



Southern Fire Exchange Webinar

Air Quality 101

Essential Concepts and Tools for Prescribed Burners

January 30, 2020
1:00-2:30 PM EST





What? Wildland and Prescribed Fire Smoke and Air Quality

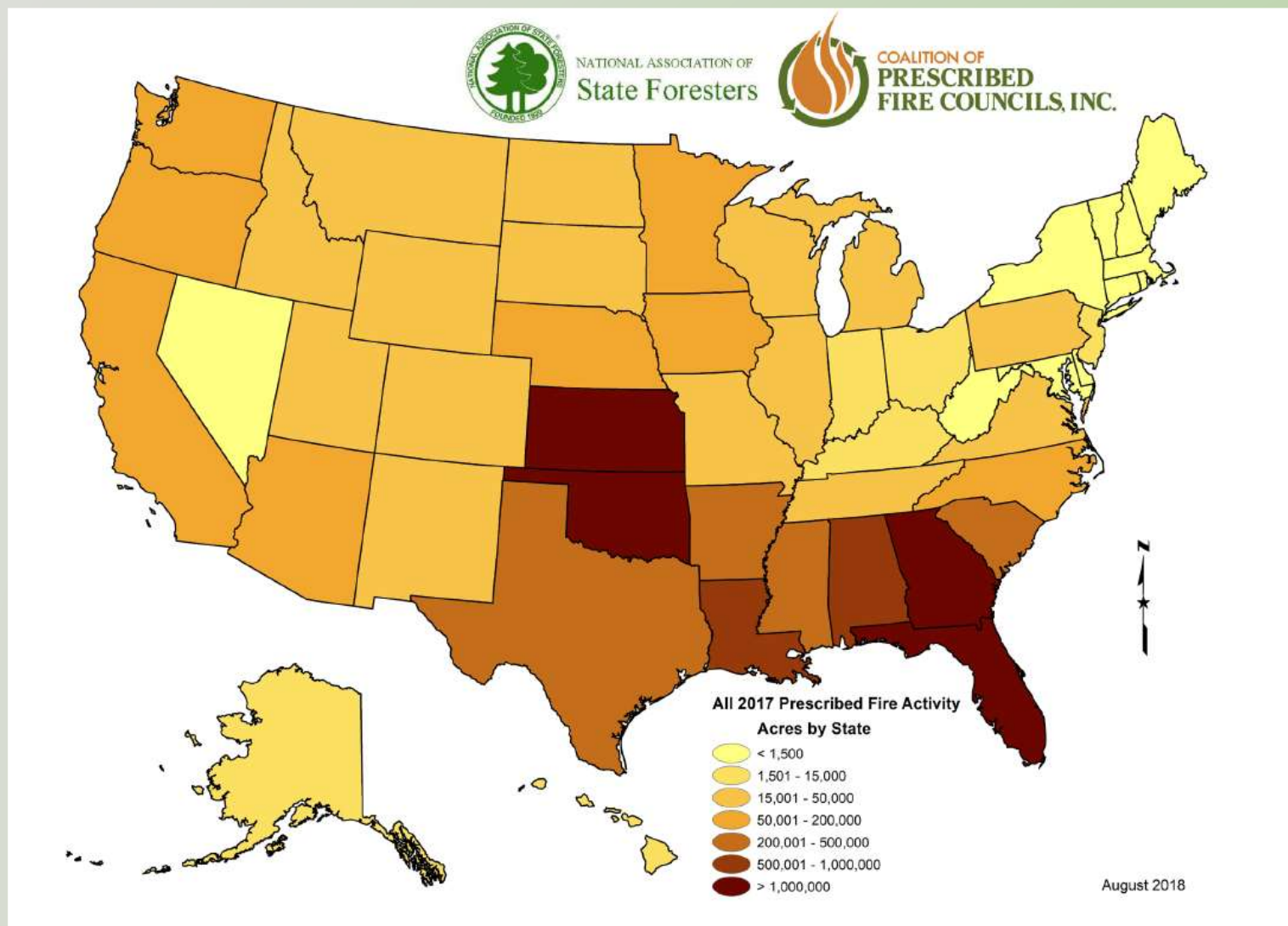
Rick Gillam, U.S. EPA Region 4

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2017 Prescribed Fire Activity

<http://www.prescribedfire.net/>





Wildland Fire Smoke Production

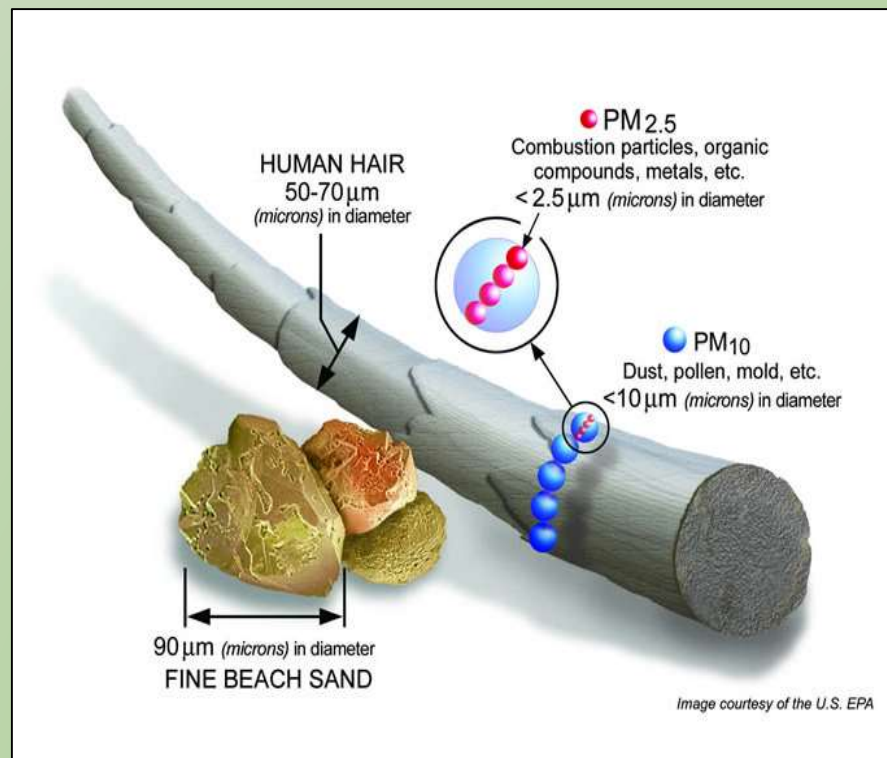


Figure 1.3.2. Examples of fire types and intensity: (a) ground fires (can be low intensity but long duration), (b) low intensity surface fire, (c) moderate to high intensity surface fire with some tree crown involvement, and (d) high intensity stand replacing crown fire. Photos courtesy of: US Forest Service, Boise National Forest (a,c,d); and US Forest Service, Gila National Forest (b).



Air Quality Impacts from Wildfires and Prescribed Fires

- **Smoke from burning biomass can contain significant amounts of air pollutants**
 - Particulate Matter (PM)
 - Ozone Precursors (volatile organic compounds and nitrogen oxide compounds)
 - Carbon Monoxide (CO)
 - Carbon Dioxide (CO₂)
 - Hazardous Air Pollutants (HAPs), a.k.a, “Air Toxics”
 - Water Vapor and
 - Trace Minerals
- **The major pollutant of concern in smoke from wildland fire is particulate matter, especially PM_{2.5}**
 - Studies indicate that about 90 percent of smoke particles emitted during wildland fires are less than 10 microns in diameter (PM₁₀) and about 90 percent of the PM₁₀ is PM_{2.5}





Prescribed Fire vs. Wildfire PM2.5 Concentrations

<https://www.nwccg.gov/publications/420-2>

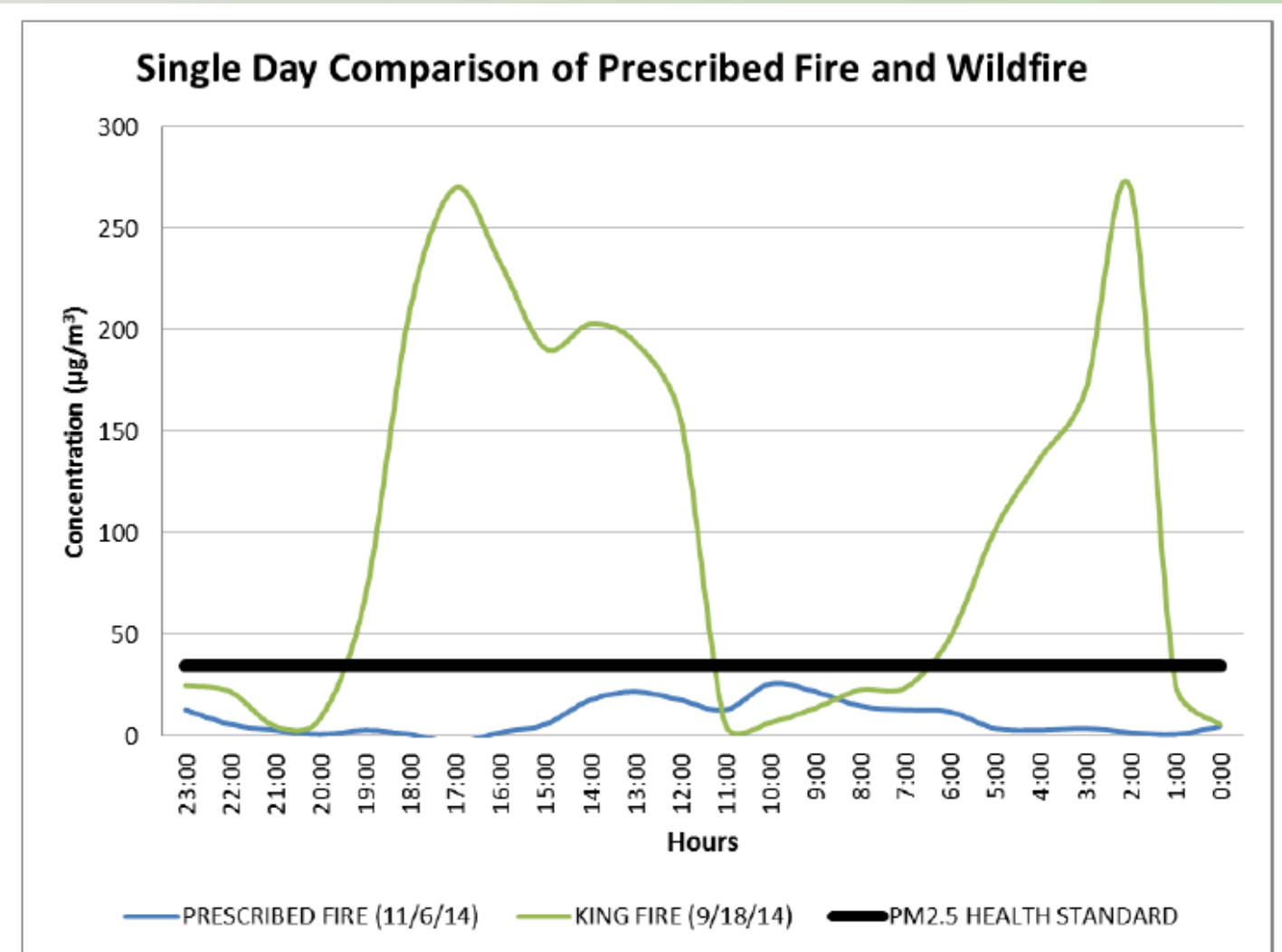
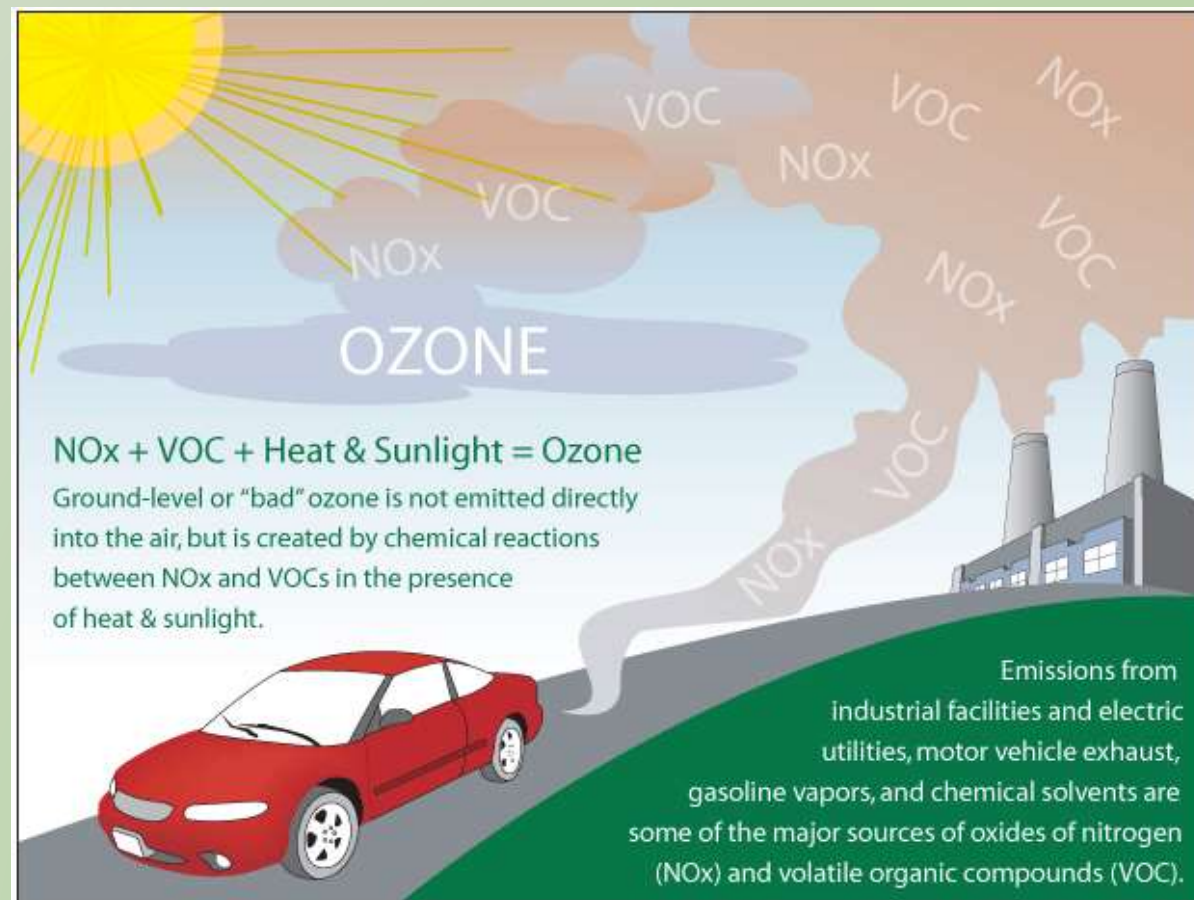


