publicly available location such as the internet
  - When AQI is greater than 100, it is critical that reporting to the news media be as extensive as possible.
  - Real-time data reporting and voluntary action programs that provide timely air quality information may also be used to meet reporting requirements

AQI Categories and Health Messages

Category Descriptor	Index Value	Message
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.

Air Quality Index

- Pollutant-specific health effects and cautionary statements address question “who will be affected”
- Based on health information supporting the NAAQS
  - Controlled human exposure, epidemiological studies exposure/risk assessments used to set breakpoints
  - Epidemiological studies useful for identifying risk factors and more serious effects
  - Controlled human exposure studies useful for identifying proportion of healthy population affected, symptoms, mechanisms of effects, genetic variability

How to use the AQI to lower the dose of inhaled pollution:

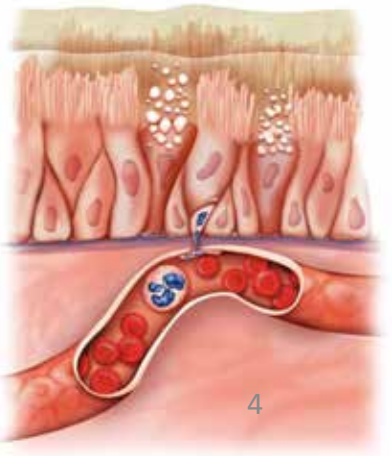
Dose = Concentration x Ventilation rate x Time

C - be active outdoors when air quality is better

V - take it easier when active outdoors

T - spend less time being active outdoors

Since people respond differently - PAY ATTENTION TO SYMPTOMS!



Fires: Current Conditions

AirNow (airnow.gov)

Fires: Current Conditions

AirNow redesign coming later this summer!!!!

Information will be available in

- Current Air Quality (circled)
- Map (below)

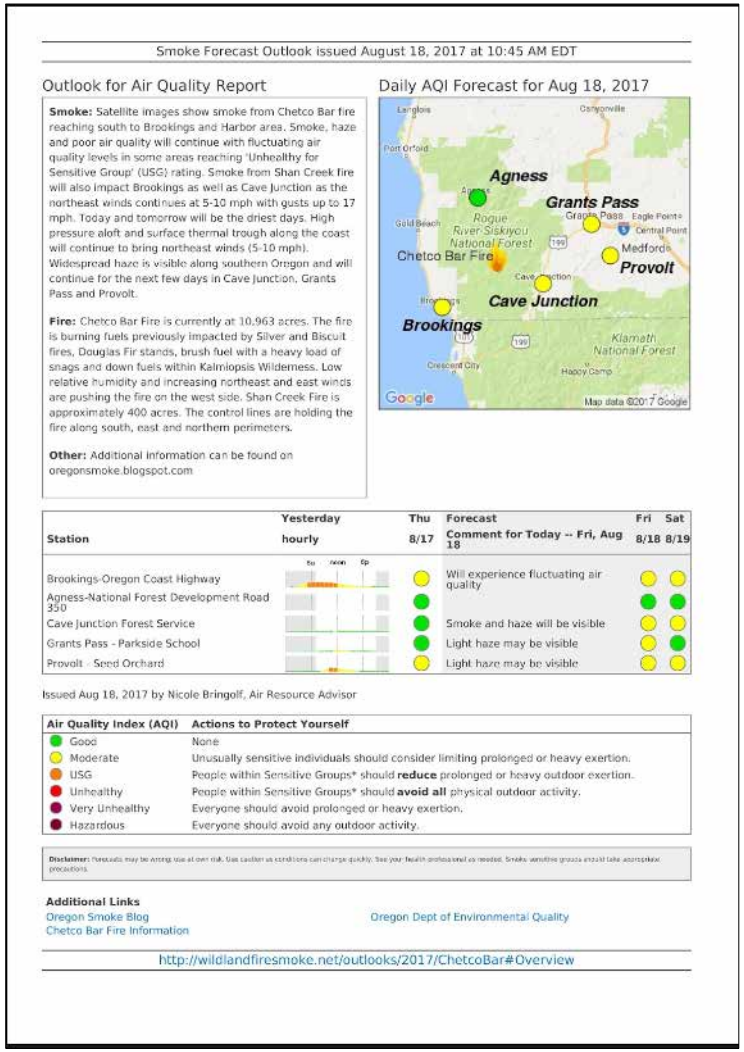
AirNow (airnow.gov)

Fires: Current Conditions

Fires Current Conditions Map

- Current Conditions map for August 18, 2017
- Smoke map generated by NOAA Hazard Mapping System (HMS)
- Updated about 5 times a day
- Uses satellite data, enhanced now that GOES-16 is operational

Fires: Current Conditions – Current Advisories



Smoke Forecast Outlook issued August 18, 2017 at 10:45 AM EDT

Outlook for Air Quality Report

Smoke: Satellite images show smoke from Chetco Bar fire reaching south to Brookings and Harbor area. Smoke, haze and poor air quality will continue with fluctuating air quality levels in some areas reaching 'Unhealthy for Sensitive Group' (USG) rating. Smoke from Shan Creek fire will also impact Brookings as well as Cave Junction as the northeast winds continues at 5-10 mph with gusts up to 17 mph. Today and tomorrow will be the driest days. High pressure aloft and surface thermal trough along the coast will continue to bring northeast winds (5-10 mph). Widespread haze is visible along southern Oregon and will continue for the next few days in Cave Junction, Grants Pass and Provolt.

Fire: Chetco Bar Fire is currently at 10,963 acres. The fire is burning fuels previously impacted by Silver and Biscuit fires, Douglas Fir stands, brush fuel with a heavy load of snags and down fuels within Kalmiopsis Wilderness. Low relative humidity and increasing northeast and east winds are pushing the fire on the west side. Shan Creek Fire is approximately 400 acres. The control lines are holding the fire along south, east and northern perimeters.

Other: Additional information can be found on oregonsmoke.blogspot.com

Daily AQI Forecast for Aug 18, 2017

Station	Yesterday hourly	Thu 8/17	Forecast Comment for Today -- Fri, Aug 18	Fri 8/18	Sat 8/19
Brookings-Oregon Coast Highway			Will experience fluctuating air quality		
Agness-National Forest Development Road 350					
Cave Junction Forest Service			Smoke and haze will be visible		
Grants Pass - Parkside School			Light haze may be visible		
Provolt - Seed Orchard			Light haze may be visible		

Issued Aug 18, 2017 by Nicole Bringolf, Air Resource Advisor

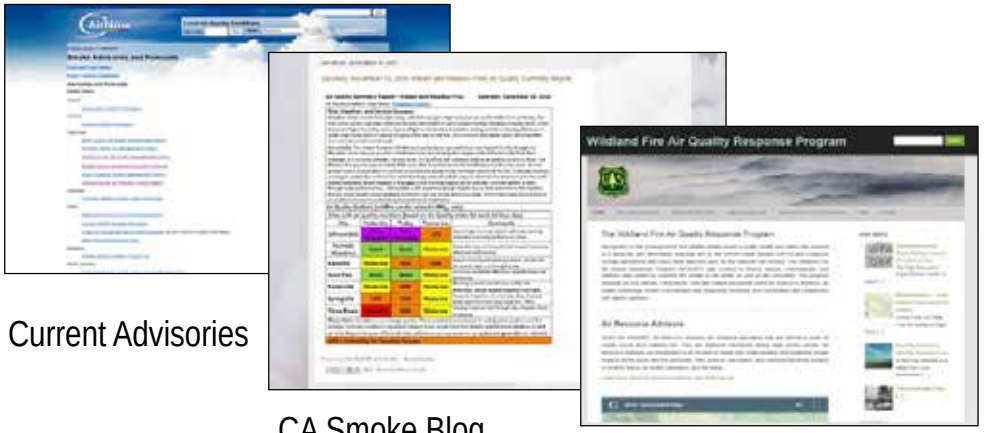
Air Quality Index (AQI)	Actions to Protect Yourself
Good	None
Moderate	Unusually sensitive individuals should consider limiting prolonged or heavy exertion.
USG	People within Sensitive Groups* should **reduce** prolonged or heavy outdoor exertion.
Unhealthy	People within Sensitive Groups* should **avoid all** physical outdoor activity.
Very Unhealthy	Everyone should avoid prolonged or heavy exertion.
Hazardous	Everyone should avoid any outdoor activity.

