

The Interagency Wildland Fire Air Quality Response Program and Opportunities for EER Support

Pete Lahm

Forest Service

Fire & Aviation Management

Washington Office

Peter.Lahm@USDA.gov

202-205-1084 // 602-432-2614 Cell

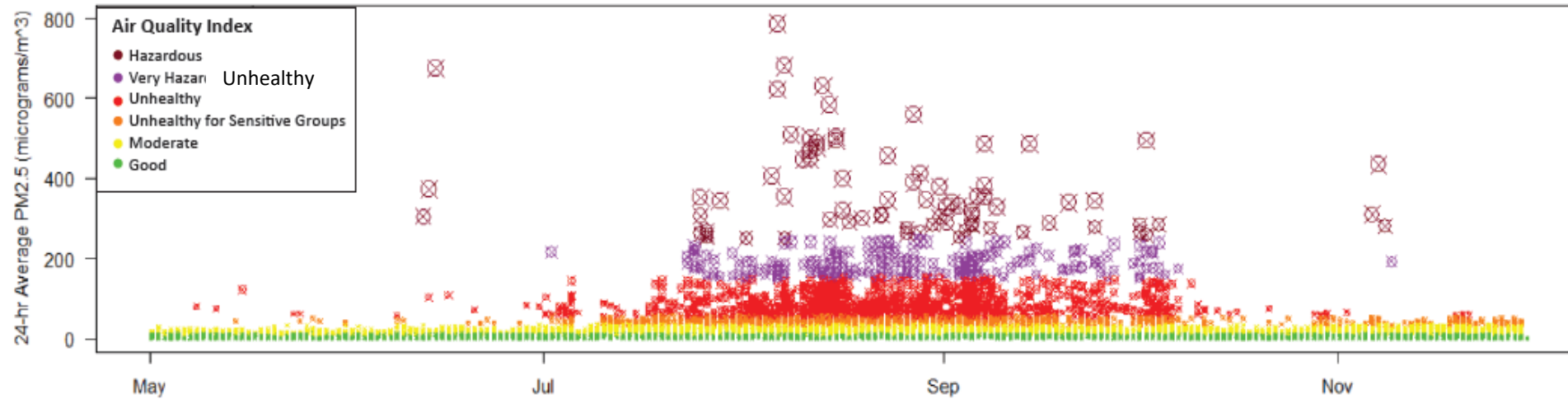


wildlandfiresmoke.net

Wildfire Smoke

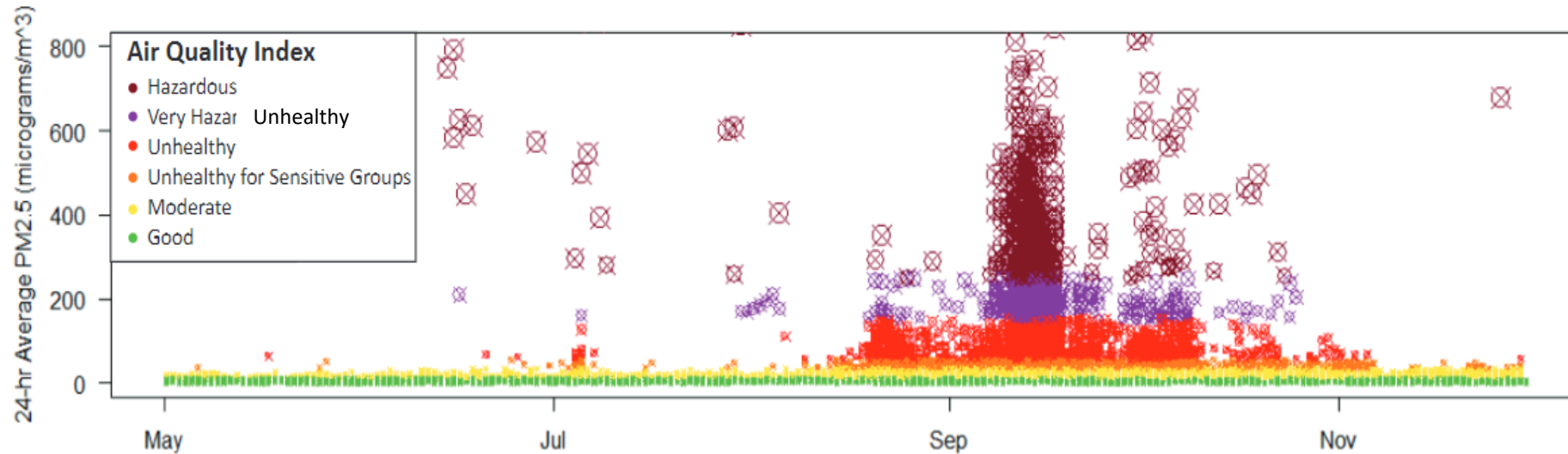
Timing of 2021 Smoke Impacts at All Western US Monitors