Figure 1.1.1. Daily fine particulate concentrations in Washoe County, Nevada of a prescribed fire as compared to a significant wildfire in California.



Ozone from Wildland and Prescribed Fires

- Emissions from fire contain ozone precursors
 - volatile organic compounds (VOCs)
 - oxides of nitrogen (NO_x)
- VOCs and NO_x react in the presence of sunlight to produce ozone
- O₃ production from fires is very complex, highly variable, and often difficult to predict





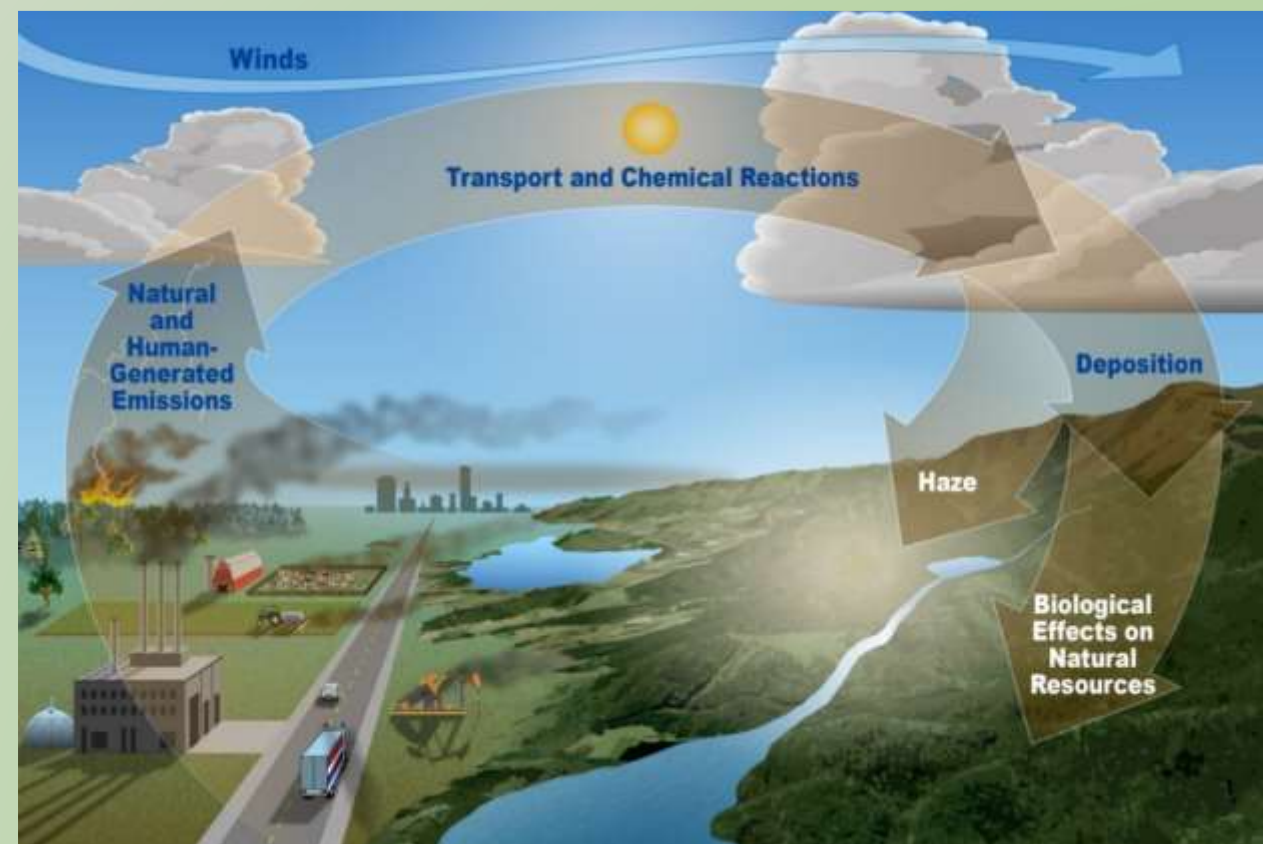
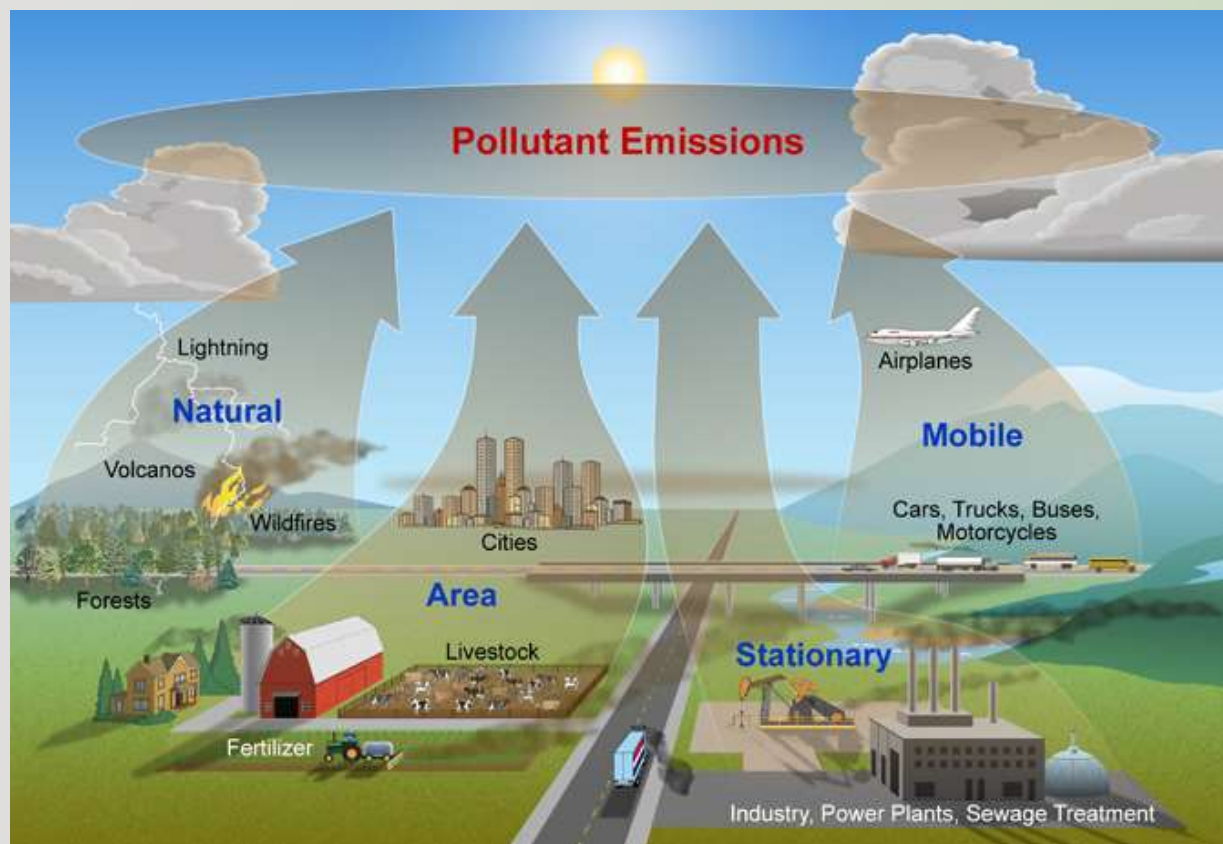
Carbon Monoxide and Other Pollutants

- Carbon monoxide is produced by incomplete combustion of wood or other organic materials
 - Dilutes rapidly so is rarely a concern for the general public unless they are in very close proximity to the fire
- Air Toxics Compounds
 - Formaldehyde - Carcinogen
 - Acrolein - Respiratory Irritant
 - Polycyclic Aromatic Hydrocarbons (PAHs)





Smoke Emissions and Transport





NWCG Smoke Management Guide for Prescribed Fire

<https://www.nwcg.gov/publications/420-2>



- Comprehensive Guide for Prescribed Fire Smoke Management
 - Smoke Impacts
 - Regulations
 - Fuel Consumption and Emissions Reduction
 - Techniques and Tools for Smoke Management
 - Communications and Public Perceptions
 - Wildland Fire and Climate Change
 - Prescribed Fire Planning



What-HEALTH



Heidi LeSane
EPA Region 4
Community Support Section



WHAT IS PM 2.5?

