



EPA ORD Research

Pacific Ecological Systems Division Enhanced Air Monitoring Program

James Markwiese, Ron Waschmann, Peter Beedlow, Alan Thornhill

US Environmental Protection Agency

Office of Research and Development

Center for Public Health and Environmental Assessment

Pacific Ecological Systems Division

2020 NW AIRQUEST Virtual Meeting



EPA ORD Research Corvallis & Newport, Oregon

The Environmental Protection Agency's Office of Research and Development conducts research to predict the condition of these systems and their contributions to human well being nationwide



- 61 EPA Staff, 67% with Ph.D.'s
 - 51 Scientists
 - 5 EPA Postdoctoral Fellows
 - 5 Program Operations Staff
- 52 On-site Contractors
- 23 NRC/ORISE Postdoctoral Fellows + Students
- 16 SEE Employees
- 23 Cooperators/Collaborators

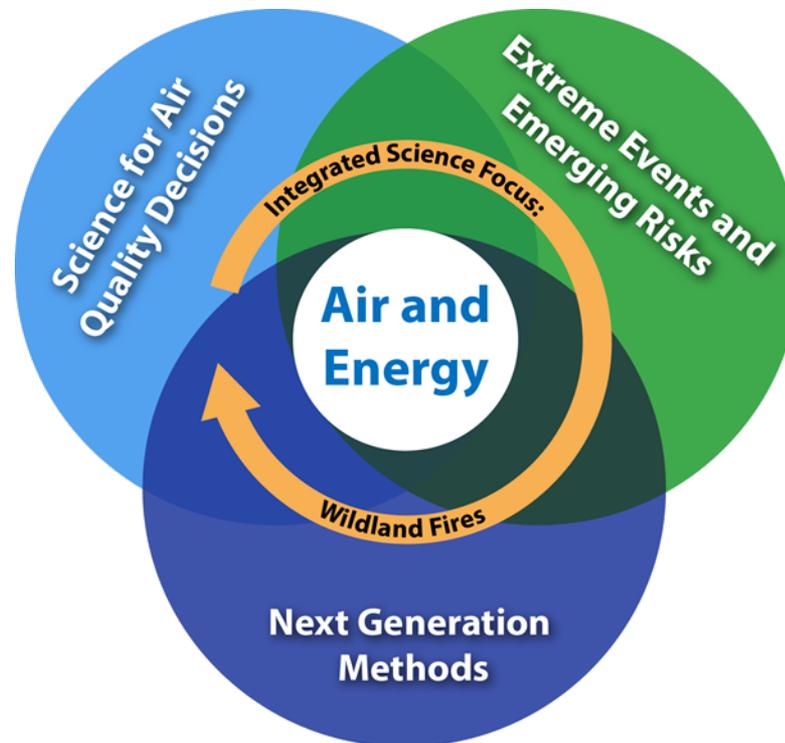
ORD supports the EPA Regions, state governments and local communities



 Office of Research and Development



ORD Research: Air and Energy



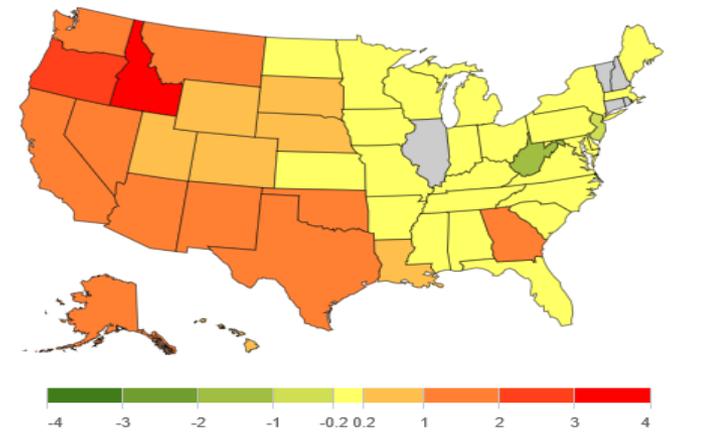


Wildfire Issues Facing the Northwest

Understand emissions from wildfires versus prescribed fire. Current dogma assumes prescribed burning significantly reduces emissions from wildfires. Is this true?