Additional Links

Oregon Smoke Blog
Chetco Bar Fire Information
Oregon Dept of Environmental Quality

http://wildlandfiresmoke.net/outlooks/2017/ChetcoBar#Overview

Smoke Forecast Outlook, Chetco Bar Fire, 8/18/17, 10:45 am



Current Advisories

CA Smoke Blog

USFS
Wildland Fire Air Quality Response Program

- State/Local/Tribal agency blogs
- Wildland Fire Air Quality Response Program

How Smoke from Fires Can Affect Your Health

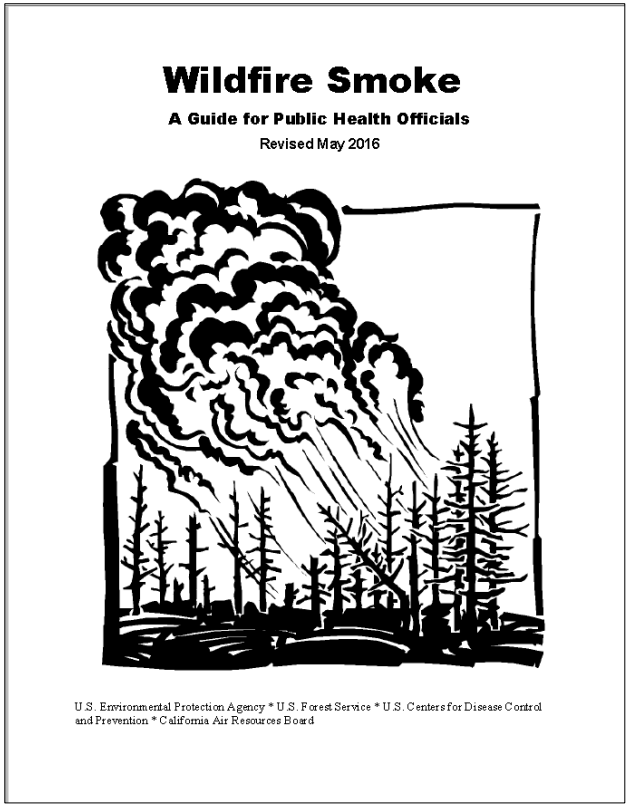
- New document - currently in html only
- May develop pdf version

https://airnow.gov/index.cfm?action=smoke.index

Wildfire Smoke

A Guide for Public Health Officials (2016)

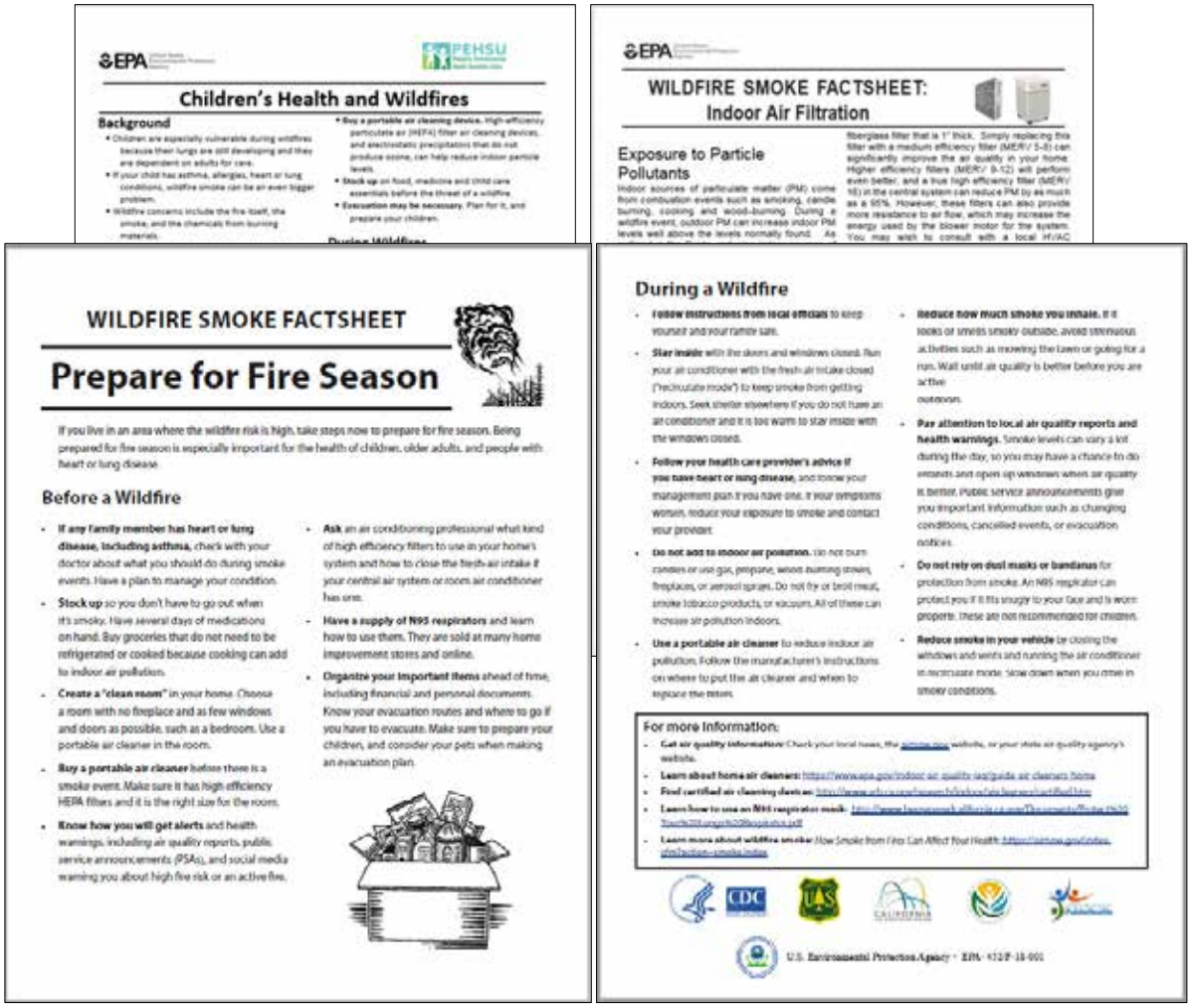
- Revised by EPA/CDC and NIOSH/USFS/California Agencies
- Updated air quality and health information
- Exposure reduction measures incorporate stronger evidence base
- Entirely new section on communicating air quality
  - Uses “Current PM” levels from AirNow
  - Uses satellite information on Fires: Current Conditions page
  - Visual range information updated
- New fact sheets about children’s health



https://www3.epa.gov/airnow/wildfire_may2016-revised.pdf

Coming Soon - Wildfire Guide Fact Sheets

- ✓ Prepare for Fire Season
- Protect Your Lungs
- Indoor Air Filtration
- Reduce Your Smoke Exposure
- Children's Health and Wildfire Smoke
- Protect Yourself from Ash



EPA PEHSU

Children's Health and Wildfires

Background

EPA

WILDFIRE SMOKE FACTSHEET:
Indoor Air Filtration

Exposure to Particle Pollutants

WILDFIRE SMOKE FACTSHEET

Prepare for Fire Season

If you live in an area where the wildfire risk is high, take steps now to prepare for fire season. Being prepared for fire season is especially important for the health of children, older adults, and people with heart or lung disease.

Before a Wildfire

During a Wildfire

For more information:

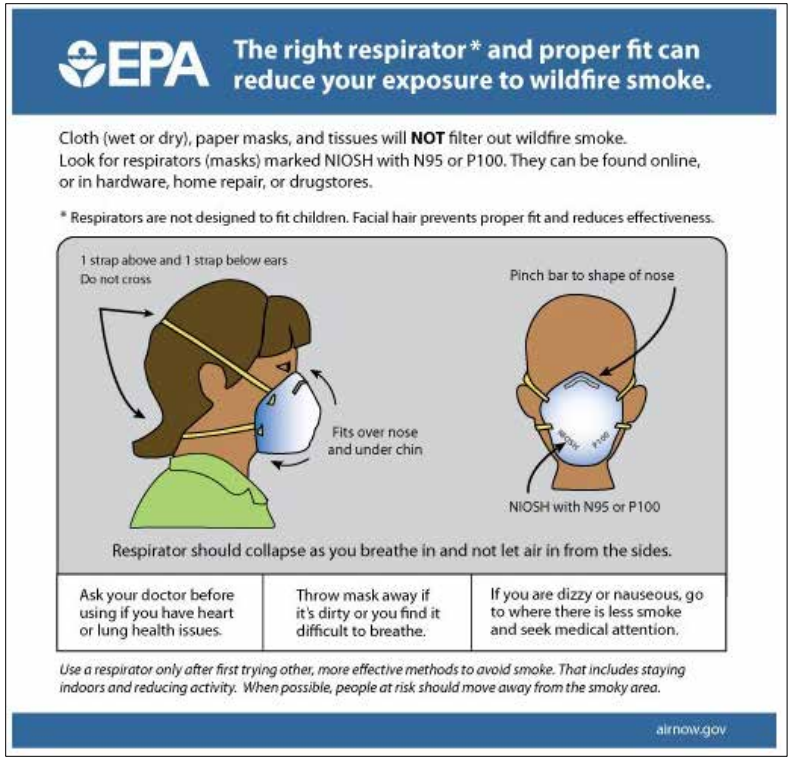
U.S. Environmental Protection Agency

https://www3.epa.gov/airnow/smoke_fires/prepare-for-fire-season.pdf

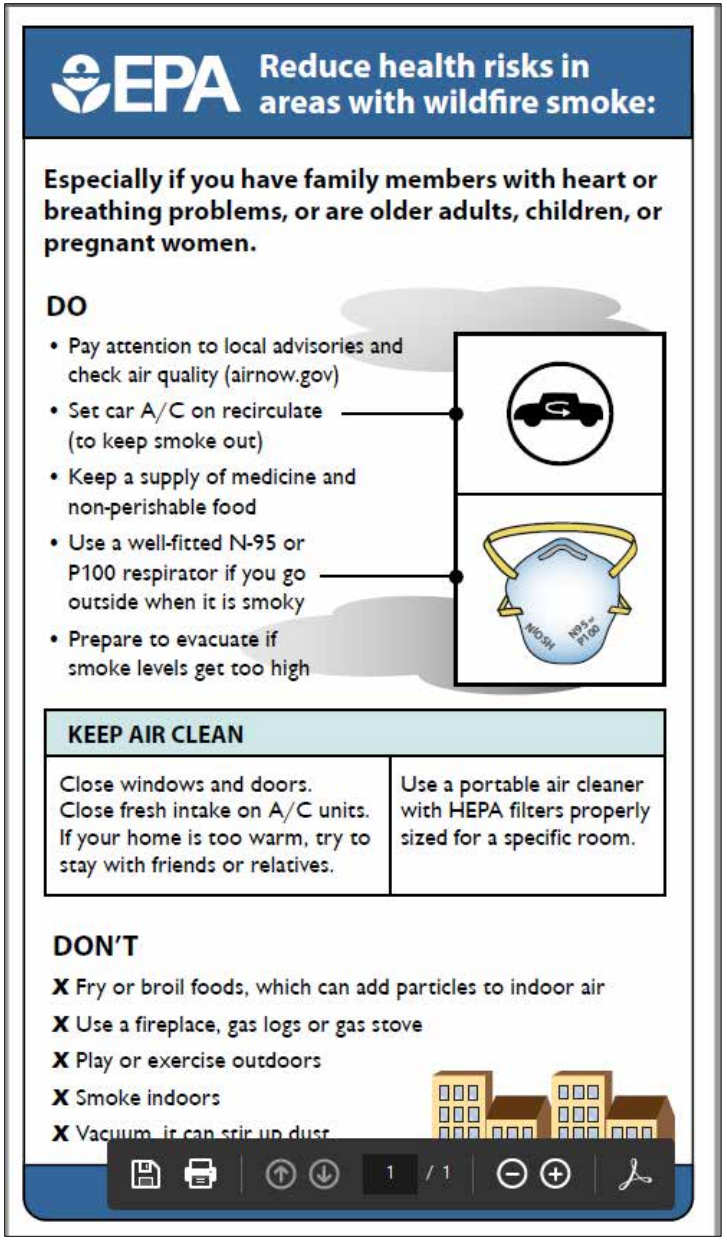
Wildfire Guide – Next Revision

- Updated look
- Health effects section
  - Addition of ozone
  - Multi-day exposure
  - Heat and smoke
  - Smoke vs urban particles
- Add sections
  - PM web course for health professionals
  - Sensor use
  - Ash clean-up
- Additional fact sheets
  - Older adults
  - Pets
  - Livestock
  - After the Fire

Infographics



https://airnow.gov/static/topics/images/epa-infographic-respirator.jpg



https://www3.epa.gov/airnow/smoke_fires/reduce-health-risks-with-wildfire-smoke.pdf

PM Web Course for Healthcare Professionals

This web course and the following tools can be found at:
https://airnow.gov/index.cfm?action=health_providers.index

What Is It? Who Is It For?

Particle Pollution and Your Patients' Health is an evidence-based training course that:

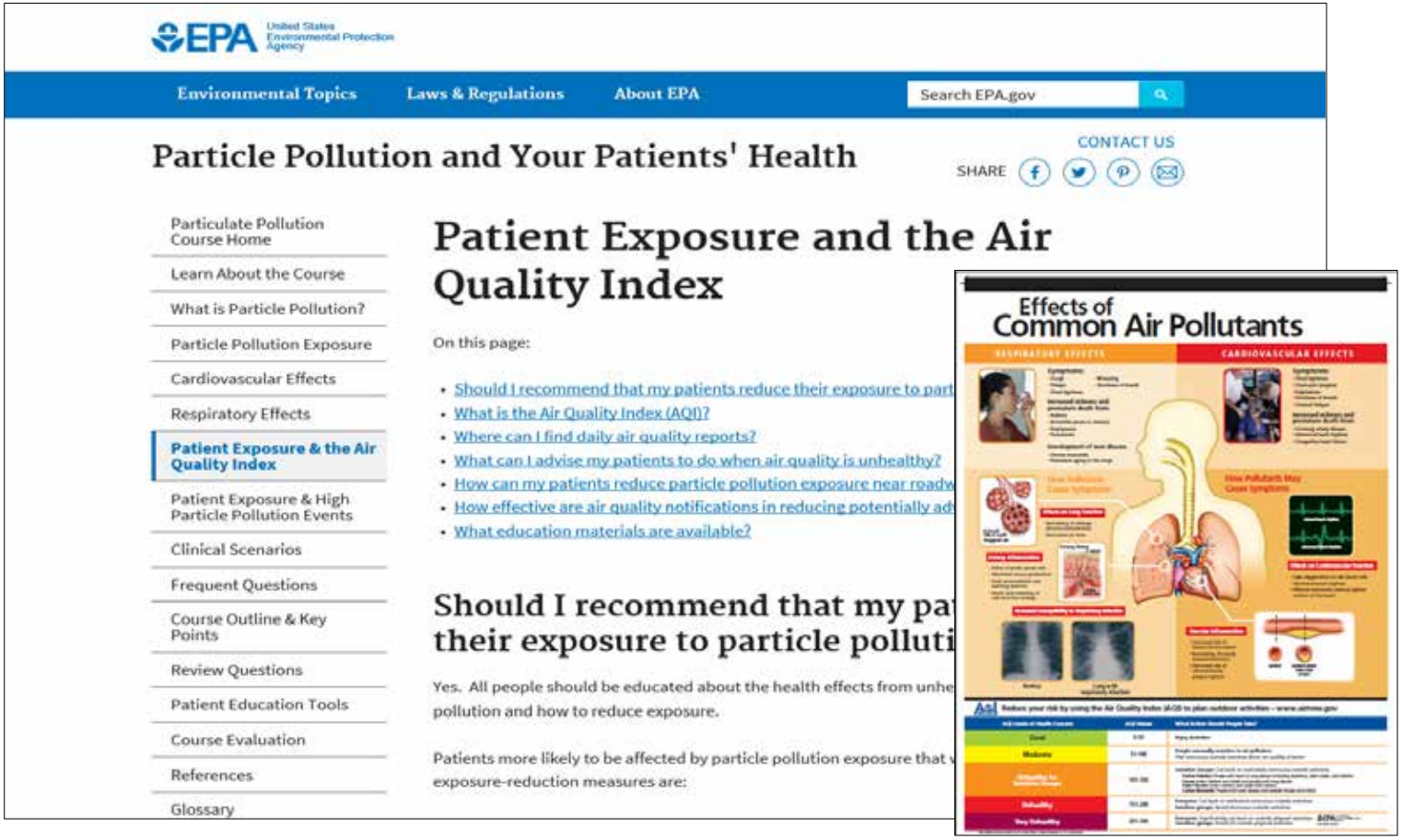
- Describes the biological mechanisms responsible for the cardiovascular and respiratory health effects associated with particle pollution exposure
- Helps health-care providers advise their patients about particle pollution exposure
- Provides practical education tools to help patients understand how particle pollution exposure can affect their health and how they can use the Air Quality Index to protect their health