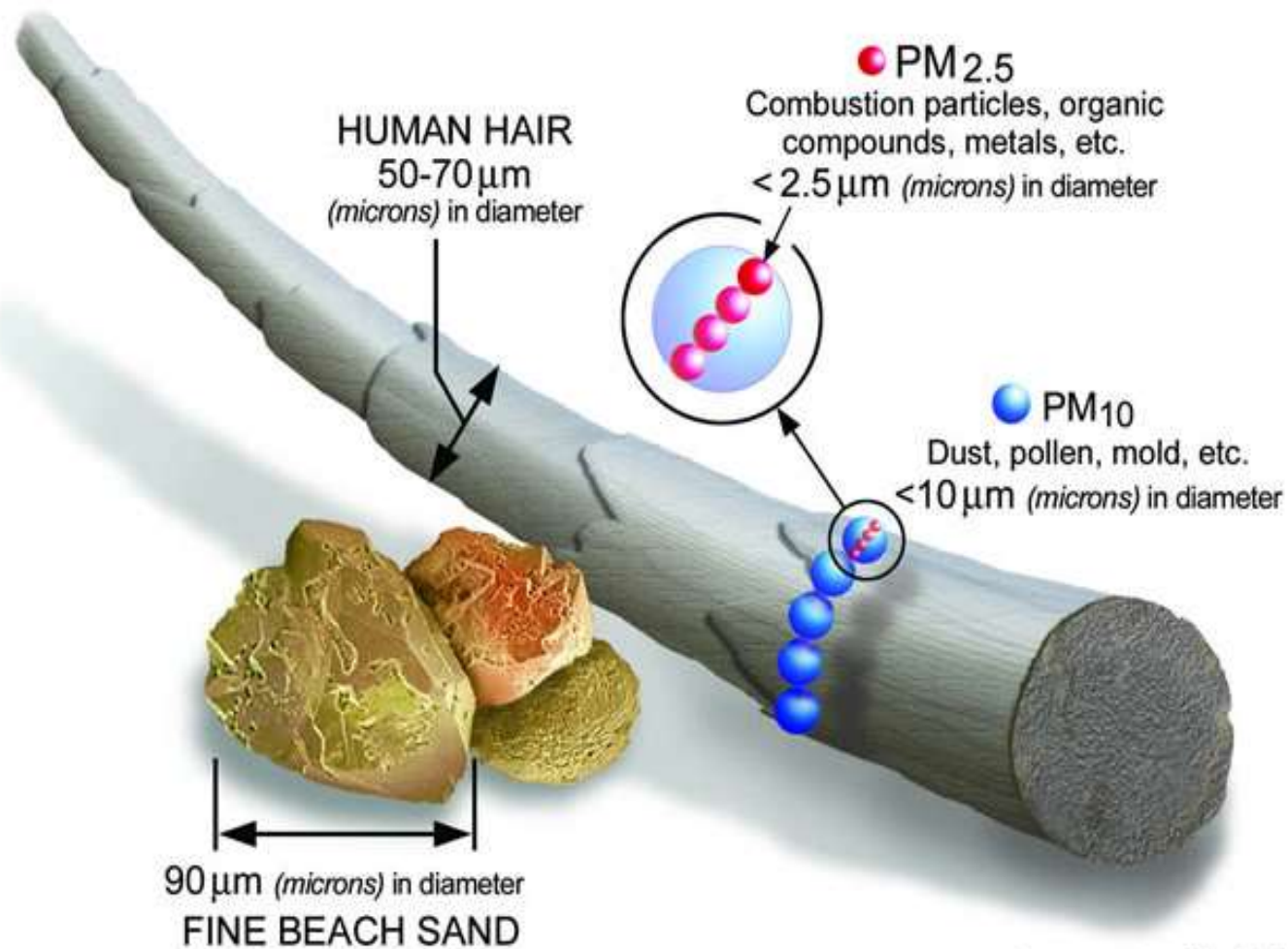
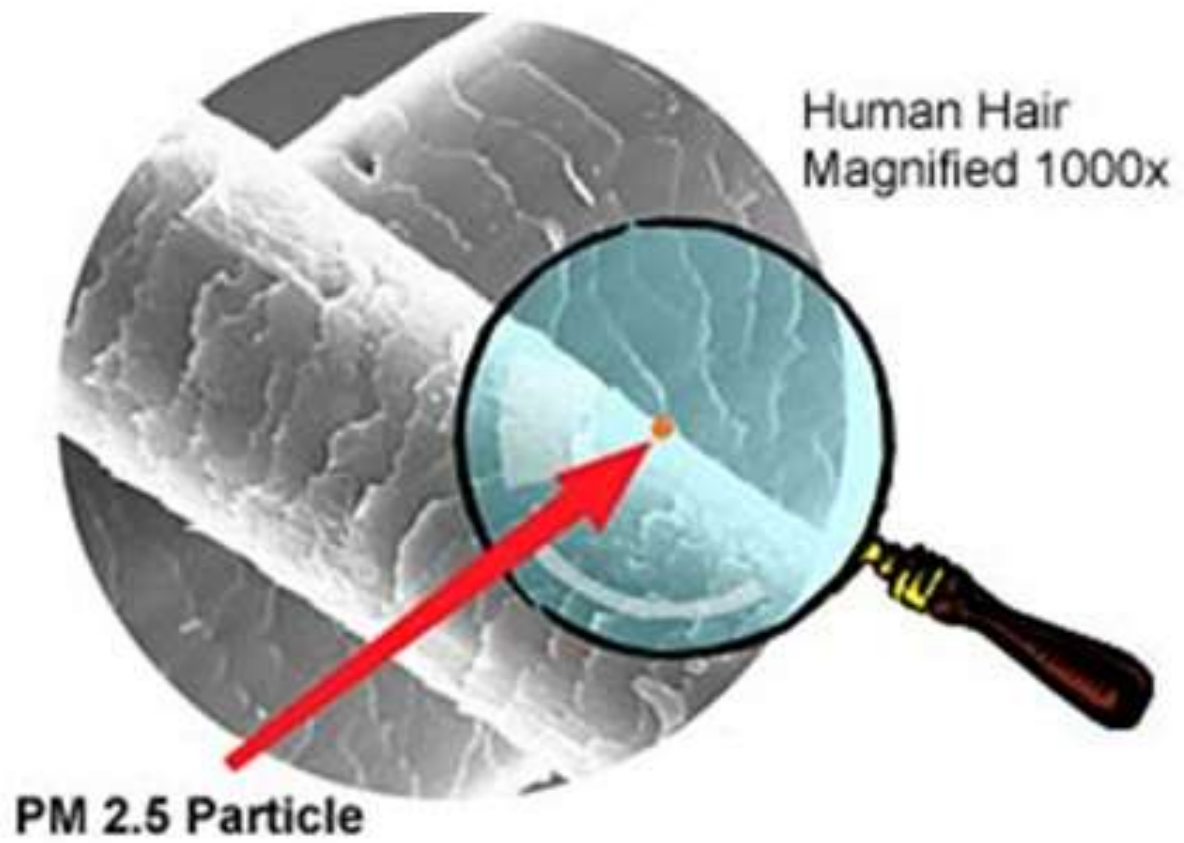


Image courtesy of the U.S. EPA





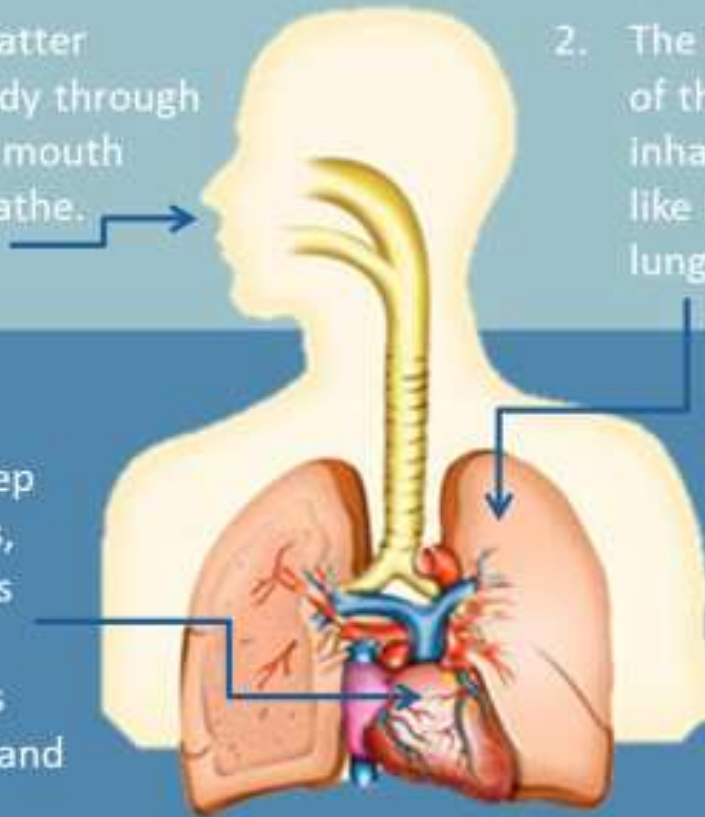
HEALTH IMPACTS

HOW PARTICULATE MATTER ENTERS THE BODY

1. Particulate matter enters the body through the nose and mouth when we breathe.

2. The body eliminates most of the larger particles we inhale. Smaller particles like PM2.5 continue to the lungs.

3. PM2.5 can penetrate deep into the lungs, having serious health consequences for the lungs and heart.



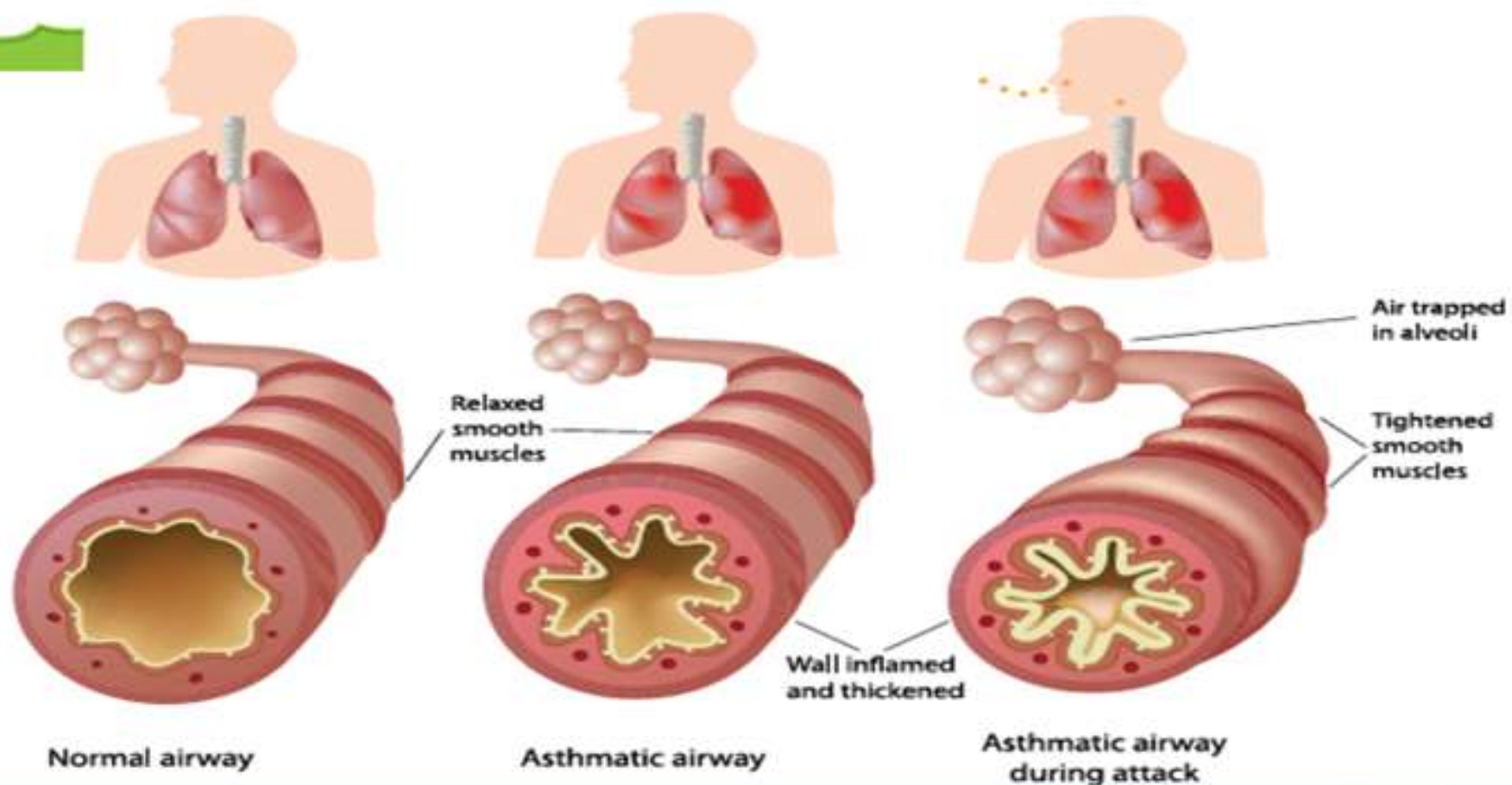


EXAMPLE: ASTHMA



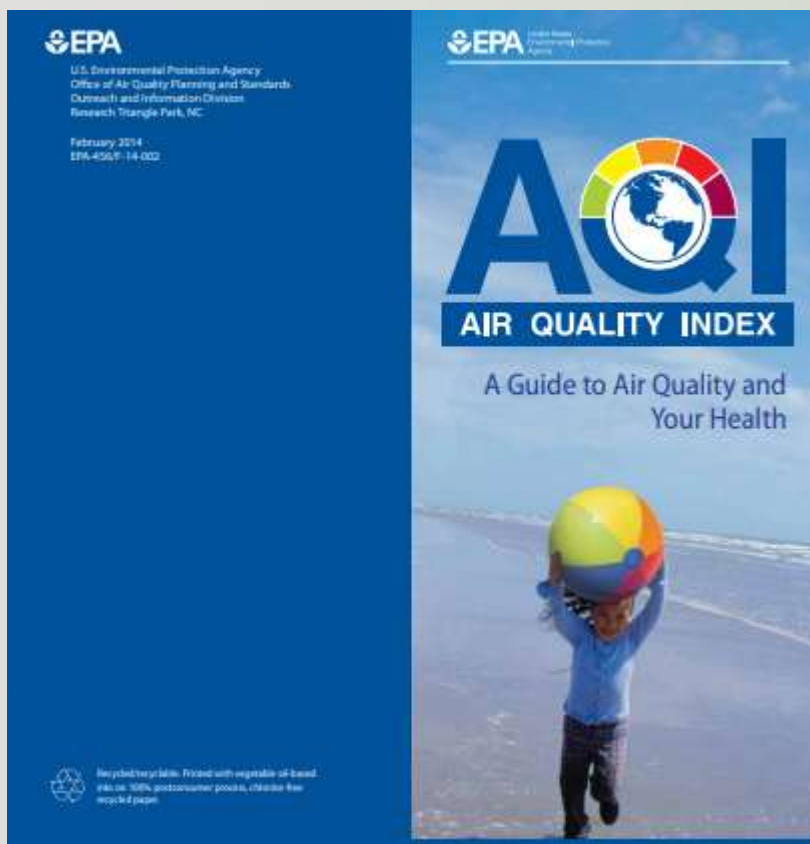
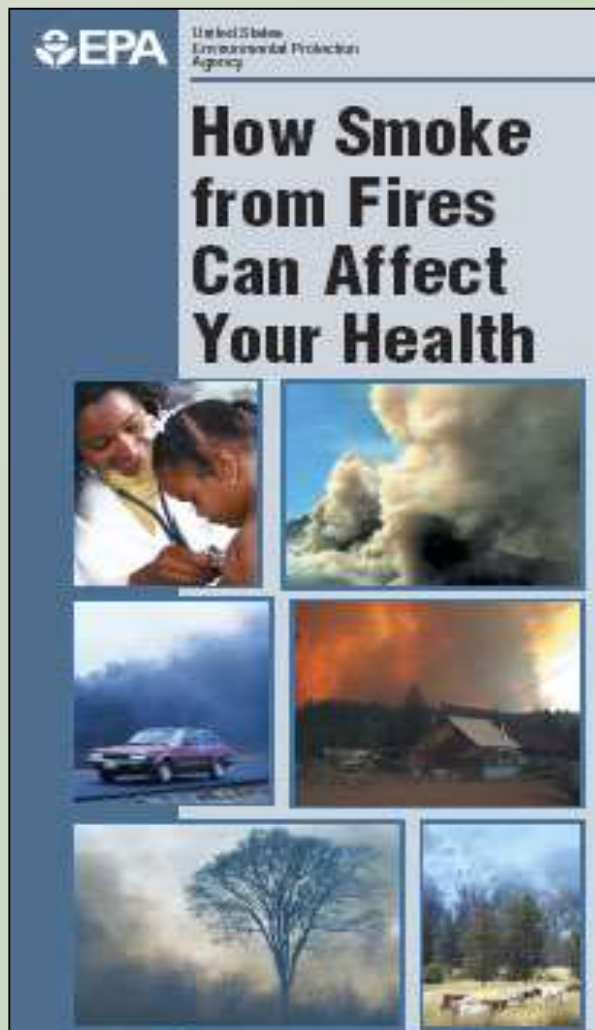