- Does the smoke from vegetation and wildland Urban Interface found throughout west (oak, pine, chaparral) produce different types and levels of pollution?
- What is the estimated smoke exposure for those near fires, and how does it relate to observed health effects?
- How do prescribed burns contribute to air pollution?
- How do we characterize exposure?
 - Scale
 - Cost

Change in Annual Burned Acreage by State Between 1984–1999 and 2000–2014



Source:
MTBS (Monitoring Trends in Burn Severity). 2016. MTBS data summaries.

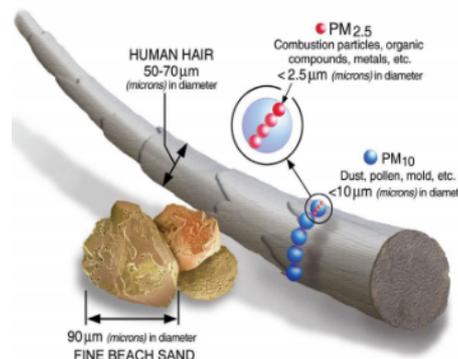
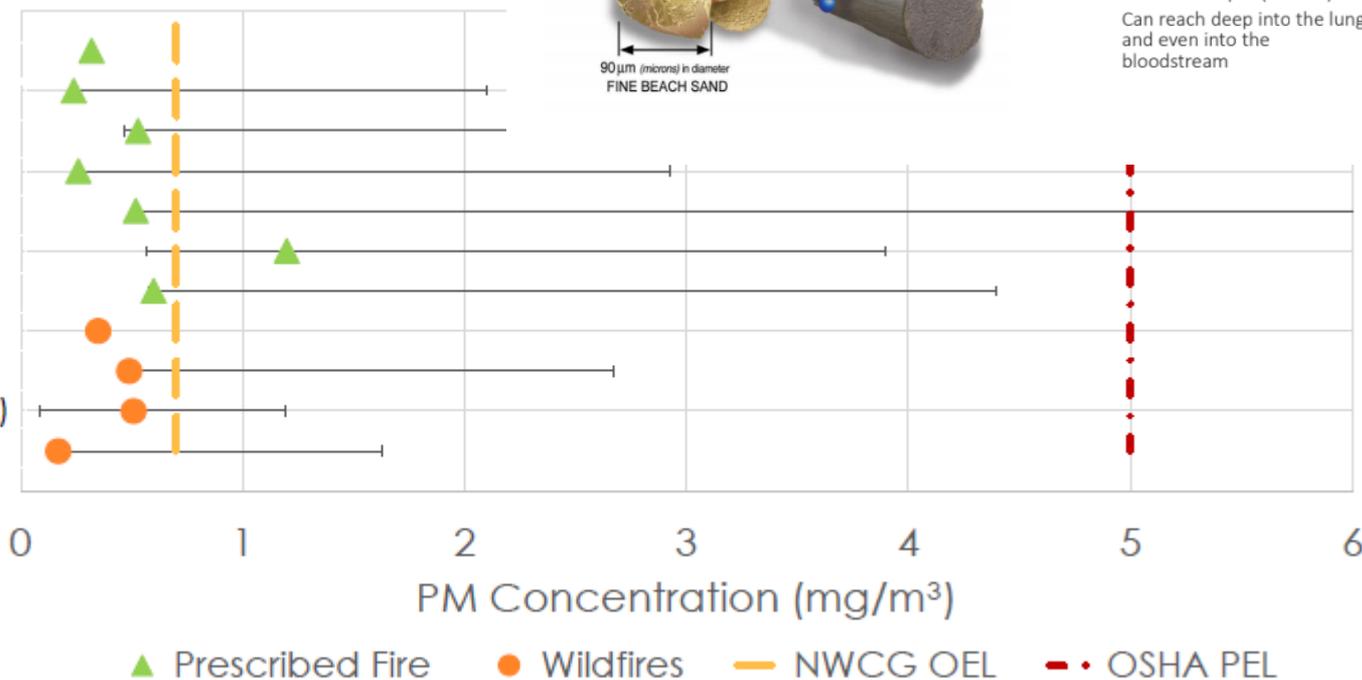


Prescribed Fire vs Wildfires

PM_{2.5}

Data compiled by Kathleen Navarro (NIOSH)