Particle Pollution and Your Patients' Health is designed for family medicine physicians, internists, pediatricians, occupational and rehabilitation physicians, nurse practitioners, nurses, asthma educators, pulmonary specialists, cardiologists, and other medical professionals who counsel patients about lung, heart or vascular disease

Offers Continuing Education Credits to physicians, nurses, health educators

- Continuing education for clinicians is required for continued licensure in many states

Patient Exposure and the AQI



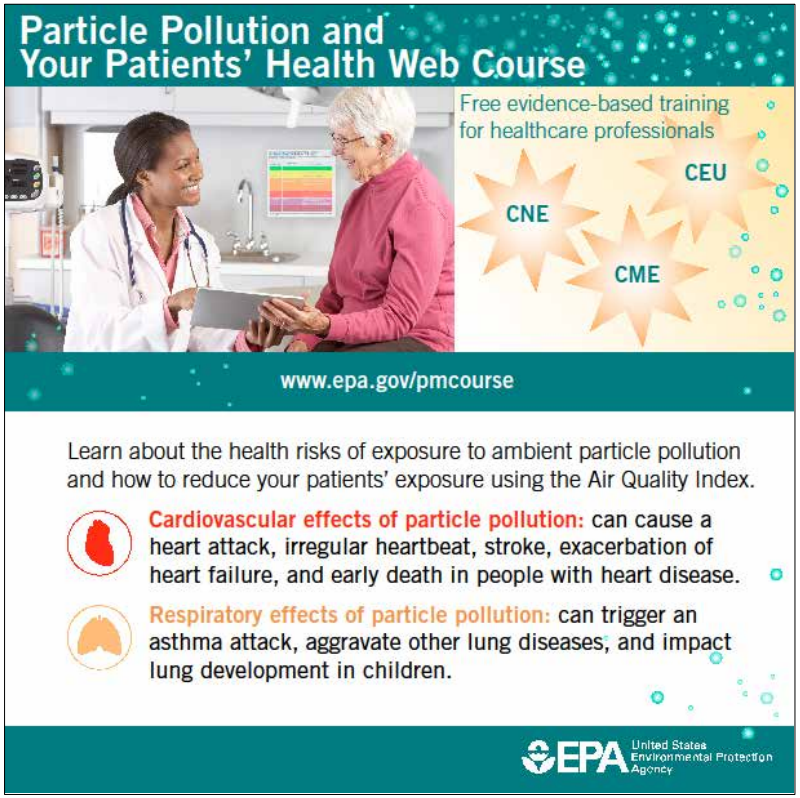
High Particle Pollution Events

Consistent with Wildfire Smoke
A Guide for Public Health Officials

Why a Course for Clinicians?

- Part of CDC's Behavioral Risk Factor and Surveillance System of health related telephone surveys
  - In 2005 six states included questions about how environmental factors and the AQI affect people's activity levels
  - The states: Colorado, Florida, Indiana, Kansas, Massachusetts, and Wisconsin
- Results highlights:
  - **People with lifetime asthma** were almost twice as likely to report a change in activity based on an air quality alert if they had been advised by a healthcare professional to do so (Wen et al., 2009)
  - **People *without* asthma** were than three times as likely to report such a change, if they had been advised by a healthcare professional to do so. (Wen et al., 2009)
  - **In Kansas,** people were almost four times as likely to change outdoor activity levels if they were advised by a healthcare professional.
  - BUT: only a small percentage of people in groups considered to be at increased risk from particle pollution reported that healthcare professionals had advised them to pay attention to the AQI. (Kansas Department of Health and Environment, 2006).

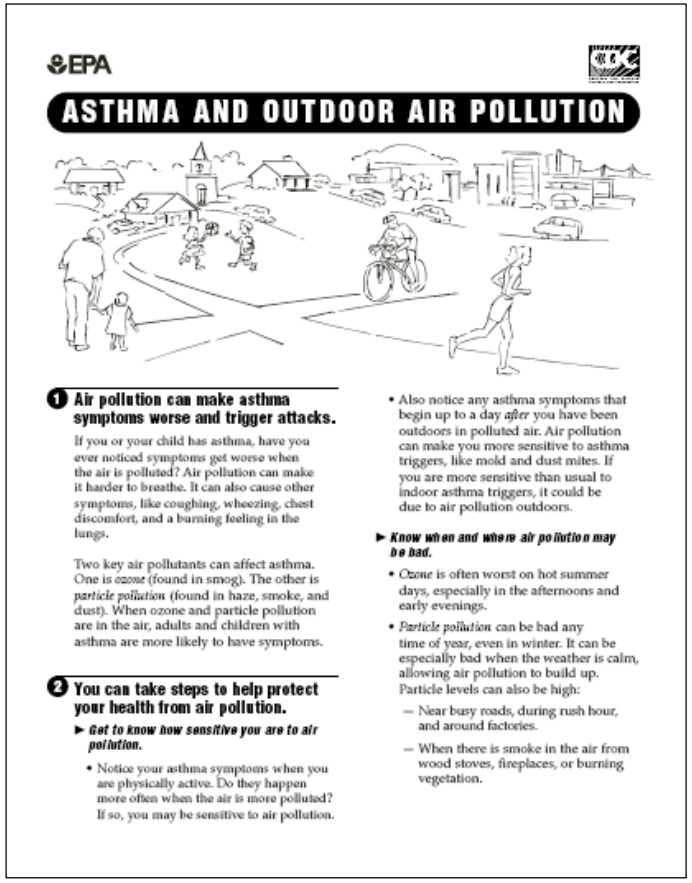
PM Web Course Outreach Materials



https://www.airnow.gov/index.cfm?action=health_providers.index

Downloadable Factsheets for Heart and Lung Disease

In English and Spanish



EPA

ASTHMA AND OUTDOOR AIR POLLUTION

1 Air pollution can make asthma symptoms worse and trigger attacks.

If you or your child has asthma, have you ever noticed symptoms get worse when the air is polluted? Air pollution can make it harder to breathe. It can also cause other symptoms, like coughing, wheezing, chest discomfort, and a burning feeling in the lungs.

Two key air pollutants can affect asthma. One is *ozone* (found in smog). The other is *particle pollution* (found in haze, smoke, and dust). When ozone and particle pollution are in the air, adults and children with asthma are more likely to have symptoms.

2 You can take steps to help protect your health from air pollution.

► ***Get to know how sensitive you are to air pollution.***

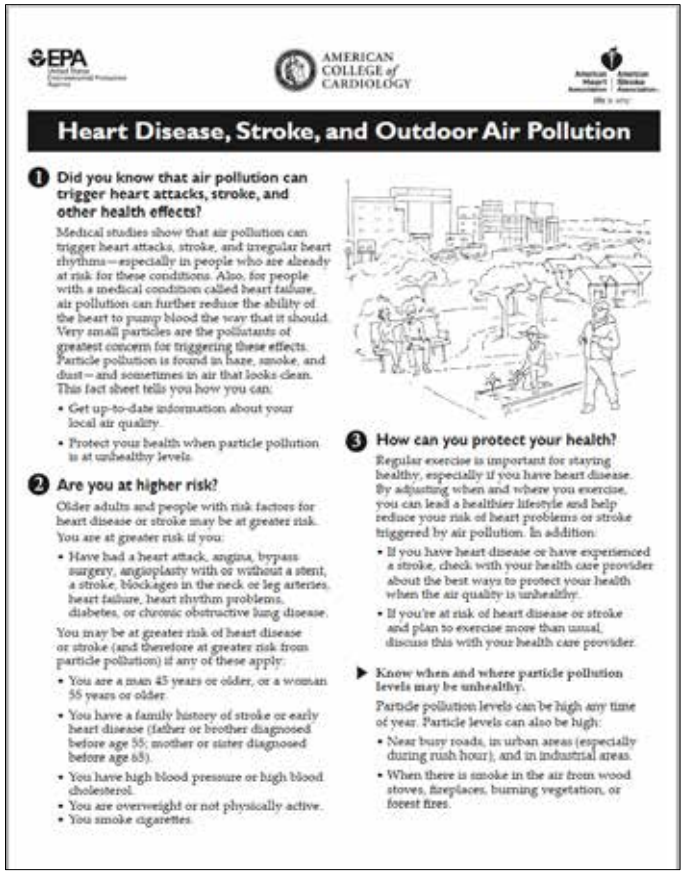
- Notice your asthma symptoms when you are physically active. Do they happen more often when the air is more polluted? If so, you may be sensitive to air pollution.
- Also notice any asthma symptoms that begin up to a day *after* you have been outdoors in polluted air. Air pollution can make you more sensitive to asthma triggers, like mold and dust mites. If you are more sensitive than usual to indoor asthma triggers, it could be due to air pollution outdoors.