The Pathology of Asthma





RESOURCES





Why?

Regulations, Guidance and Policies

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EPA Laws, Regulations, Guidance and Policies

- Particulate Matter (PM) and Ozone National Ambient Air Quality Standards (NAAQS)
 - PM10 NAAQS = 150 ug/m³, 24-hour average
 - PM2.5 NAAQS = 35 ug/m³, 24-hr average and 12 ug/m³, annual average
 - Ozone NAAQS = 70 ppb, 8-hour average
- Exceptional Events Regulations and Guidance
- Regional Haze Regulations
- 1998 Interim Air Quality Policy on Wildland and Prescribed Fires



Image from GA EPD Exceptional Event submittal to EPA November 2007



EPA Recognizes the Importance of Prescribed Fire

- “...EPA has continued to express an understanding of the importance of prescribed fire, noting that it can be used to mimic the natural process necessary to manage and maintain existing fire-adapted ecosystems and/or return an area to its historical ecosystem (or another natural ecosystem if the historical ecosystem is no longer attainable) while reducing the risk to public safety and the risk of uncontrolled emissions from catastrophic wildfires.”

- Quote from the preamble to EPA’s November 2015 Proposed Exceptional Events Rule Revisions - http://www.epa.gov/sites/production/files/2015-11/documents/ee_nprm_11-20-15_80_fr_72840.pdf





Areas Designated Nonattainment for the PM NAAQS

PM-2.5 Nonattainment Areas (2012 Standard)



PM-2.5 Classification

Serious

Moderate

Nonattainment areas are indicated by color. When only a portion of a county is shown in color, it indicates that only that part of the county is within a nonattainment area boundary.

PM-2.5 Nonattainment Areas (2006 Standard)



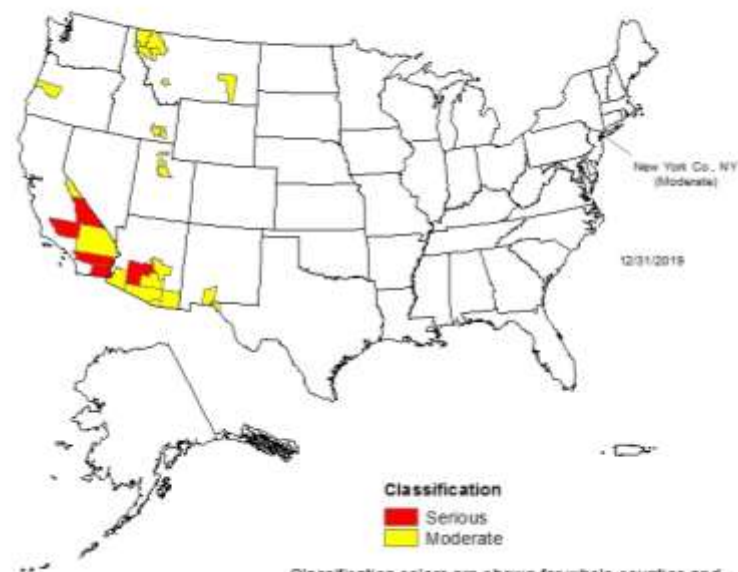
PM-2.5 Classification

Serious

Moderate

Nonattainment areas are indicated by color. When only a portion of a county is shown in color, it indicates that only that part of the county is within a nonattainment area boundary.

Counties Designated Nonattainment for PM-10



Classification

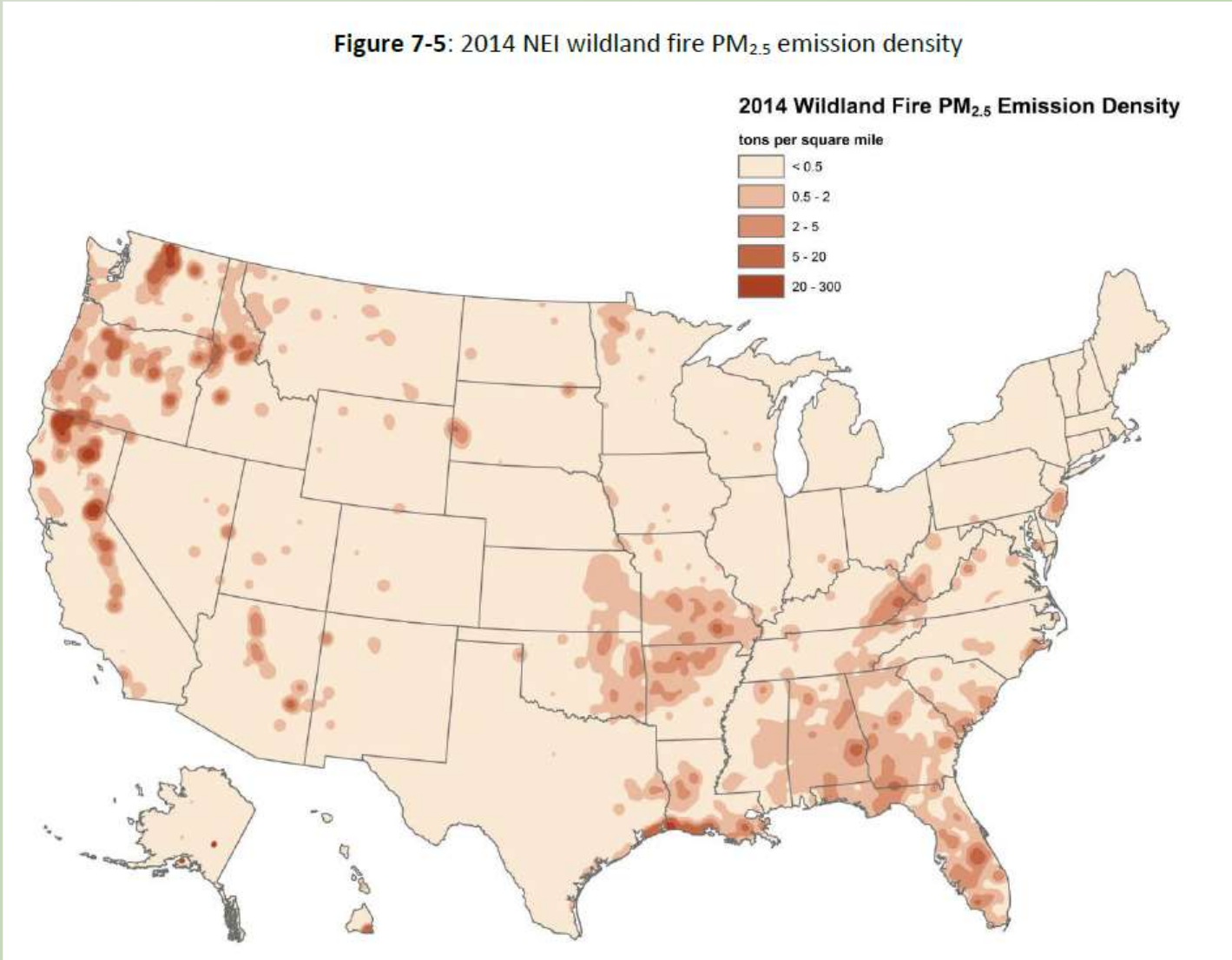
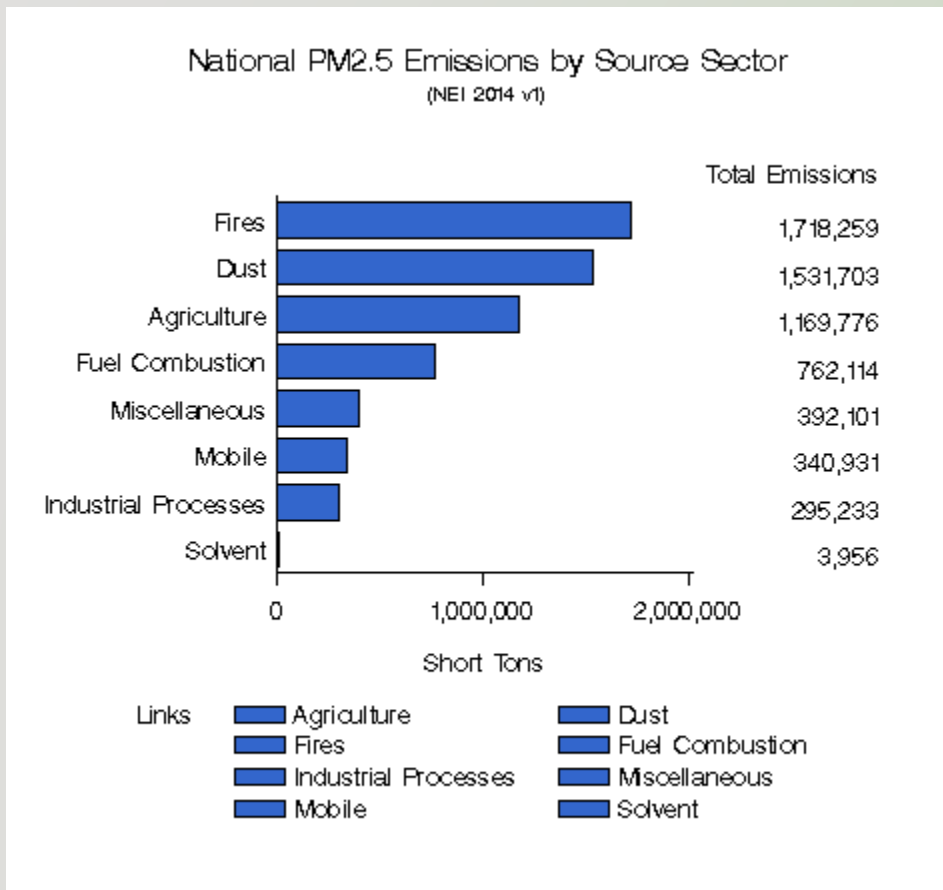
Serious

Moderate

Classification colors are shown for whole counties and denote the highest area classification that the county is in