- Reinhardt & Broyles 2019
- Adetona, 2016
- Adetona et al., 2013
- Adetona et al., 2011
- Reisen et al., 2011
- Neitzel et al., 2009
- Reisen & Brown, 2009
- Reinhardt & Broyles 2019
- Gaughan et al., 2014 (Fireline)
- Gaughan et al., 2014 (Mop-up)
- Reisen et al., 2011



Particulate Matter

- Greater than 10 μm
Usually don't reach the lungs
Can irritate eyes, nose, throat
- Less than 10 μm (PM₁₀)
Get into the lungs. Can affect lungs, heart, blood vessels
- Less than 2.5 μm (PM_{2.5})
Can reach deep into the lungs, and even into the bloodstream



EPA, Wildfire and Smoke

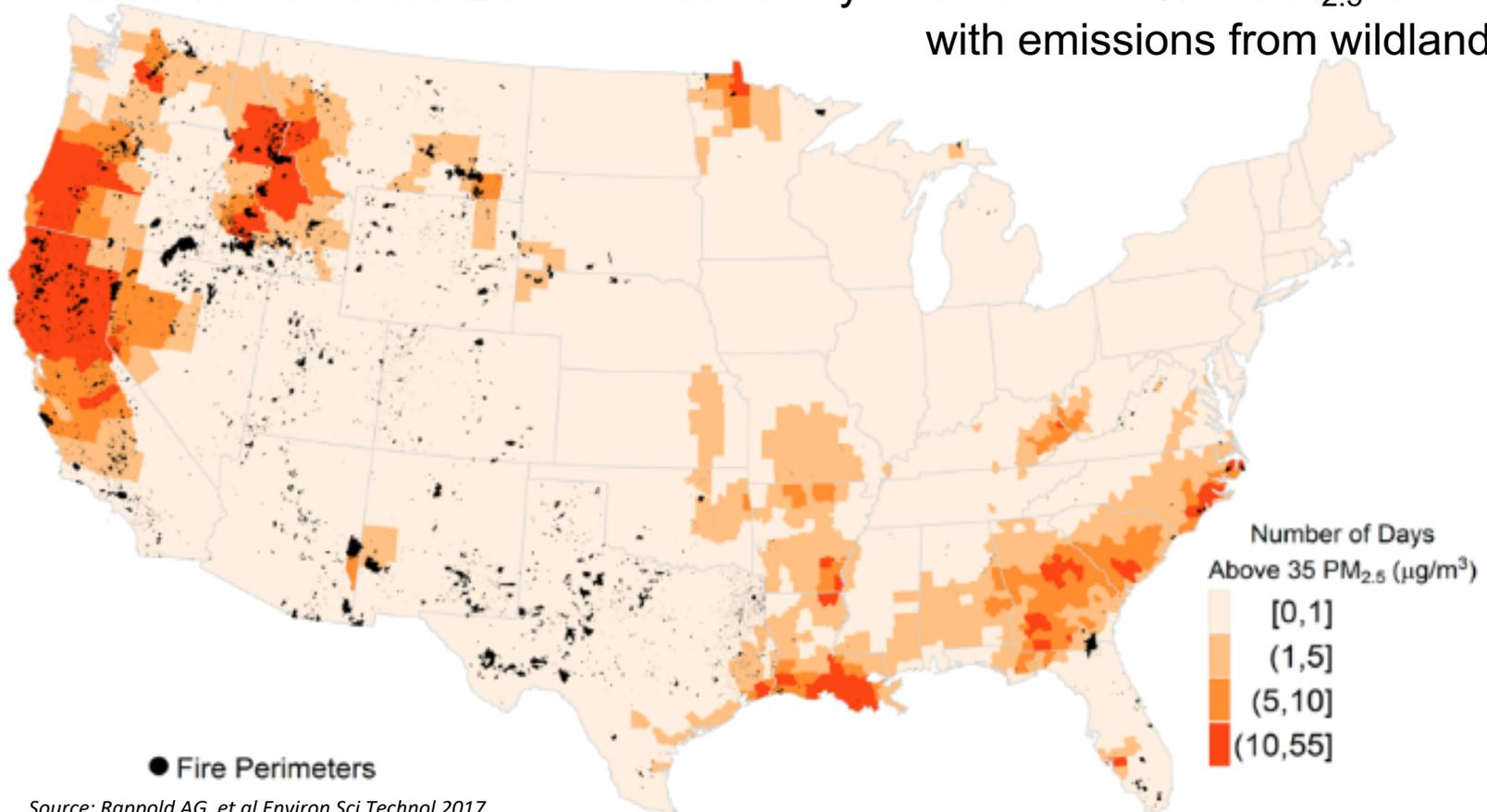
- Wildland fires are increasing in size and severity in the US
- Air quality managers interested in reliable and accurate tools and to assess impacts of wildfires; e.g.,
 - Respiratory-related hospital admission rates surge during and after wildfire events
- How and to whom do we communicate these approaches/guidance to reduce risks?
 - **Smoke Sense:** is a citizen-science study using a mobile-device app that maps current wildfire locations, while also providing current and forecasted air-quality measures
 - The app has over 20,000 citizen scientists use the Smoke Sense app and report wildfire smoke and health observations..