► ***Know when and where air pollution may be bad.***

- *Ozone* is often worst on hot summer days, especially in the afternoons and early evenings.
- *Particle pollution* can be bad any time of year, even in winter. It can be especially bad when the weather is calm, allowing air pollution to build up. Particle levels can also be high:
  - Near busy roads, during rush hour, and around factories.
  - When there is smoke in the air from wood stoves, fireplaces, or burning vegetation.

Asthma

https://www3.epa.gov/airnow/asthma-flyer.pdf



EPA

AMERICAN COLLEGE of CARDIOLOGY

Heart Disease, Stroke, and Outdoor Air Pollution

1 Did you know that air pollution can trigger heart attacks, stroke, and other health effects?

Medical studies show that air pollution can trigger heart attacks, stroke, and irregular heart rhythms—especially in people who are already at risk for these conditions. Also, for people with a medical condition called heart failure, air pollution can further reduce the ability of the heart to pump blood the way that it should. Very small particles are the pollutants of greatest concern for triggering these effects. Particle pollution is found in haze, smoke, and dust—and sometimes in air that looks clean. This fact sheet tells you how you can:

- Get up-to-date information about your local air quality.
- Protect your health when particle pollution is at unhealthy levels.

2 Are you at higher risk?

Older adults and people with risk factors for heart disease or stroke may be at greater risk. You are at greater risk if you:

- Have had a heart attack, angina, bypass surgery, angioplasty with or without a stent, a stroke, blockages in the neck or leg arteries, heart failure, heart rhythm problems, diabetes, or chronic obstructive lung disease.

You may be at greater risk of heart disease or stroke (and therefore at greater risk from particle pollution) if any of these apply:

- You are a man 45 years or older, or a woman 55 years or older.
- You have a family history of stroke or early heart disease (father or brother diagnosed before age 55; mother or sister diagnosed before age 65).
- You have high blood pressure or high blood cholesterol.
- You are overweight or not physically active.
- You smoke cigarettes.

3 How can you protect your health?

Regular exercise is important for staying healthy, especially if you have heart disease. By adjusting when and where you exercise, you can lead a healthier lifestyle and help reduce your risk of heart problems or stroke triggered by air pollution. In addition:

- If you have heart disease or have experienced a stroke, check with your health care provider about the best ways to protect your health when the air quality is unhealthy.
- If you're at risk of heart disease or stroke and plan to exercise more than usual, discuss this with your health care provider.

► **Know when and where particle pollution levels may be unhealthy.**

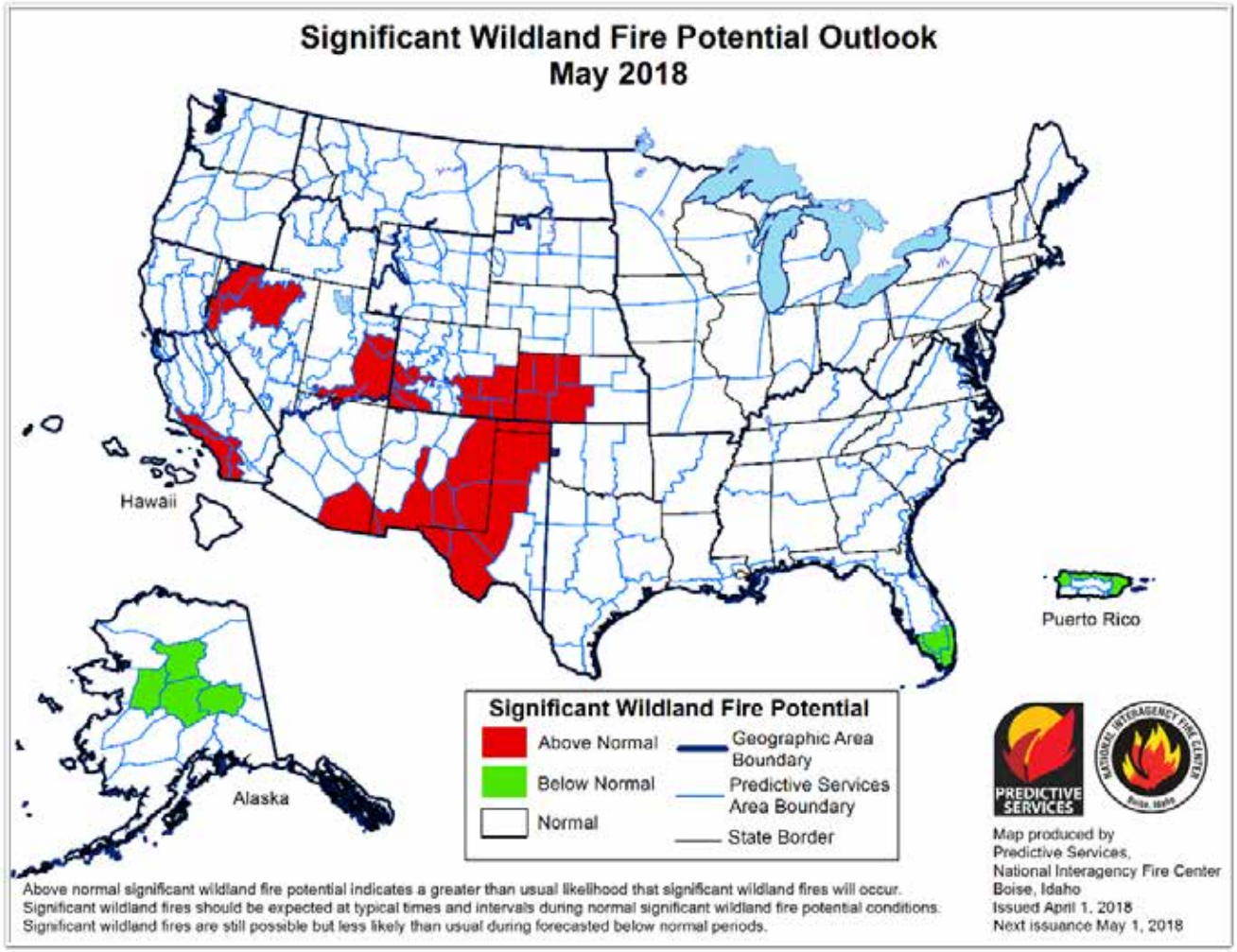
Particle pollution levels can be high any time of year. Particle levels can also be high:

- Near busy roads, in urban areas (especially during rush hour), and in industrial areas.
- When there is smoke in the air from wood stoves, fireplaces, burning vegetation, or forest fires.

Cardiovascular Disease – February 2016

https://www3.epa.gov/airnow/heartflyer.pdf

Important Planning Tool



National Interagency Fire Center (NIFC) – updated monthly; current predictions through July 2018
https://www.predictiveservices.nifc.gov/outlooks/outlooks.htm

Sensor Concentration ≠ Air Quality Index

Sensor Reading
Concentration
Short term (e.g. 1-minute)
Data Quality Unknown

Air Quality Index
Index Value & Color
Averaged (e.g. 8-hour, 24-hour)
Data Quality Assured

Air Resource Advisors:
Forecasting Wildfire Smoke

Ali Kamal, PhD | Health Scientist
Health & Environmental Impacts Division
Office of Air Quality Planning & Standards
U.S. Environmental Protection Agency