(by Air Quality Index (AQI) Level)



Timing of 2020 Smoke Impacts at All Western US Monitors

(by Air Quality Index (AQI) Level)



Interagency Wildland Fire Air Quality Response Program

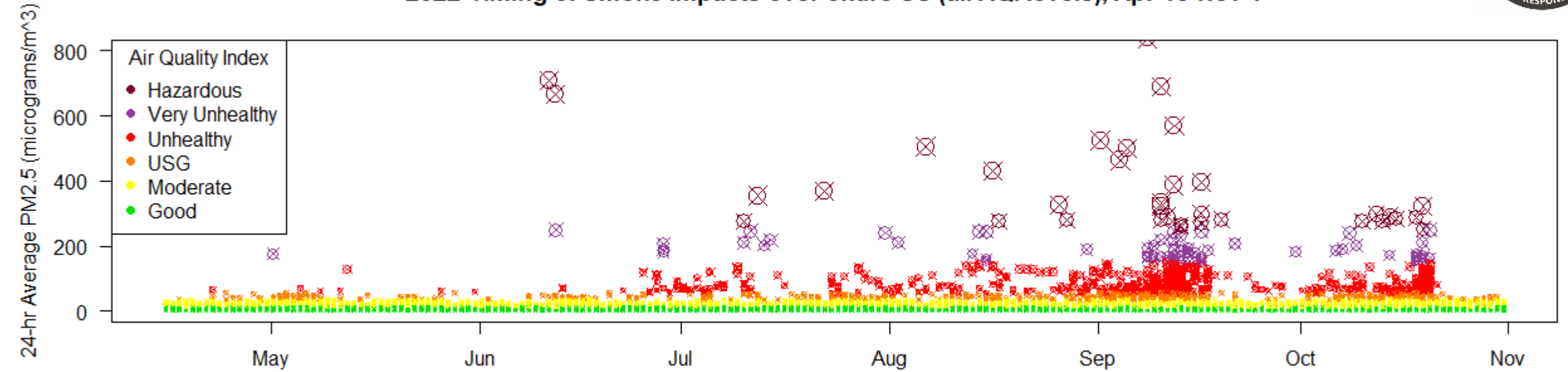


Number of regulatory monitor days above 24-hour NAAQS: 2020 is 4000+ days and 2021 is 3000+ days.

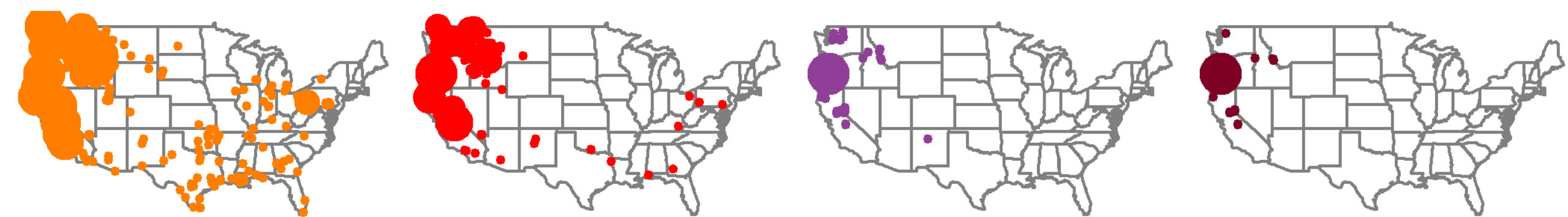
2022 has 1000+ days above 35 from wildfire Smoke