Eagle Creek Fire, Sep 2017



Days, fire-PM_{2.5} > daily health standard

Improved emissions data will inform wildfire contribution to air pollutants under Clean Air Act. National Emissions Inventory estimates >30% of PM_{2.5} associated with emissions from wildland fires



Source: Rappold AG, et al Environ Sci Technol 2017

Source: Rappold AG, et al Environ Sci Technol 2017



Days, AQI unhealthy for sensitive groups/worse

Bend and Medford wildfire smoke trends

Number of Days

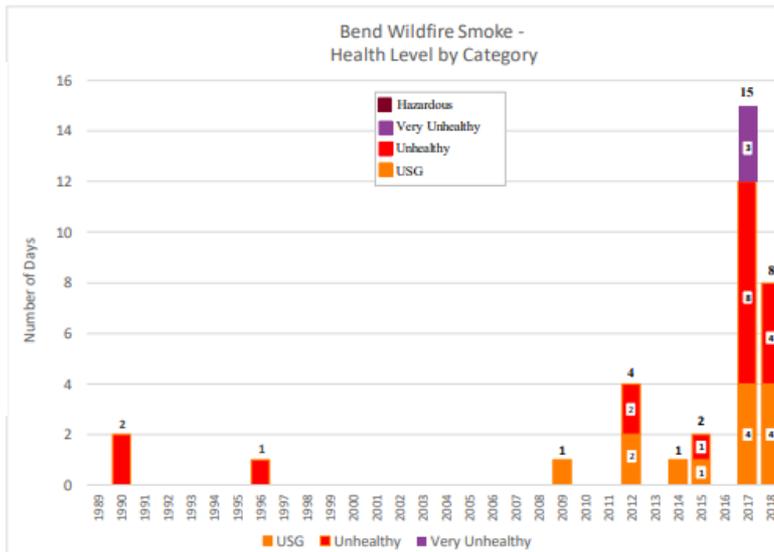


Figure 1. Bend AQI unhealthy for sensitive groups or worse wildfire smoke trends 1989 to 2018.

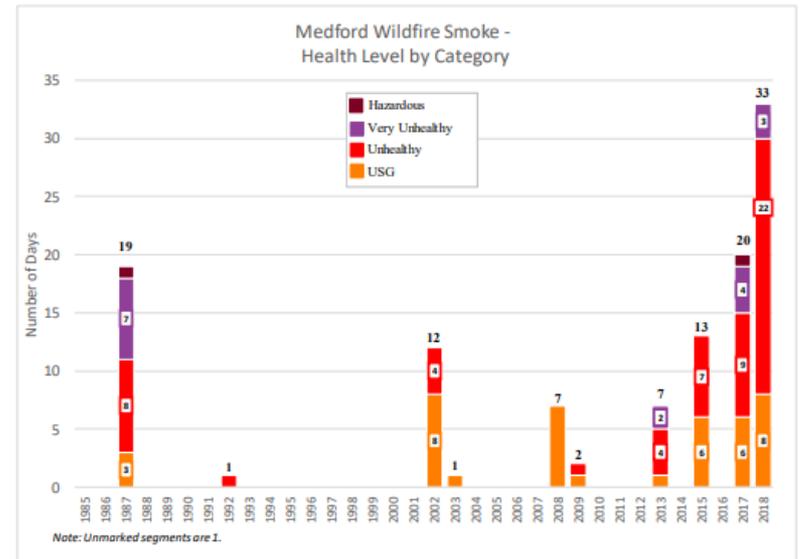


Figure 3. Medford AQI unhealthy for sensitive groups or worse wildfire smoke trends 1985 to 2018.