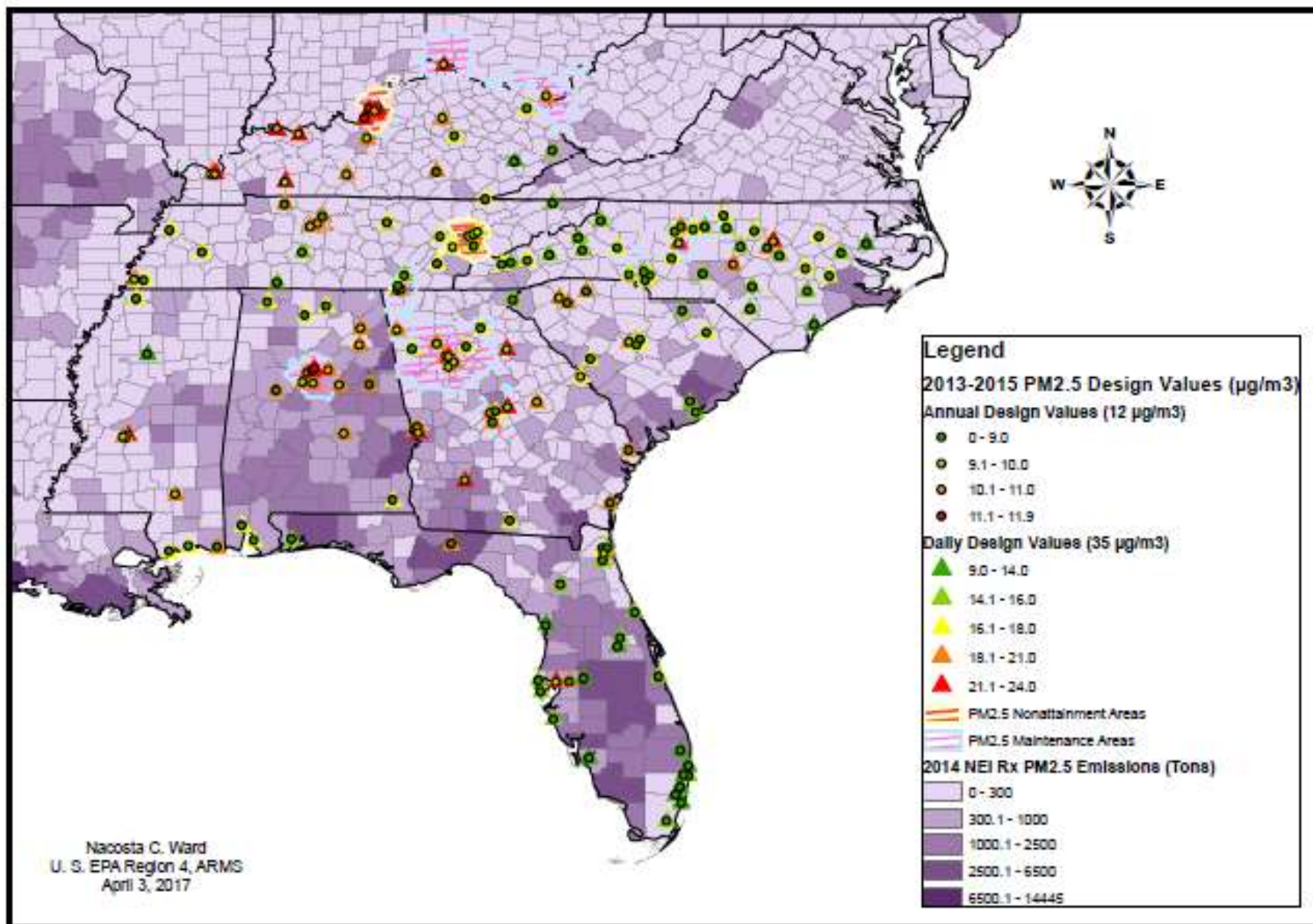
EPA National Emissions Inventory (NEI) PM_{2.5} Data





PM2.5 Monitors and Nonattainment Areas

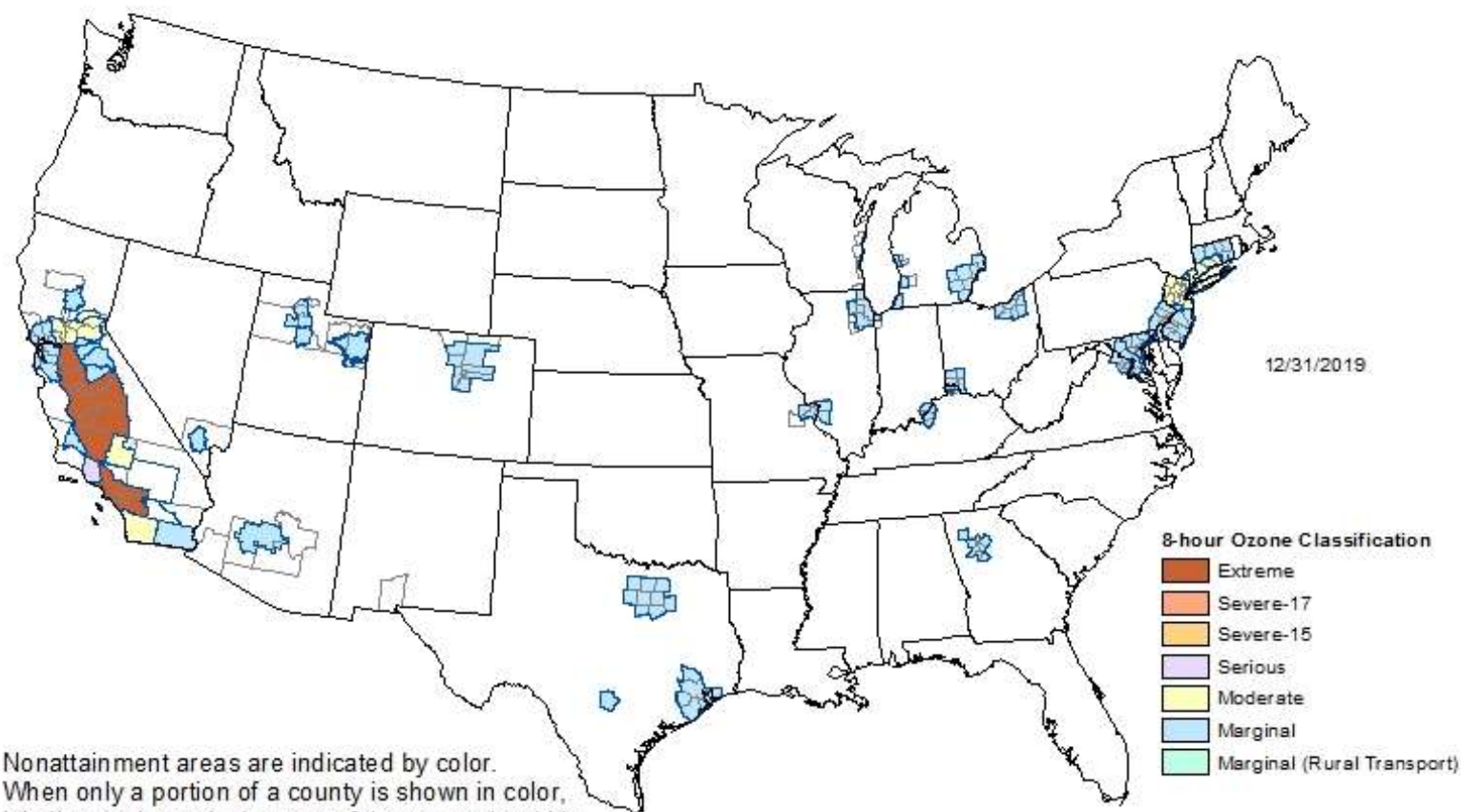
Daily ($35 \mu\text{g}/\text{m}^3$) and Annual ($12 \mu\text{g}/\text{m}^3$) NAAQS





Areas Designated Nonattainment for the 2015 Ozone NAAQS

8-Hour Ozone Nonattainment Areas (2015 Standard)

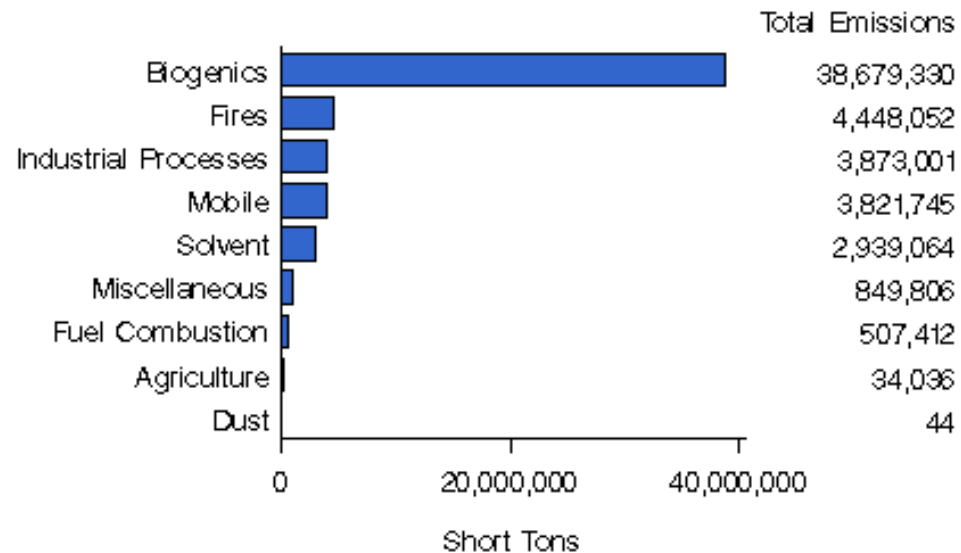


Nonattainment areas are indicated by color. When only a portion of a county is shown in color, it indicates that only that part of the county is within a nonattainment area boundary.



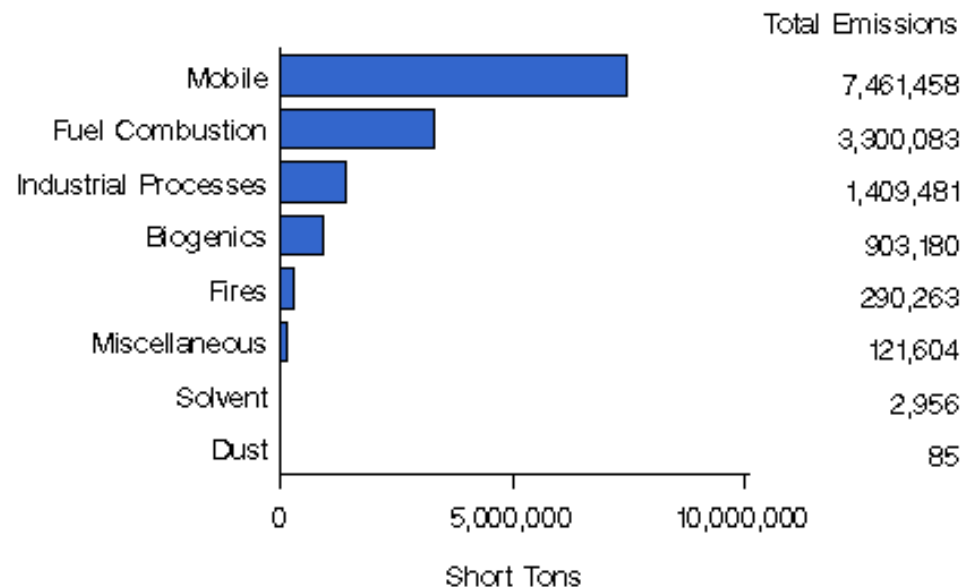
EPA National Emissions Inventory (NEI) Ozone Precursor Data

National Volatile Organic Compounds Emissions by Source Sector
(NEI 2014 v1)



- Links
- Agriculture
 - Biogenics
 - Dust
 - Fires
 - Fuel Combustion
 - Industrial Processes
 - Miscellaneous
 - Mobile
 - Solvent

National Nitrogen Oxides Emissions by Source Sector
(NEI 2014 v1)



- Links
- Biogenics
 - Dust
 - Fires
 - Fuel Combustion
 - Industrial Processes
 - Miscellaneous
 - Mobile
 - Solvent



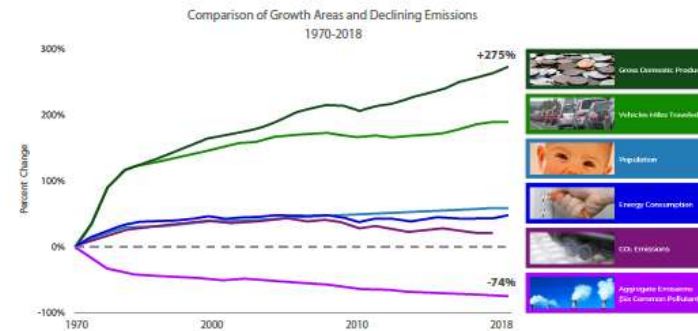
Our Nation's Air

Air Quality Improves as America Grows

<https://gispub.epa.gov/air/trendsreport/2019>

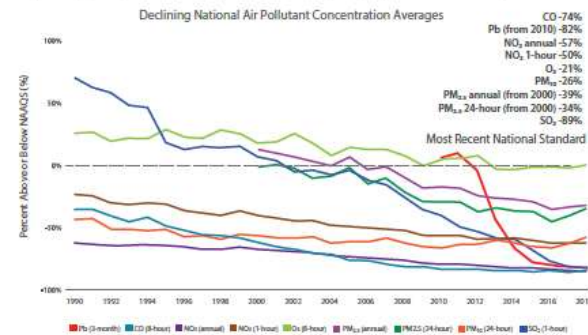
Economic Growth with Cleaner Air

Between 1970 and 2018, the combined emissions of the six common pollutants (PM_{2.5} and PM₁₀, SO₂, NO_x, VOCs, CO and Pb) dropped by 74 percent. This progress occurred while the U.S. economy continued to grow, Americans drove more miles and population and energy use increased.