May 2, 2018

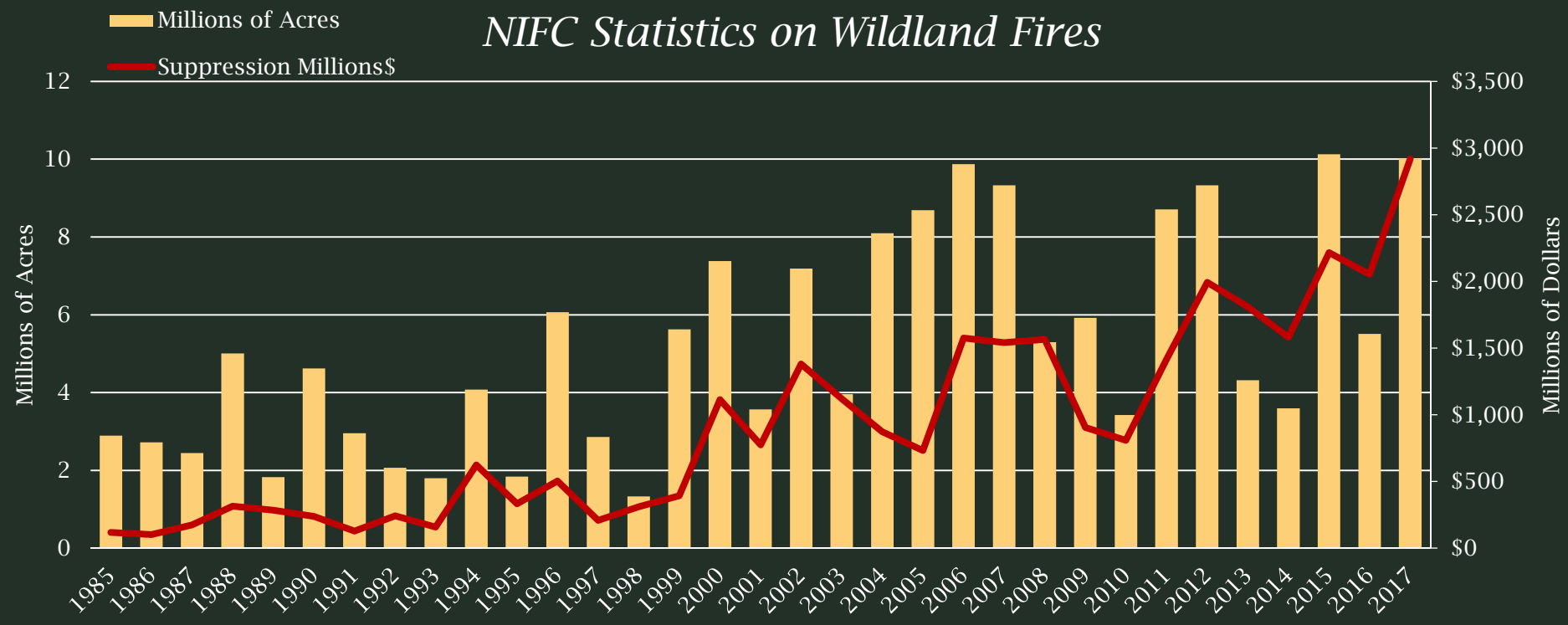
Introduction to the ARA Program

-What is the Air Resource Advisor (ARA) Program?

-What does an ARA do?

Introduction to the ARA Program

-Between 2005 and 2014, 6.4 Million Acres Burned on average in the US, in 2015, +10 Million Acres Burned, 2017 costs highest on record

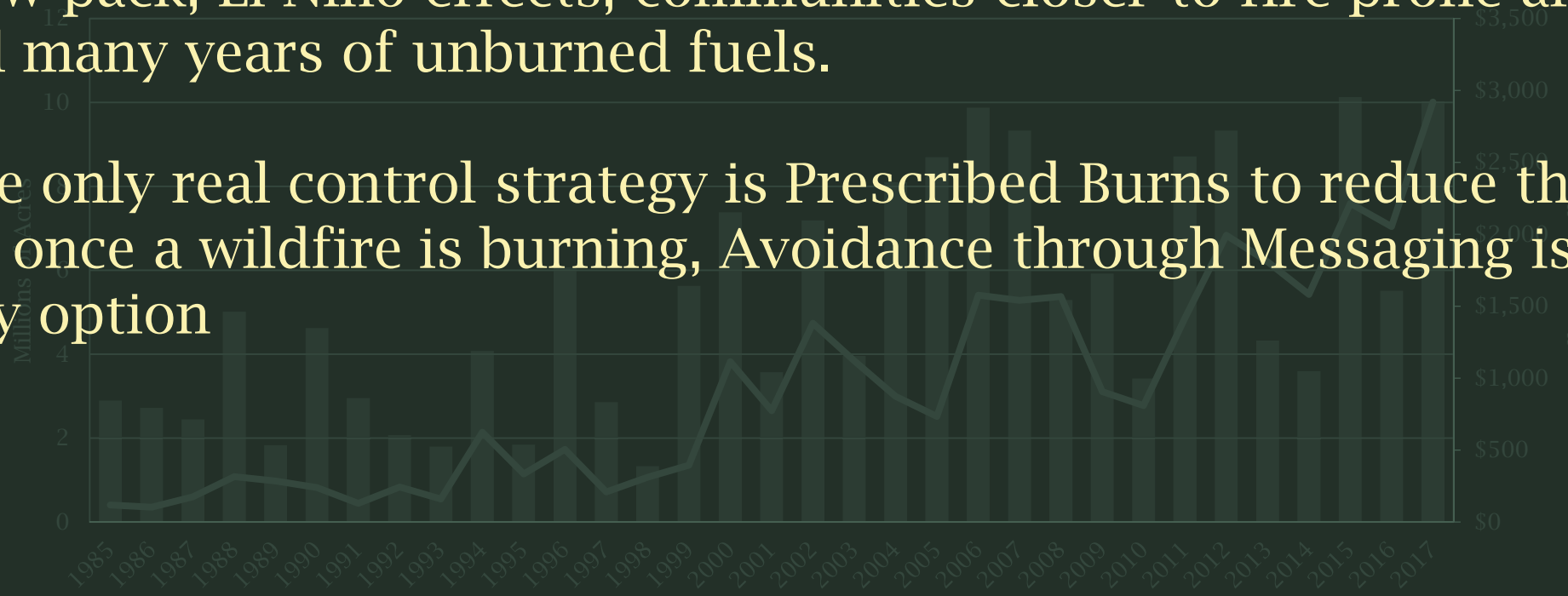


Introduction to the ARA Program

-Between 2005 and 2014, 6.4 Million Acres Burned on average in the US, in 2015, +10 Million Acres Burned, 2017 costs highest on record

-The fire season is getting longer, drier and hotter summers, less snow pack, El Niño effects, communities closer to fire-prone areas, and many years of unburned fuels.

-The only real control strategy is Prescribed Burns to reduce the risk, but once a wildfire is burning, Avoidance through Messaging is the only option



The Need for ARAs

-Air quality early-warnings are effective at protecting at-risk populations (AirNow, AQI, Wildfire Smoke Guide)

-ARAs are dispatched to predict smoke impacts on the public & fire crews

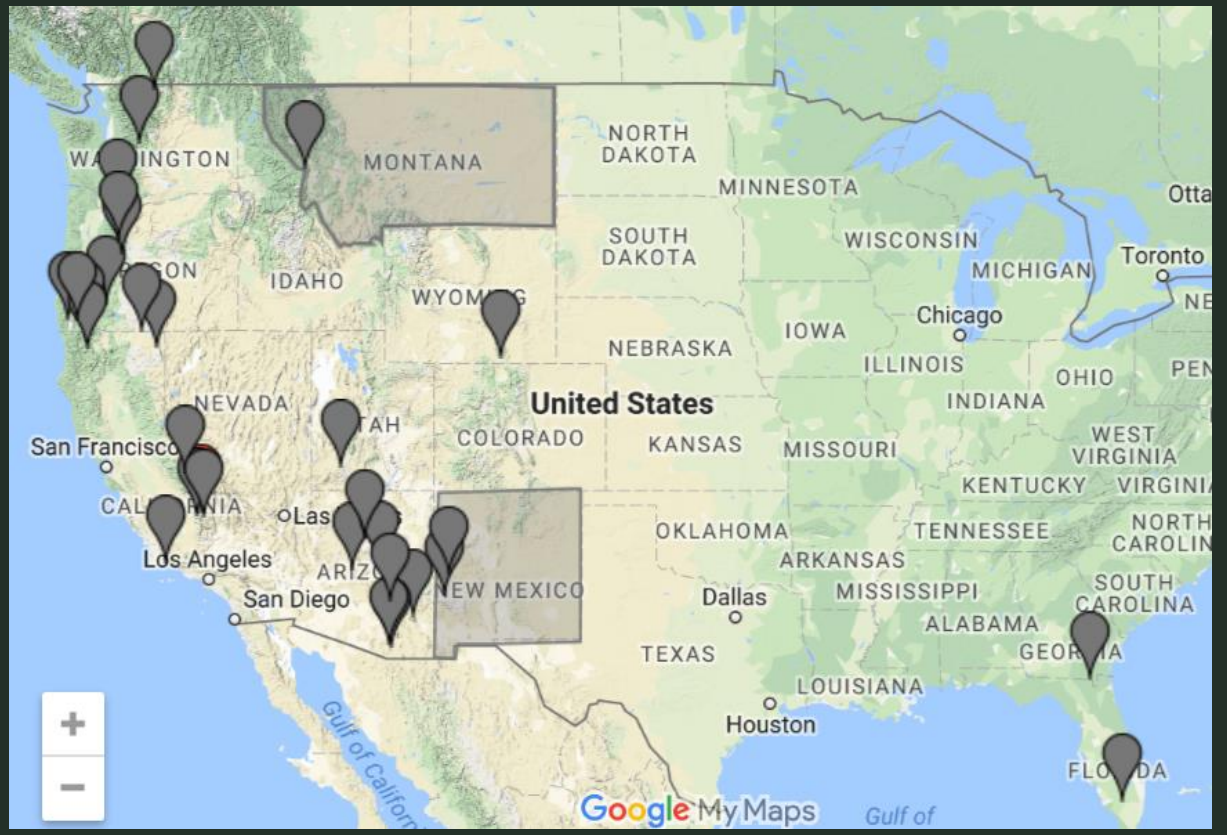
-ARAs relay smoke information to the public to mitigate smoke exposure

ARA Deployments

- Number of ARAs Dispatched

2017: 101	2014: 39
2016: 55	2013: 25
2015: 40	2012: 13

- More than 1200 Daily Smoke Forecasts were produced in 2017



What does an ARA do?