Source: Oregon DEQ, Wildfire Smoke Trends and Associated Health Risks; Bend, Klamath Falls, Medford and Portland - 1985 to 2018

<https://www.oregon.gov/deq/FilterDocs/smoketrends.pdf>



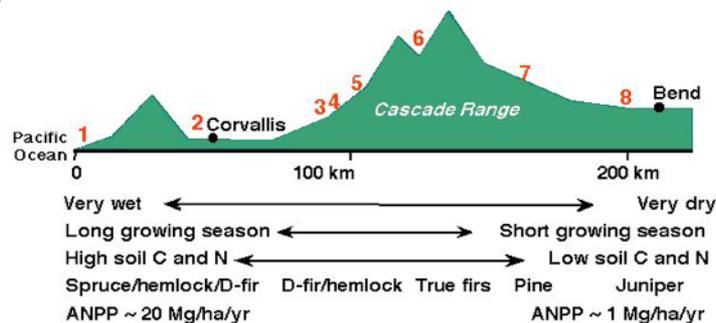
Wildland Smoke – EPA & Partners

- USFS PNW research station, coordinating with controlled burn schedule in Pacific Northwest
- OR DEQ air monitoring staff sensor co-location
- Industry sensor co-location
- University of Oregon support upcoming high-profile sporting events
- Oregon Health Authority, Public Health Division concerns voiced by the public; e.g., burning polyethylene-covered slash piles
- Fire forecasting: exploration of coast to crest network environmental monitoring data



Enhanced Monitoring Network: Tools To Address Wildfire Issues

- Establishing reference grade Stationary & Mobile AQM platforms (under the Air and Energy Research Program), advantages:
 - Low background air quality levels (required to test dynamic range of sensors optimized for more polluted environments) and acute seasonal smoke events (high smoke levels impact performance of most all AQ sensors)
 - Proximity to western wildland fire action areas
 - Support to EPA Regions and States
- Monitoring platforms facilitate integration across disciplines (especially health & ecology) and ORD Labs/Centers, Regions, States, Tribes, Local Air Quality Districts to fulfill 1970 CAA legal mandate to research and protect **public health** and **environment**





Air Quality Base Station

PESD Enhanced Air Monitoring Status (2020-02-19) - Base Station

Existing Equipment			Equipment to Purchase
<p>Data Acquisition System</p> 	<p>Calibration Equipment - ZAS & GPT</p> 	<p>CO Teledyne T300</p> 	
<p>PM2.5 Teledyne T640</p> 	<p>Multiparameter Weather Sensor</p> 	<p>True NO2/NOx/NO Teledyne CAPS 500</p> 	
<p>Ozone Teledyne 400E</p> 	<p>CO2 LI840A</p> 	<p>H2S & SO2 Teledyne T101</p> 	
	<p>Ozone Teledyne T265</p> 	<p>NH3 & NO2 Teledyne T201</p> 	
		<p>PM2.5 BAM-1020 & Shelter</p> 	
		<p>CO2 LI850</p> 	



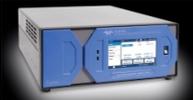
EPA Mobile Unit





Wildland Smoke Mobile Station

PESD Enhanced Air Monitoring Status (2020-02-19) - Mobile Station

Existing Equipment	Equipment to Purchase			
<p>Data Acquisition System</p> 	<p>Calibration Equipment Span Gas Diluter (GPT)</p> 	<p>CO Teledyne T300</p> 	<p>O3 Teledyne T265</p> 	<p>NH3 & NO2 Teledyne T201</p> 
<p>Calibration Equipment Zero Air Source</p> 	<p>PM2.5 BAM-1020 & Shelter</p> 	<p>True NO2/NOx/NO Teledyne CAPS 500</p> 	<p>H2S & SO2 Teledyne T101</p> 	<p>CO2 LI850</p> 
<p>Ruggedized Equipment Cases</p> 	<p>Multiparameter Weather Sensor</p> 	<p>Communications</p> 	<p>Generators</p> 	