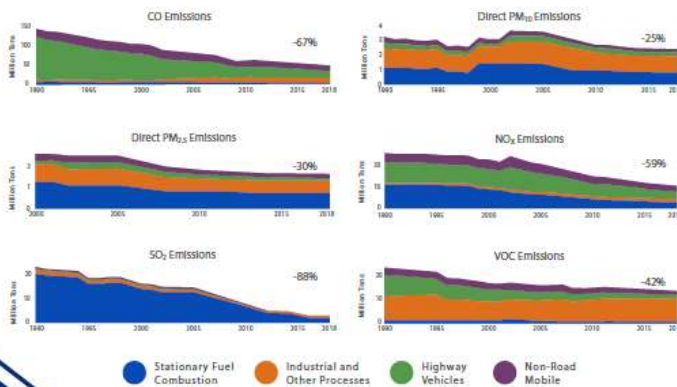
Air Quality Trends Show Clean Air Progress

While some pollutants continue to pose serious air quality problems in areas of the U.S., nationally, criteria pollutant concentrations have dropped significantly since 1990 improving quality of life for many Americans. Air quality improves as America grows.



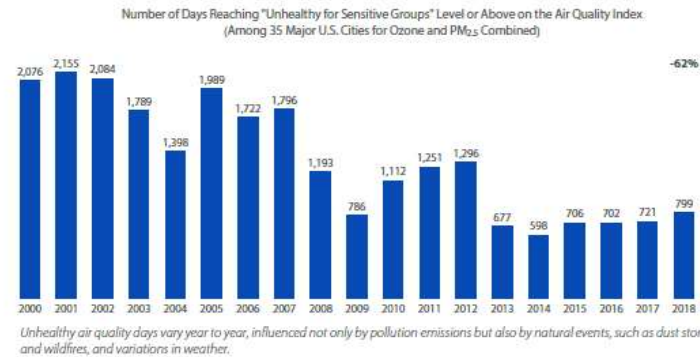
Air Pollutant Emissions Decreasing

Emissions of key air pollutants continue to decline from 1990 levels. These reductions are driven by federal and state implementation of stationary and mobile source regulations.



Unhealthy Air Days Show Long-Term Improvement

The Air Quality Index (AQI) is a color-coded index EPA uses to communicate daily air pollution for ozone, particle pollution, NO₂, CO, and SO₂. A value in the unhealthy range, above national air quality standard for any pollutant, is of concern first for sensitive groups, then for everyone as the AQI value increases. Fewer unhealthy air quality days means better health, longevity, and quality of life for all of us.





Exceptional Events Regulations and Guidance

- The Exceptional Events Rule provides a way for air quality monitoring data to be excluded from regulatory decisions and actions such as nonattainment designations if a state can provide convincing evidence to EPA that high monitoring values are the result of an exceptional or natural event
- **CAA Section 319 defines an exceptional event as an event that:**
 - Affects air quality;
 - Is not reasonably controllable or preventable;
 - Is an event that is caused by human activity that is unlikely to recur at a particular location, or is a natural event; and
 - Is determined by EPA to be an exceptional event
- Exceptional Events Guidance: “Prescribed Fire on Wildland that May Influence Ozone and Particulate Matter Concentrations,” August 2019
 - <https://www.epa.gov/air-quality-analysis/final-2016-exceptional-events-rule-supporting-guidance-documents-updated-faqs>





Regional Haze Regulations and Guidance

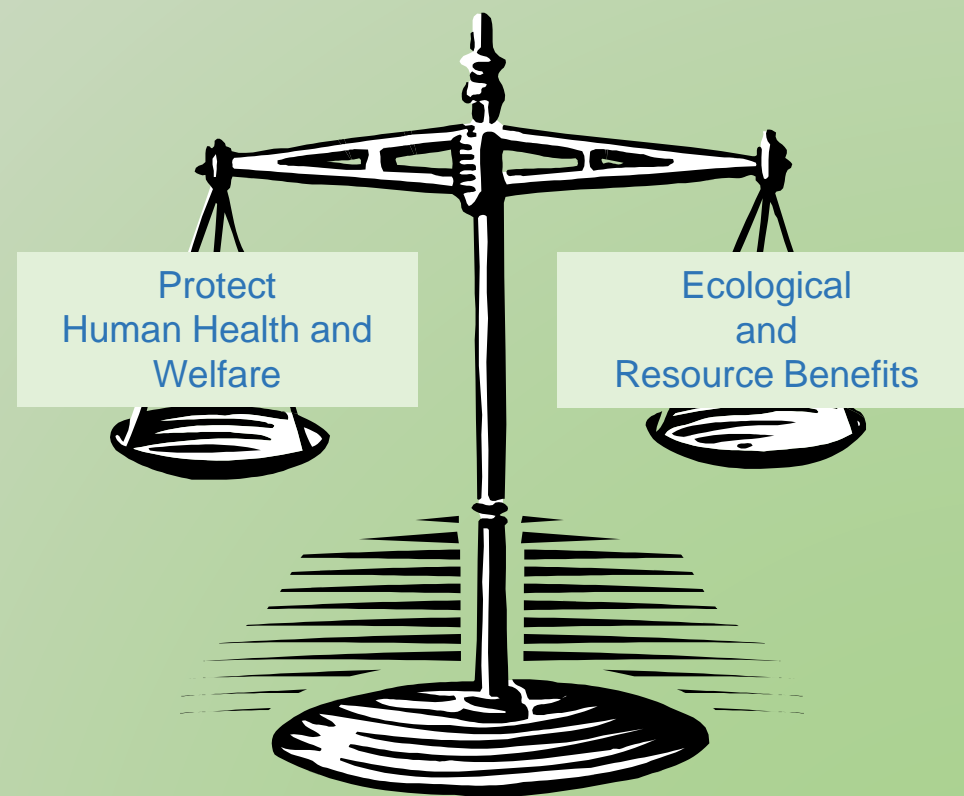
- The Clean Air Act and the Regional Haze Rule requires state and federal agencies to work together to improve visibility in 156 national parks and wilderness areas such as the Grand Canyon & the Great Smokies
- On January 10, 2017, the EPA issued updates to the Regional Haze Rule
- Revised the rule's terminology and definitions to be consistent with the Exceptional Events Rule (e.g., "wildfire" definition, use of "basic smoke management practices" and "smoke management programs")
- Rule continues to require states to consider **basic smoke management practices** and **smoke management programs** when developing their long-term strategies for making progress in visibility
- Recent Guidance Documents issued in August and September 2019 for use in Round 2 State Implementation Plans due in 2021.
 - <https://www.epa.gov/visibility/visibility-guidance-documents>





EPA's 1998 Interim Air Quality Policy on Wildland and Prescribed Fires

- Attempts to Integrate 2 Public Policy Goals:
 1. To allow fire to function in its natural role in maintaining healthy wildland ecosystems
 2. To protect public health and welfare by mitigating the impacts of air pollutant emissions on air quality and visibility
- Encourages collaboration among fire management agencies and air quality agencies
- Encourages consideration of smoke management techniques and smoke management planning





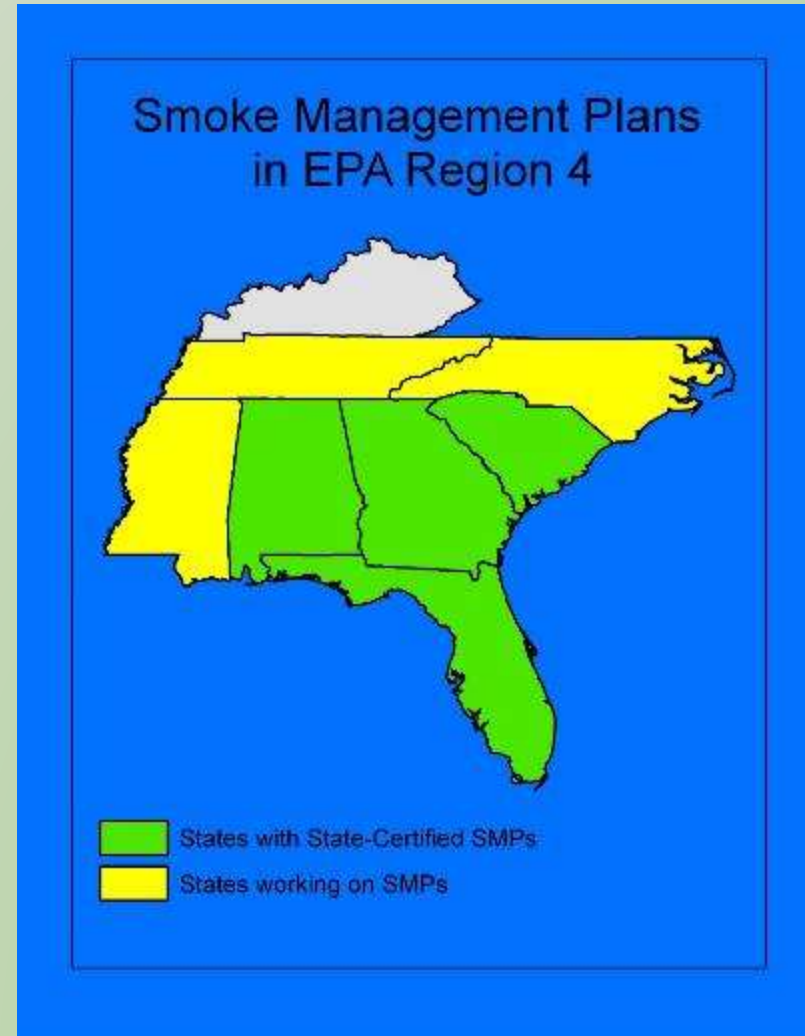
Smoke Management Programs

- Purpose of Smoke Management Programs (SMPs):
 - Mitigate nuisance and public safety hazards from smoke being transported into populated areas
 - Prevent deterioration of air quality and NAAQS violations
 - Address visibility impacts in mandatory Class I Federal areas
- SMPs are needed when:
 - Citizens complain of repeated smoke intrusions
 - Fires are contributing to increasing trends of monitored air pollutant levels
 - Fires in the area significantly contributing to visibility impairment at Class I areas
- Recommended Components of an SMP:
 - A process for authorizing or granting approval to manage fires for resource benefits (e.g., burn permits)
 - Consideration of methods for minimizing air pollutant emissions by using alternative treatments or reducing fuel levels before burning
 - Consideration of the need for Burn Plans which address the following:
 - Actions to minimize fire emissions
 - Evaluation of smoke dispersion
 - Public notification and exposure reduction procedures
 - Air quality monitoring
 - Public education and awareness programs
 - Surveillance and enforcement programs for ensuring that the SMP is effective
 - Procedures for periodically evaluation the SMP



Smoke Management Programs in the Southeast

- States with State-certified SMPs formally submitted to EPA pursuant to the 1998 Interim Policy
 - Alabama
 - Florida
 - Georgia
 - South Carolina
- Other states that have smoke management programs
 - North Carolina
 - Mississippi





How?

Smoke Tools and Resources

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Basic Smoke Management Practices (BSMPs)

- EPA Exceptional Events Rule and Guidance

- https://www.epa.gov/sites/production/files/2019-08/documents/ee_prescribed_fire_final_guidance_-_august_2019.pdf

- Southern Fire Exchange Fact Sheet

- http://southernfireexchange.org/SFE_Publications/factsheets/2014-1.pdf

- USFS and NRCS Recommendations

- https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1046311.pdf

Table 2: Summary of Basic Smoke Management Practices, Benefit Achieved with the BSMP, and When It Is Applied^a

Basic Smoke Management Practice ^b	Benefit achieved with the BSMP	When the BSMP is applied—before/during/after the burn
Evaluate Smoke Dispersion Conditions	Minimize smoke impacts	Before, During, After.
Monitor Effects on Air Quality	Be aware of where the smoke is going and degree it impacts air quality.	Before, During, After.
Record-Keeping/Maintain a Burn/Smoke Journal.	Retain information about the weather, burn and smoke. If air quality problems occur, documentation helps analyze and address air regulatory issues	Before, During, After.
Communication—Public Notification	Notify neighbors and those potentially impacted by smoke, especially sensitive receptors.	Before, During.
Consider Emission Reduction Techniques	Reducing emissions through mechanisms such as reducing fuel loading can reduce downwind impacts.	Before, During, After.
Share the Airshed—Coordination of Area Burning.	Coordinate multiple burns in the area to manage exposure of the public to smoke.	Before, During, After.

^a EPA believes that elements of these BSMP could also be practical and beneficial to apply to wildfires for areas likely to experience recurring wildfires.

^b The list of BSMP in this table is not intended to be all-inclusive. Not all BSMP are appropriate for all burns. Goals for applicability should retain flexibility to allow for onsite variation and site-specific conditions that can be variable on the day of the burn. Burn managers can consider other appropriate BSMP as they become available due to technological advancement or programmatic refinement.