Modeling

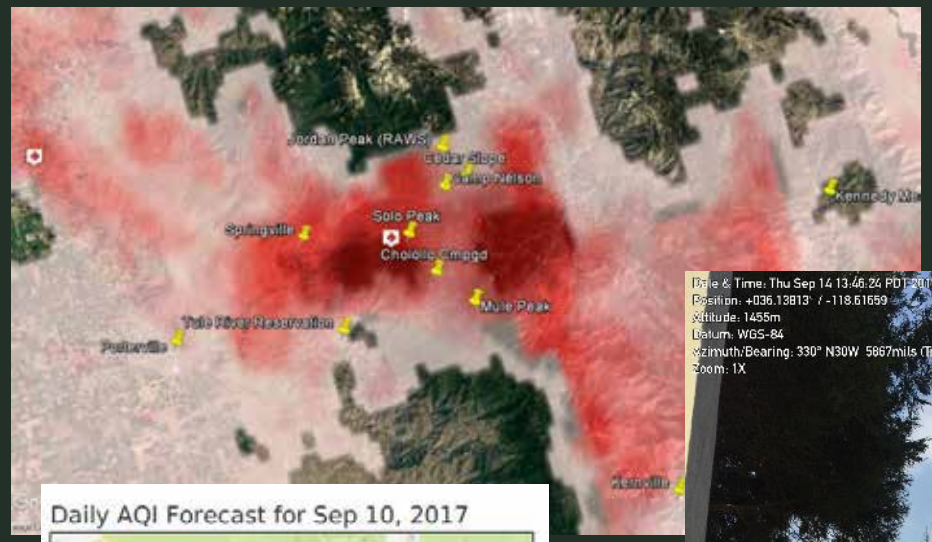
- Smoke Impacts (BlueSky)
- Hysplit/Playground 2.0

Monitoring

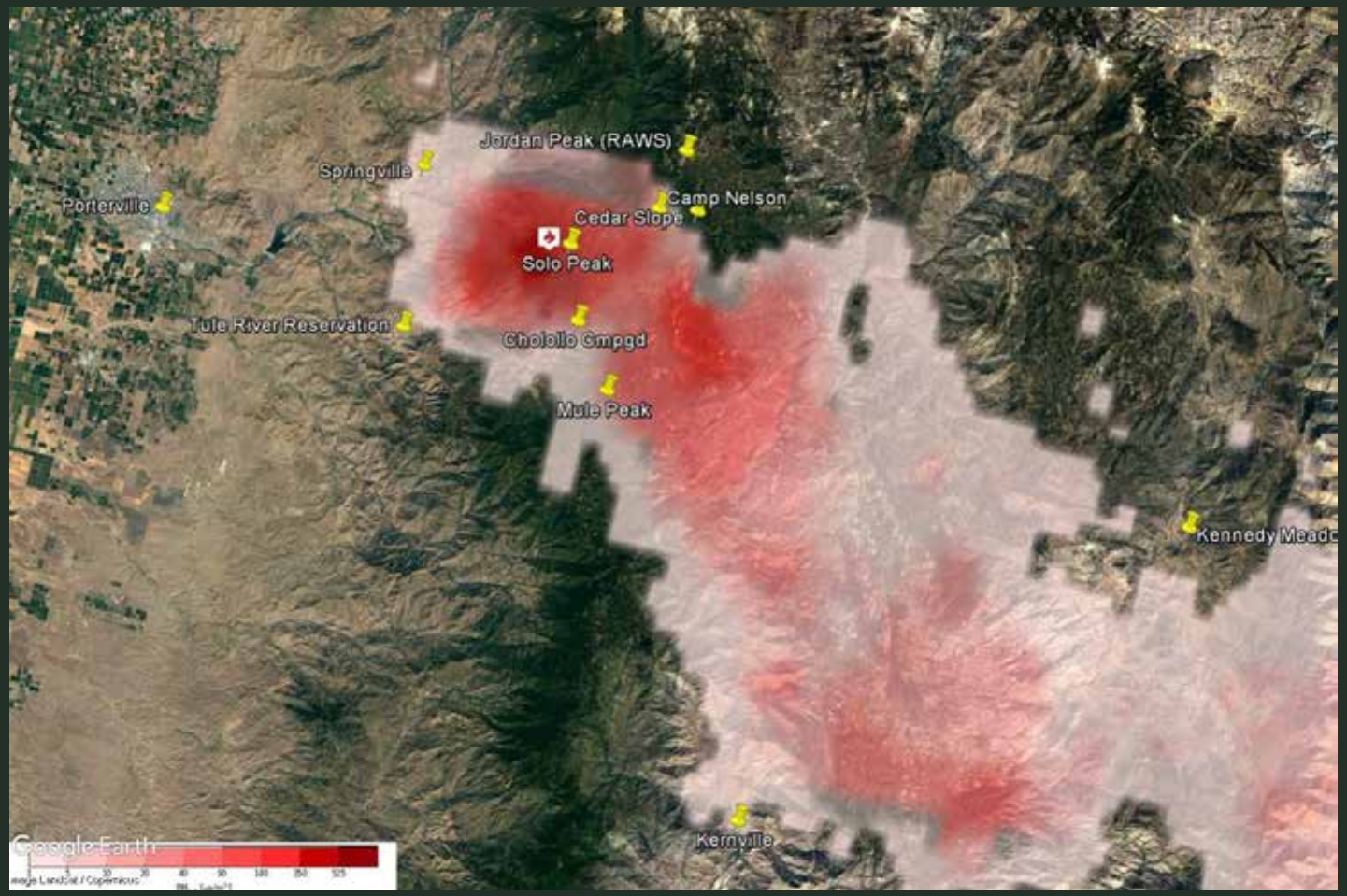
- Real-Time PM Monitoring
- Observing Fire Behavior