EPA Long Term Ecological Research

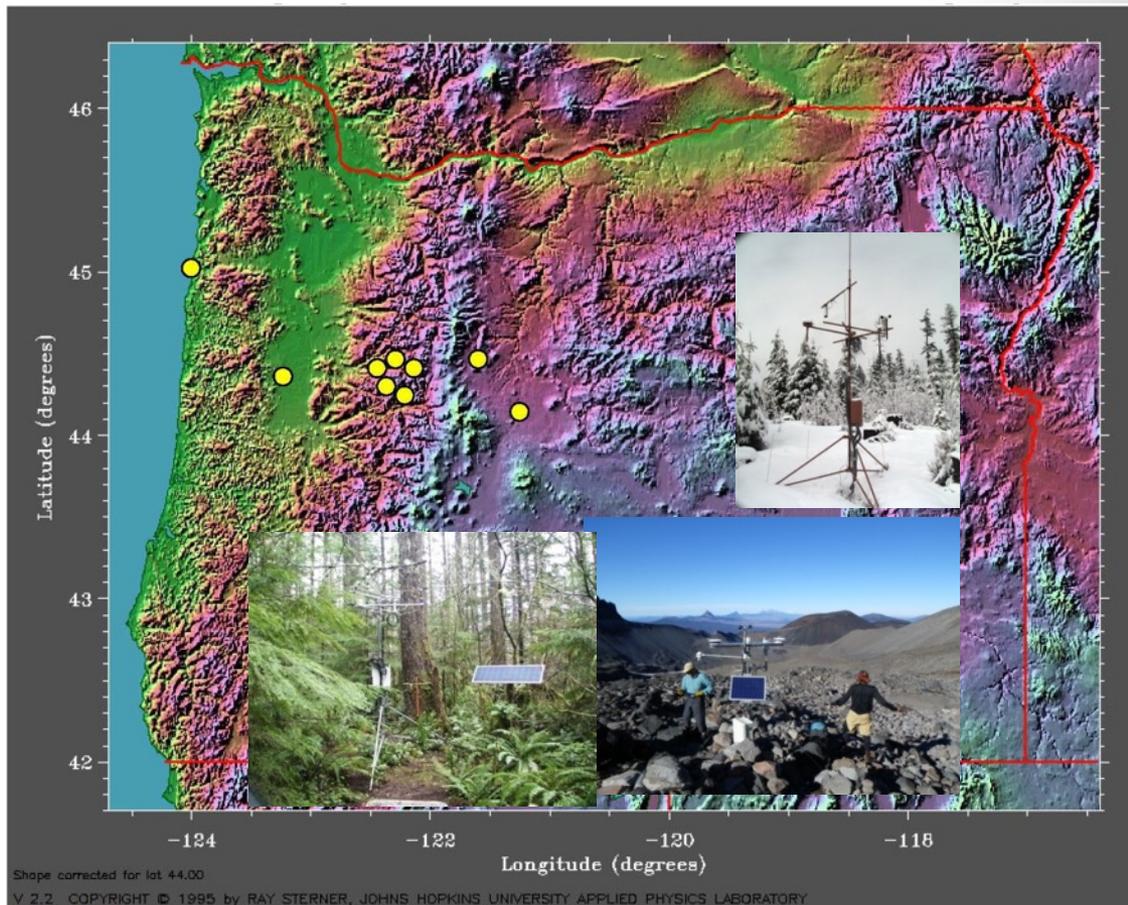




Pacific Ecological Systems Division “Coast to Crest” environmental monitoring network