Smoke Management Pocket Guide



- Understand and follow local, state, federal, and tribal prescribed fire laws and regulations
- Identify, map, and avoid impacting smoke sensitive areas
- Match appropriate smoke impact screening tools to burn complexity
- Notify appropriate parties (neighbors, public agencies, authorities) of intent to burn
- Use test fire to verify expected smoke dispersion
- Only burn when smoke dispersion conditions are favorable

- Be aware of other burning activity and sources of pollution in your area
- When feasible, use ignition patterns and methods which minimize smoke production
- Monitor changing weather conditions and respond to unintended smoke impacts
- Minimize impacts from smoldering smoke
- In high smoke risk areas, explore alternative methods to burning
- Enhance smoke management skills through training and experience



SERPPAS Smoke Mobile App

<http://smokeapp.serppas.org/>



Prescribed Fire Smoke Management Pocket Guide



About



Guidelines



Fuel Calculator



Smokepedia



Fact Sheets



Resources

Guidelines

1. Understand and follow local, state, federal, and tribal prescribed fire laws and regulations
2. Identify, map, and avoid impacting smoke sensitive areas
3. Match appropriate smoke impact screening tools to burn complexity
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6. Only burn when smoke dispersion conditions are favorable
7. Be aware of other burning activity and sources of pollution in your area
8. When feasible, use ignition patterns and methods which minimize smoke production
9. Monitor changing weather conditions and respond to unintended smoke impacts
10. Minimize impacts from smoldering smoke
11. In high smoke risk areas, explore alternative methods to burning
12. Enhance smoke management skills through training and experience

Menu

Resources

Home

GoodFires

Introduction to Prescribed Fire in Southern Ecosystems (10.5 MB)

SmoC Emissions & Smoke Portal

Smoke Management & Air Quality for Land Managers

Prescribed Fire Use Survey (15.9 MB)

Mobile Apps

AIRNow Mobile App (iPhone/Android)

Forestry Fire Management Information System (FMIS) Mapping Tool

Smoke Screening

U.S. Forest Service Simple Smoke Screening Tool


VSmoke-GIS

NOAA HYSPLIT Model



Southern Fire Exchange Website – Models and Tools


http://southernfireexchange.org/Models_Tools/Smoke.html



SOUTHERN Fire Exchange
Uniting Fire Science and Natural Resource Management

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Models and Tools

Smoke

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Smoke Models and Tools

BlueSky Framework is a model management system that facilitates the use of predictive models to simulate the cumulative impacts of smoke on air quality from forest, agricultural, and range fires.

CONSUME is the Newest Version of Consume Found in the **Fuel and Fire Tools (FFT)**. FFT integrates FCCS with Consume and FEPS into a single user interface, and offers direct linkages to the Pile Calculator and Digital Photo Series. The older stand-alone version of FEPS (v1.1) is still available for download but will not be updated and is no longer compatible with recent versions of Windows (7 and higher).


FEPS (Fire Emission Production Simulator) The latest version of the Fire Emissions Production Simulator (FEPS) is housed within the **Fuel and Fire Tools (FFT)**. FFT integrates FCCS with Consume and FEPS into a single user interface, and offers direct linkages to the Pile Calculator and Digital Photo Series. The older stand-alone version of FEPS (v1.1) is still available for download but will not be updated and is no longer compatible with recent versions of Windows (7 and higher).

HYSPLIT links to current NOAA weather forecasts to project plume dispersion and downwind concentrations from fires or a variety of other sources, within the next 48 hours. The model can be downloaded to a PC or run interactively on the **Air Resources Laboratory's READY** website.

The Simple Smoke Screening Model is a graphical tool created by the Southern High Resolution Monitoring Consortium (SHRMC) that predicts the downwind smoke impact zone based on the wind forecast direction, burn acres, fuel type, and ignition method. This tool is now hosted on our site.

VSmoke is a detailed planning tool that estimates downwind concentrations of particulate matter at 31 fixed distances, and how far and how well a person may see through the smoke plume at each distance.

VSmoke-Web is a user-friendly tool which produces smoke plume overlays on a map or satellite image that represent expected downwind concentrations of particulate matter relative to the Air Quality Index and potential health impacts.



5



Southern Fire Exchange Models and Tools

VSmoke-Web

ECAMMS
SHRAC
Smoke
VSmoke

Estimating Prescribed Fire Smoke Impacts

Map
Satellite

Search Box

Fire & Weather Info

1. Location

Lat:
 Lon:
2. Fire Size

Acres:
 Duration: hours
 Ignition Method:
3. Fuel Load

Fuel Type:
 Tons/Acre:
4. Fuel Consumption

Fuel Moisture Scenario:
5. Emissions

% consumed:
 PM 2.5 Emission Factor: lbs/ton
 Particulate Emission Rate: grams/sec
 Heat Release Rate: MW
6. Weather

Mixing Height: ft

About

VSmoke-Web is a web-based implementation of VSmoke (Lundin, 1995) and is designed to assist with planning prescribed burns in the Southern United States. VSmoke is a simple gaussian smoke dispersion model that calculates isopleths of surface smoke concentration. Output from the model represents peak hourly concentrations of PM2.5 or visibility (under development). Contour values and their colors correspond to the PM 2.5 thresholds for the Air Quality Index (AQI) and reflect potential health impacts ranging from moderate to hazardous ([Visit AirNow for smoke AQI info](#)). Burn location can be set by clicking on the map or by entering the Latitude and Longitude. Note that the Latitude and Longitude should be entered in decimal degrees (30.38, -84.37) or degrees+decimal minutes (30 22.80, -84 22.20 - note the space between degree and minute values).

Models and Tools

Simple Smoke Model Created by the Southern High Resolution Modeling Consortium

Home / Models and Tools / Simple Smoke

Map
Satellite

Search Box

File of Fuel Info

Lat:

Lon:

Acres:

Fuel Type:

Ignition Method:

Wind Direction:

Mixing Height:

Update Map

After generating a grid save the data for display in Google Earth [Get KML data](#)

Refresh Map

About

The [Southern Smoke Management Guide](#) made use of a simple graphical smoke screening system. This system relied upon a simple protractor to use with paper maps in marking out a smoke impact zone. The Southern High Resolution Modeling Consortium created a digital version of this tool. This is a simple screening tool designed to help identify smoke sensitive targets, not to predict smoke concentrations. It follows the graphical screening method outlined [here](#). The acreage value is used to set the width of the screening grid and also increases the screening distance for larger burns. Burn location can be set by clicking on the map or by entering the Latitude and Longitude. Note that the Latitude and Longitude should be entered in decimal degrees (30.38, -84.37) or degrees+decimal minutes (30 22.80, -84 22.20 - note the space between degree and minute values).

The screening area shown on the map is divided into 2 zones. The first zone (colored red) is used to identify critical smoke-sensitive areas. This is the most probable smoke impact area. If there are smoke-sensitive targets within this critical zone burning is not recommended under the current prescription.

The other zone (yellow) shows an area of less severe smoke impact.



Southern Fire
Exchange Fact Sheets
http://southernfireexchange.org/SFE_Publications/SmokeAirWeather.html



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SFE Publications Fact Sheets and Research Summaries

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Smoke Management, Air Quality, and Weather

Detailed Point Weather Forecasts

Accurate hour-by-hour forecasts are critical components of planning and managing your burns. This fact sheet explains the short, easy steps for accessing 48-hour detailed forecasts through the NOAA Fire Weather website.

Online Tools for Planning Smoke Management

Mitigating smoke impacts on human health and safety is one of the challenges that landowners and agencies face when conducting prescribed burns. Particulate matter (PM) in smoke, produced by the combustion of fuels during burning, can aggravate respiratory ailments and reduce visibility along roads and near airports.

Predicting Smoke Movement: User-Friendly Computer Models

Smoke management is one of the most important considerations in fire prescriptions. This fact sheet introduces the primary models that can be used for most prescribed fire in the South, such as Simple Smoke Screening, VSmoke, and HYSPLIT.

Situational Awareness: Nighttime Smoke and Fog on Prescribed Burns

Responsibility for smoke dispersal is in the hands of the burn manager. Many of the factors that impact smoke decisions are summarized in this fact sheet on nighttime smoke and fog.

Basic Smoke Management Practices for Prescribed Burning

Basic Smoke Management Practices (BSMPs) are activities that prescribed fire managers should use to reduce the amount and negative effects of smoke produced during prescribed fires. This fact sheet introduces the six BSMPs and provides a list of important resources for managing smoke.

Online Tools for Weather Information

Two organizations, the National Weather Service (NWS) and the State Climate Office of North Carolina, have been developing web-based tools that allow anyone to explore and customize multiple displays of various weather elements simultaneously.

Smoke Prediction with VSMOKE

VSMOKE is a frequently used computer-based model for predicting concentrations of fine particulate matter and cross-plume visibility from prescribed fires. This fact sheet provides a brief overview of this model, its applicability and limitations, and describes model inputs and outputs.

Summary of Smoke Related Joint Fire Science Program Grants Relevant to the Southeastern U.S.

This fact sheet summarizes smoke research relevant to the southeastern U.S. funded by the Joint Fire Science Program (JFSP) as presented in the publication, "A compendium of brief summaries of smoke science research in support of the Joint Fire Science Program Smoke Science Plan" (April 21, 2017). These studies fall under four general themes: emissions inventory, model validation, populations and smoke, and potential future fire and air quality.

Superfog: State of the Science

This fact sheet summarizes presentations from the 2013 International Association of Wildland Fire Smoke Symposium to familiarize managers with the tools and information they can use to prepare for and determine the likelihood of superfog events.

Wildland Fire Smoke Effects on Public Health What Does the Research Say?

This fact sheet summarizes the progress of scientific research investigating the effects of wildland fire smoke on public health and actions individuals can take to minimize their exposure to smoke.



Wildland Fire / Air Quality Tools

<https://tools.airfire.org>

WFAQRP-AirFire Tools Home - Tool Status - AirFire Home - WFAQRP Home

Wildland Fire / Air Quality Tools

Notice: Due to temporary technical issues, this site will show temporary URLs in your browser.
Please use the permanent link <https://tools.airfire.org> to return to this page.

This page provides links to the most recent versions of tools produced by the U.S. Forest Service PNW Research Station's Pacific Wildland Fire Sciences Laboratory in support of the Wildland Fire Air Quality Response Program and wildland fire operations.



Monitoring PM2.5
Aggregated ground monitoring information
[More info / help](#)



BlueSky Daily Run Viewer
Visualize daily smoke forecasts
[More info](#)

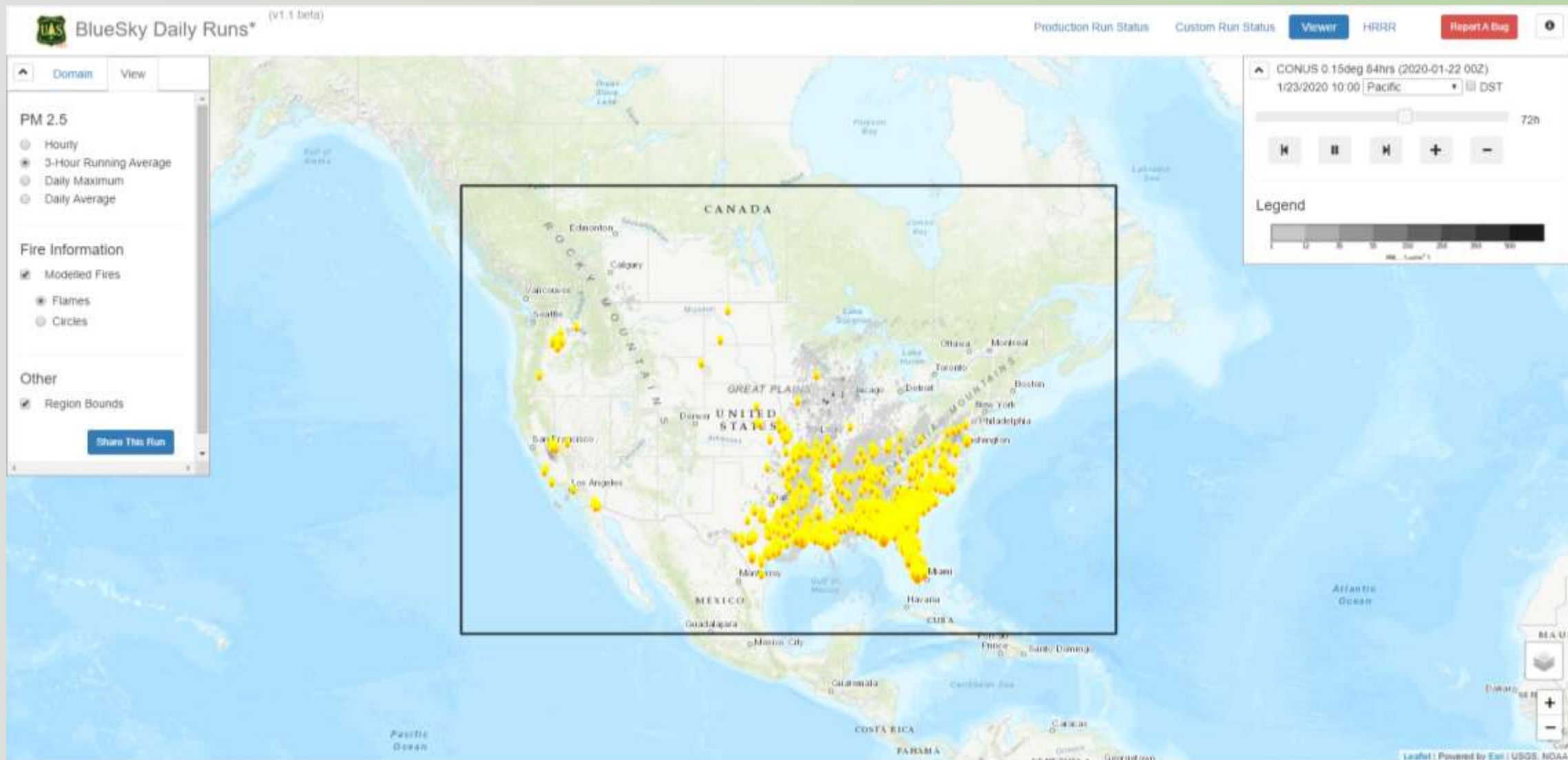


BlueSky Playground
v2 (previous) | v3 (alpha test)
Customized emissions and dispersion modeling. Two versions available.
[More info / help \(v3\)](#)