Messaging

- Smoke Forecasts
- Meeting/Briefings



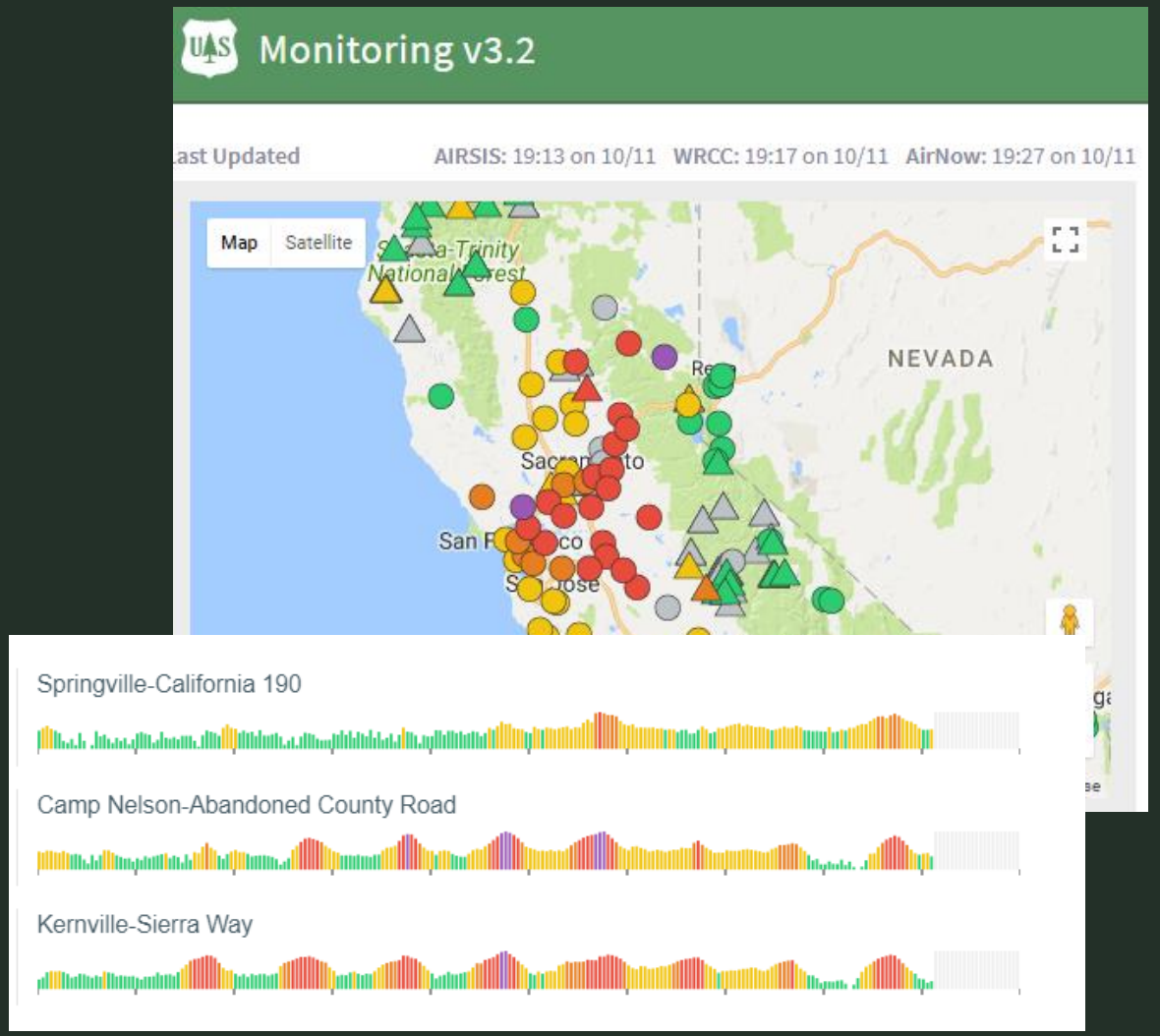
Modeling: Projecting the Path of Smoke



- Meteorological Data
- Infrared Satellite Data
- 72 Hour Projections
- Help ARAs forecast the smoke for the next 1 to 2 days

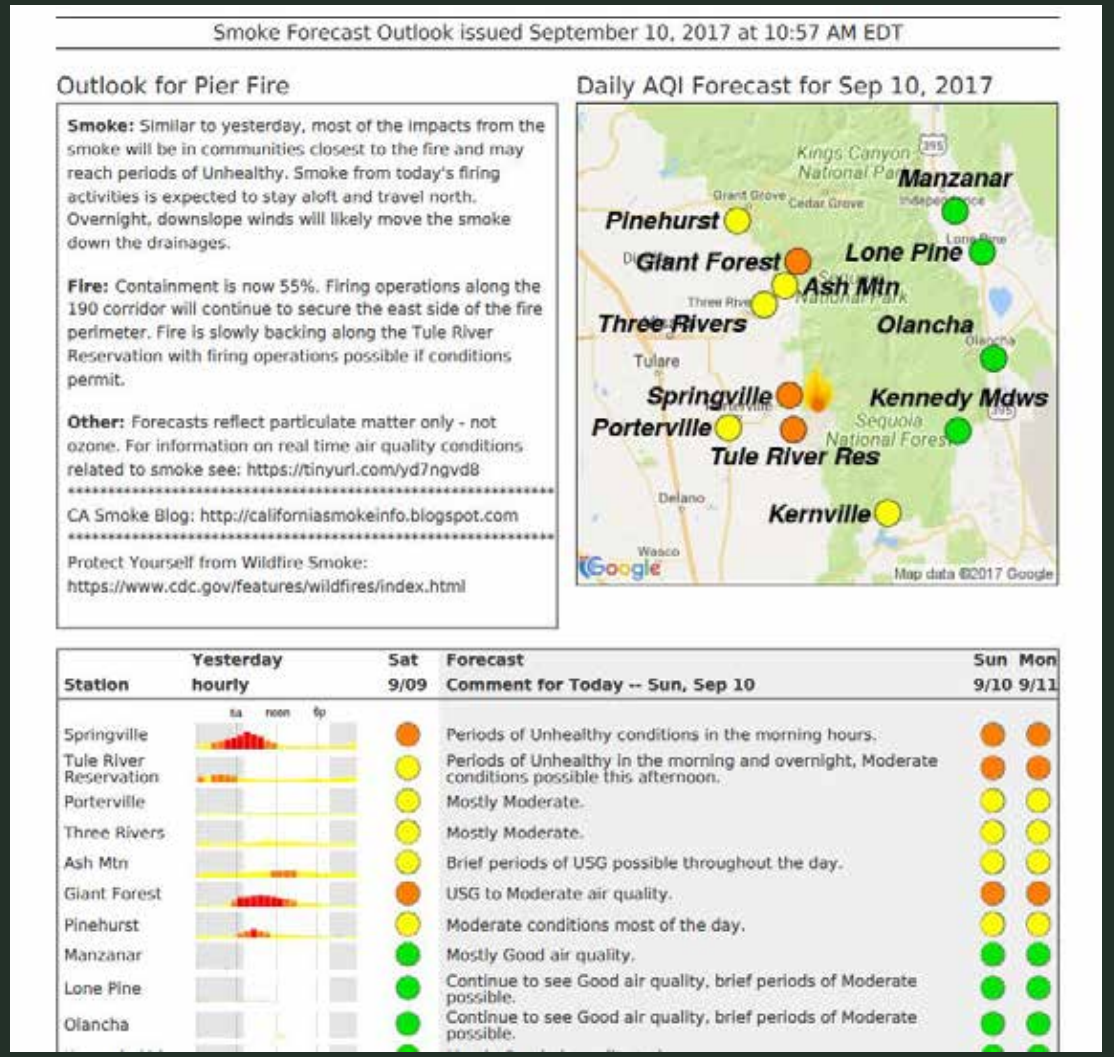
Monitoring: Smoke Observations

- Determine the siting of $PM_{2.5}$ monitors to track the smoke near at-risk communities
- Hourly $PM_{2.5}$ data is uplinked by satellite and accessible in an online database
- Observe day/night trends and how smoke behaves in downwind communities



Messaging

- Daily Smoke Forecasts provide communities with expected smoke impacts
- Public can then make informed decisions on when to go outside and when to take shelter



Smoke Forecast Outlook issued September 10, 2017 at 10:57 AM EDT

Outlook for Pier Fire

Smoke: Similar to yesterday, most of the impacts from the smoke will be in communities closest to the fire and may reach periods of Unhealthy. Smoke from today's firing activities is expected to stay aloft and travel north. Overnight, downslope winds will likely move the smoke down the drainages.

Fire: Containment is now 55%. Firing operations along the 190 corridor will continue to secure the east side of the fire perimeter. Fire is slowly backing along the Tule River Reservation with firing operations possible if conditions permit.

Other: Forecasts reflect particulate matter only - not ozone. For information on real time air quality conditions related to smoke see: https://tinyurl.com/yd7ngvd8

CA Smoke Blog: http://californiasmokeinfo.blogspot.com

Protect Yourself from Wildfire Smoke: https://www.cdc.gov/features/wildfires/index.html

Daily AQI Forecast for Sep 10, 2017

Station	Yesterday hourly	Sat 9/09	Forecast Comment for Today -- Sun, Sep 10	Sun 9/10	Mon 9/11
Springville			Periods of Unhealthy conditions in the morning hours.		
Tule River Reservation			Periods of Unhealthy in the morning and overnight, Moderate conditions possible this afternoon.		
Porterville			Mostly Moderate.		
Three Rivers			Mostly Moderate.		
Ash Mtn			Brief periods of USG possible throughout the day.		
Giant Forest			USG to Moderate air quality.		
Pinehurst			Moderate conditions most of the day.		
Manzanar			Mostly Good air quality.		
Lone Pine			Continue to see Good air quality, brief periods of Moderate possible.		
Olancha			Continue to see Good air quality, brief periods of Moderate possible.		

ARAs and the Public

- Social Media (Facebook/Twitter)
- Air Quality Blogs/Inciweb
- Reach Out to Local Groups
- *Inform* Incident Commanders
- Attend Public Meetings
- Available to Answer Questions
- Go out and talk to people!


Thank you
wildlandfiresmoke.net
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