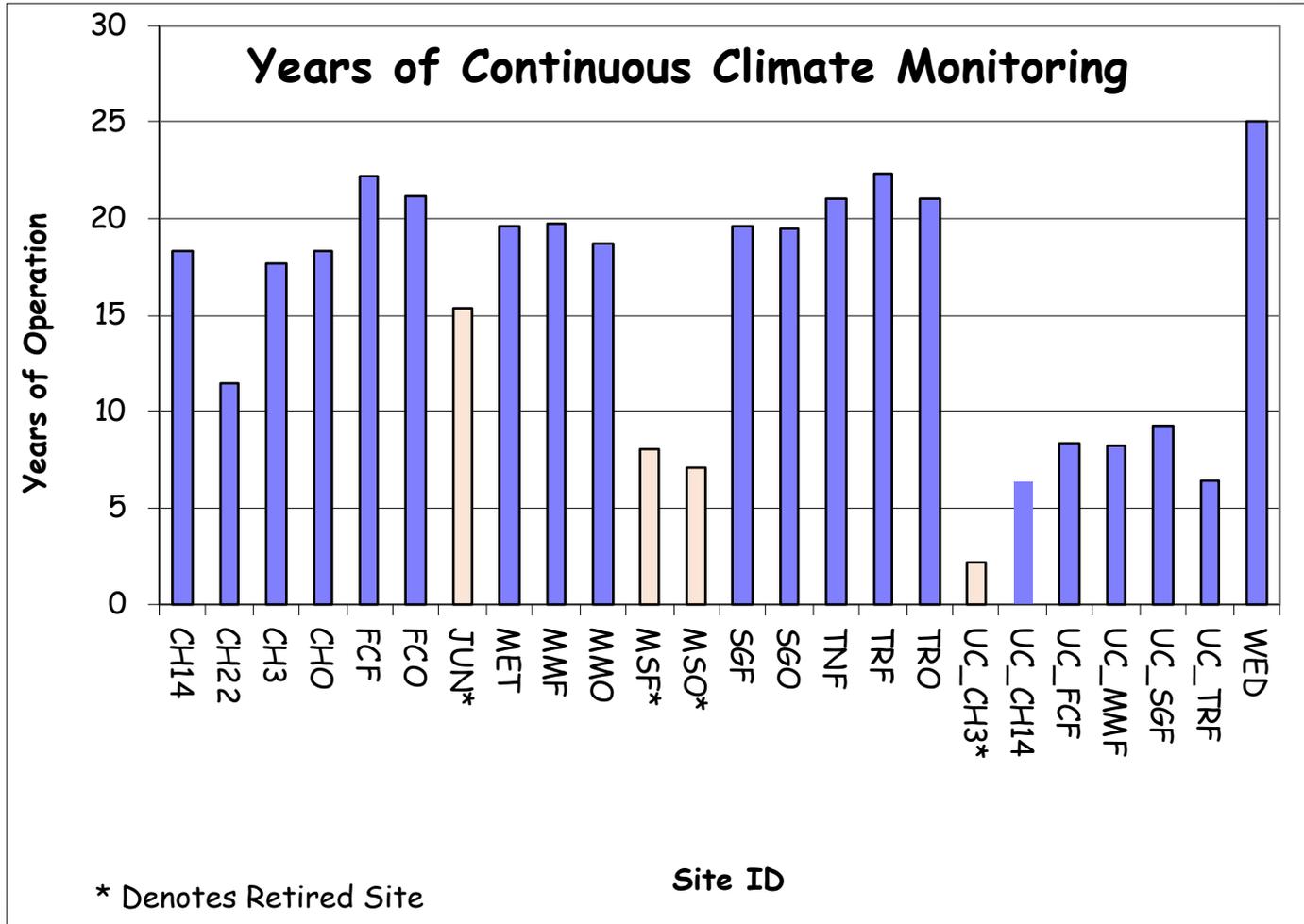
US Environmental Protection Agency,
Pacific Ecological Systems Division
monitoring above- and belowground
climate data since 1993 from:

- 23 enhanced monitoring locations along an Oregon Cascade Mountain “Crest-to-Coast” transect; nine sites indicated by ●
- Sites located in old-growth and mature coniferous forests (Douglas-fir, Sitka spruce, alder, juniper, ponderosa pine), adjacent clear-cuts, and top of canopy locations
- Exploring data for forecasting fires





Coast to Crest Operational Span





Coast to Crest Climatological Data

Following variables measured every 5-minutes with hourly averages/totals computed for each location:

- air temperature
- relative humidity
- rainfall
- photosynthetically active radiation
- soil temperature (multiple depths)
- snow depth (where applicable)
- volumetric soil moisture (multiple depths)
- wind speed and direction
- shortwave radiation
- barometric pressure

Incremental tree growth data (stem circumference and tree-ring measurements) also submitted to the archive





Contact Information

For more information on how to protect public health and reduce exposure please visit EPA's Smoke Ready Toolbox for Wildfires



The views expressed in this presentation are those of the author(s) and do not necessarily reflect the views or policies of the U.S. Environmental Protection Agency

James Markwiese, PhD
541.754.4670
markwiese.james@epa.gov