©



U.S. Forest Service BlueSky Smoke Model





EPA Smoke-Ready Toolbox for Wildfires

<https://www.epa.gov/smoke-ready-toolbox-wildfires>

EPA United States Environmental Protection Agency

Environmental Topics Laws & Regulations About EPA Search EPA.gov

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Smoke-Ready Toolbox for Wildfires

Smoke from wildfires in the United States is adversely affecting air quality and potentially putting more people at health risk from smoke exposure. EPA, the U.S. Forest Service (USFS) and other federal, state and community agencies and organizations are working together to identify ways the public can prepare to reduce their health risk *before* a wildfire. Public health officials and others can use the resources in the Smoke-Ready Toolbox to help educate people about the risks of smoke exposure and actions they can take to protect their health.

Smoke & Your Health

- [AirNow](#)
- [Smoke Advisories](#)
- [Fires and Your Health](#)
- [Frequent Questions](#)
- [Smoke Sense App](#)
- [Prepare for Natural Disasters and Recovery](#)
- [Wildfires and Indoor Air Quality](#)

Current Fires

- [Current Fires](#)
- [Current Fire Incident Information System](#)
- [NOAA Smoke Forecast Tool](#)
- [NOAA's Fire Weather Outlook](#)
- [GEOMAC Wildland Fire Support](#)
- [MODIS Active Fire Mapping](#)
- [National Interagency Coordination Center](#)
- [National Interagency Fire Center](#)

Featured Resources

EPA supported and participated in the National Academies of Science, Engineering and Medicine Workshop on the Implications of the California Wildfires. [Workshop proceedings publication.](#) [EXIT](#)

[NACCHO Blog: Using the Wildfire Guide](#) [EXIT](#)

[Video - Wildfire Smoke: A Guide for Public Health Officials](#) [EXIT](#)



www.epa.gov/research

science in ACTION

INNOVATIVE RESEARCH FOR A SUSTAINABLE FUTURE

SMOKE SENSE CITIZEN SCIENCE PROJECT

A Citizen Science Project To:

1. Understand the subclinical health impacts of wildland fire smoke.
2. Discover how people protect their health during smoke exposure.
3. Develop effective strategies to communicate health risks from smoke exposure.



WHAT IS SMOKE SENSE?

The Smoke Sense project combines the power of crowdsourcing with digital technology to develop innovative approaches and solutions to reduce the health burden during smoke episodes. To the best of our knowledge, Smoke Sense is the only citizen science project that makes a connection between changes in environmental conditions and changes in population health. But Smoke Sense is more than a research study. It is also an educational tool and information resource designed to increase awareness and get people to act when they are exposed to smoke from a wildland fire.

WHY IS SMOKE SENSE IMPORTANT?

Smoke from wildland fires is harmful to health and increases visits to emergency rooms and clinics for problems related to asthma and other respiratory and cardiovascular diseases. As the incidence and intensity of large wildland fires increase in the United States, more people will be exposed to unsafe levels of particulate matter (PM) and other pollutants from smoke. This public health problem emphasizes the need for new and innovative scientific approaches to communicate health risks of exposure to wildland fire smoke to communities.

EPA Smoke Sense Mobile App

<https://www.epa.gov/air-research/smoke-sense-study-citizen-science-project-using-mobile-app>



SMOKE SENSE MOBILE APP

Individuals can participate in the citizen science project by using the Smoke Sense app, a free and publicly available mobile application.

APP FEATURES:

- Current and forecasted air quality information using the Air Quality Index (AQI)
- Map showing current fire locations and smoke plumes
- Log for reporting personal health symptoms and smoke observations
- Learning module about air pollution, wildland fires, and health impacts
- Reward badges for completing tasks

Data gathered through Smoke Sense will help EPA researchers determine how smoke impacts our health and productivity and gain important insights needed to develop health risk communication methods during smoke days. The Smoke Sense app is available for Android and iOS devices.

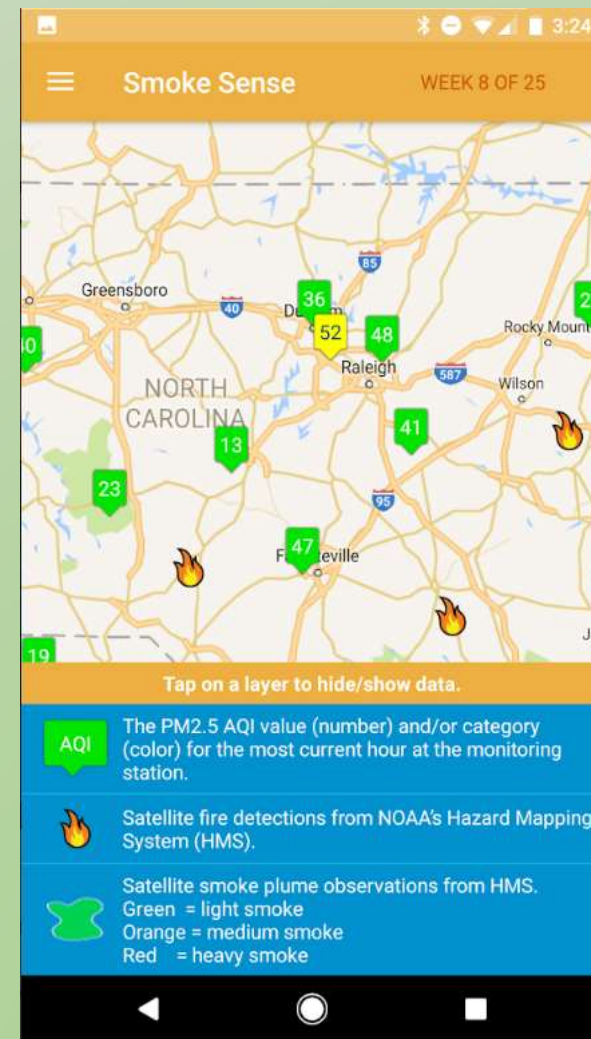
App user identities are anonymous and non-identifiable.

To Download the App

Visit www.epa.gov/air-research/smoke-sense.

Contact

SmokeSense@epa.gov





CDC Smoke and Air Quality Resources

<https://www.cdc.gov/air/wildfire-smoke/default.htm>

The screenshot shows the CDC website's 'Air Quality' section. At the top left is the CDC logo with the tagline 'Centers for Disease Control and Prevention' and 'CDC 24/7: Saving Lives. Protecting People™'. A search bar is located at the top right. Below the logo is a green navigation bar with 'Air Quality' in white text. Underneath, there's a breadcrumb 'CDC > Air Quality' and social media icons for Facebook, Twitter, LinkedIn, YouTube, and Instagram. A left-hand navigation menu lists various topics: Air Quality, Air Pollutants, Wildfire Smoke (highlighted), Guidance for Health Professionals, People with Chronic Conditions, Precautions for Pregnant Women, Protecting Children from Wildfire Smoke, Before a Wildfire Smoke Event, During a Wildfire Smoke Event, After a Wildfire Smoke Event, Public Health Issues, Infographics, Ozone and Your Health, Particle Pollution, Air Quality Resources for Professionals, Volcanoes and Air Quality, and FEMA Trailer Study. The main content area features the title 'Protect Yourself from Wildfire Smoke' with a link for 'Español (Spanish)'. Below the title is a large image of a forest at sunset or sunrise, with a dark overlay at the bottom containing the text 'Be ready to protect yourself against smoke and ash before, during, and after a wildfire.' The text below the image explains that wildfire smoke is a mix of gases and fine particles that can make anyone sick, with specific risks for people with asthma, COPD, heart disease, children, pregnant women, and responders. It lists symptoms of smoke exposure: coughing, trouble breathing, wheezing, asthma attacks, stinging eyes, scratchy throat, runny nose, irritated sinuses, and headaches. At the bottom right, there is a graphic for a guide titled 'WILDFIRE SMOKE: A Guide for Public Health Officials Revised 2019'.

CDC Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People™

Search

Air Quality

CDC > Air Quality

- Air Quality
- Air Pollutants
- Wildfire Smoke**
 - Guidance for Health Professionals
 - People with Chronic Conditions
 - Precautions for Pregnant Women
 - Protecting Children from Wildfire Smoke
 - Before a Wildfire Smoke Event
 - During a Wildfire Smoke Event
 - After a Wildfire Smoke Event
- Public Health Issues
- Infographics
- Ozone and Your Health
- Particle Pollution
- Air Quality Resources for Professionals
- Volcanoes and Air Quality
- FEMA Trailer Study

Protect Yourself from Wildfire Smoke

[Español \(Spanish\)](#)



Be ready to protect yourself against smoke and ash before, during, and after a wildfire.

When wildfires burn near you, smoke can reach your community. Wildfire smoke is a mix of gases and fine particles from burning trees and plants, buildings, and other material. Wildfire smoke can make anyone sick, but people with [asthma](#), [Chronic Obstructive Pulmonary Disease \(COPD\)](#), or [heart disease](#), and [children](#), [pregnant women](#), and [responders](#) are especially at risk.

Breathing in smoke can affect you right away, causing:

- Coughing
- Trouble breathing
- Wheezing
- Asthma attacks
- Stinging eyes
- Scratchy throat
- Runny nose
- Irritated sinuses
- Headaches





EPA Air Sensor Toolbox

<https://www.epa.gov/air-sensor-toolbox>

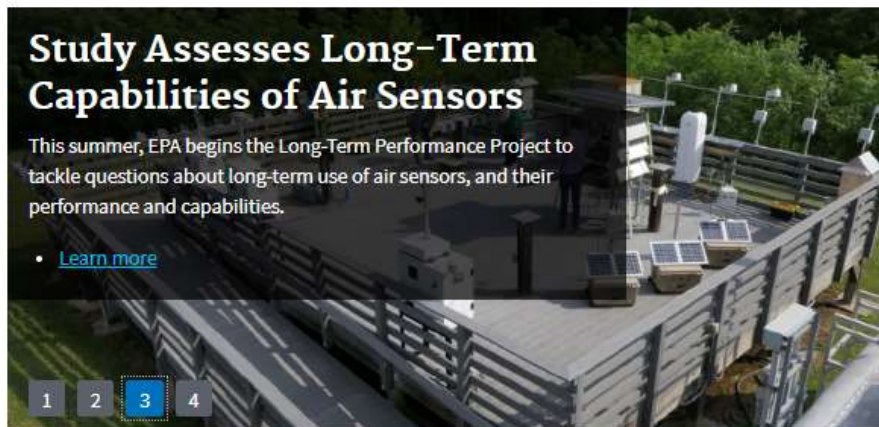


Air Sensor Toolbox

Study Assesses Long-Term Capabilities of Air Sensors

This summer, EPA begins the Long-Term Performance Project to tackle questions about long-term use of air sensors, and their performance and capabilities.

- [Learn more](#)



What's New

Get Air Sensor News by email

sign up

Approx. 8-10 emails annually.

Air sensor monitors that are lower in cost, portable and generally easier to operate than regulatory-grade monitors are widely used in the United States to understand air quality conditions. This website provides the latest science on the performance, operation and use of air sensor monitoring systems for technology developers, air quality managers, citizen scientists and the public. The EPA is involved in the advancement of air sensor technology, including performance evaluations of sensor devices and best practices for effectively using sensors. The information can help the public learn more about air quality in their communities.

How to Use Air Sensors



- [Uses for Air Sensors](#)
- [Air Sensor Guidebook](#)
- [Air Sensor Performance Evaluations](#)

What Do My Sensor Readings Mean?



- [Sensor Scale Pilot and FAQs](#)
- [AirNow - Current Air Quality](#)
- [Workshop Summary -- Air Quality Exchange: Delivering High](#)