2022 Timing of Smoke Impacts over entire US (all AQI levels), Apr 15-Nov 1



2022

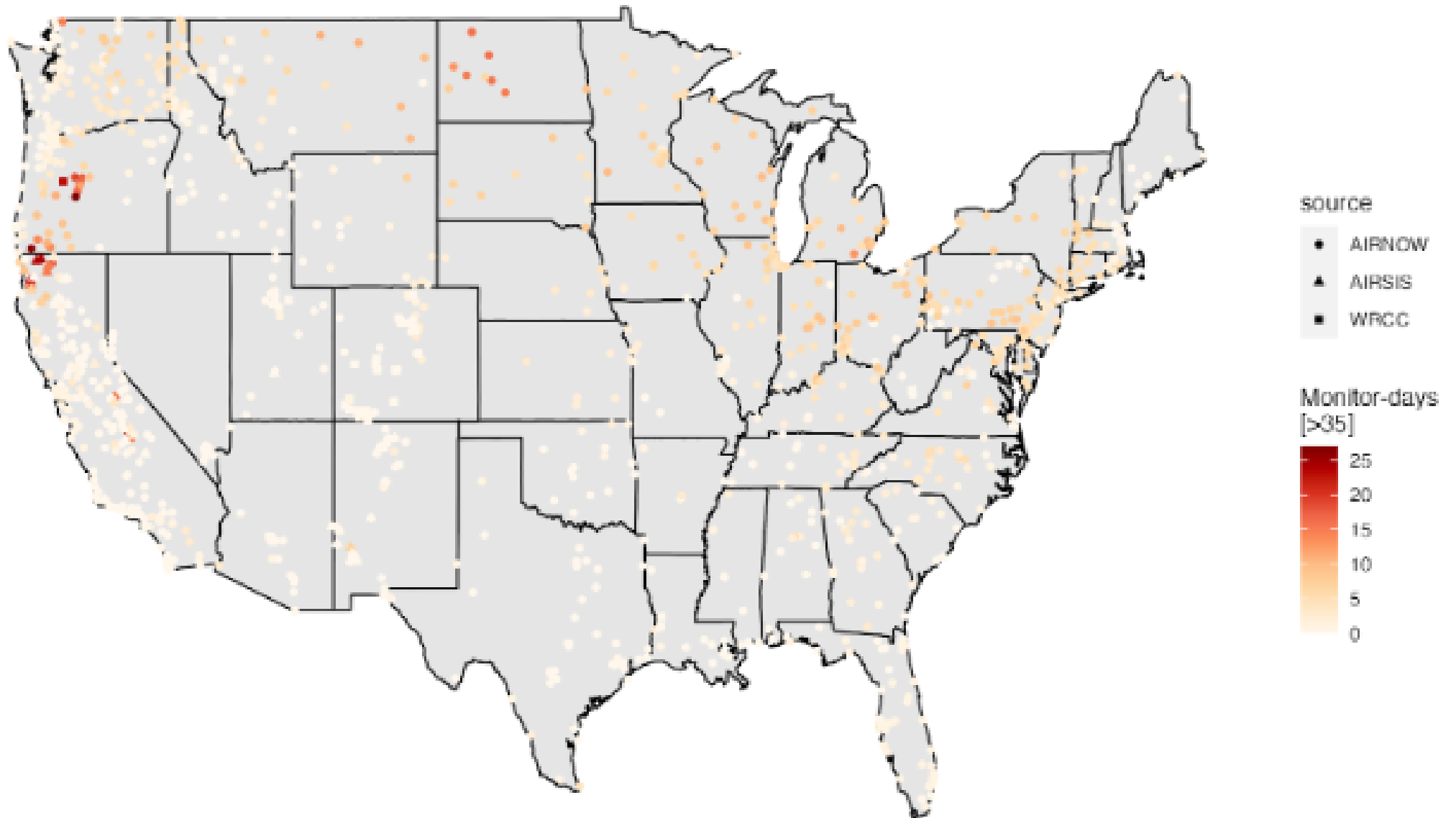


Number of days

- 1-6
- 7-13
- 14-20
- 21-27
- 28+

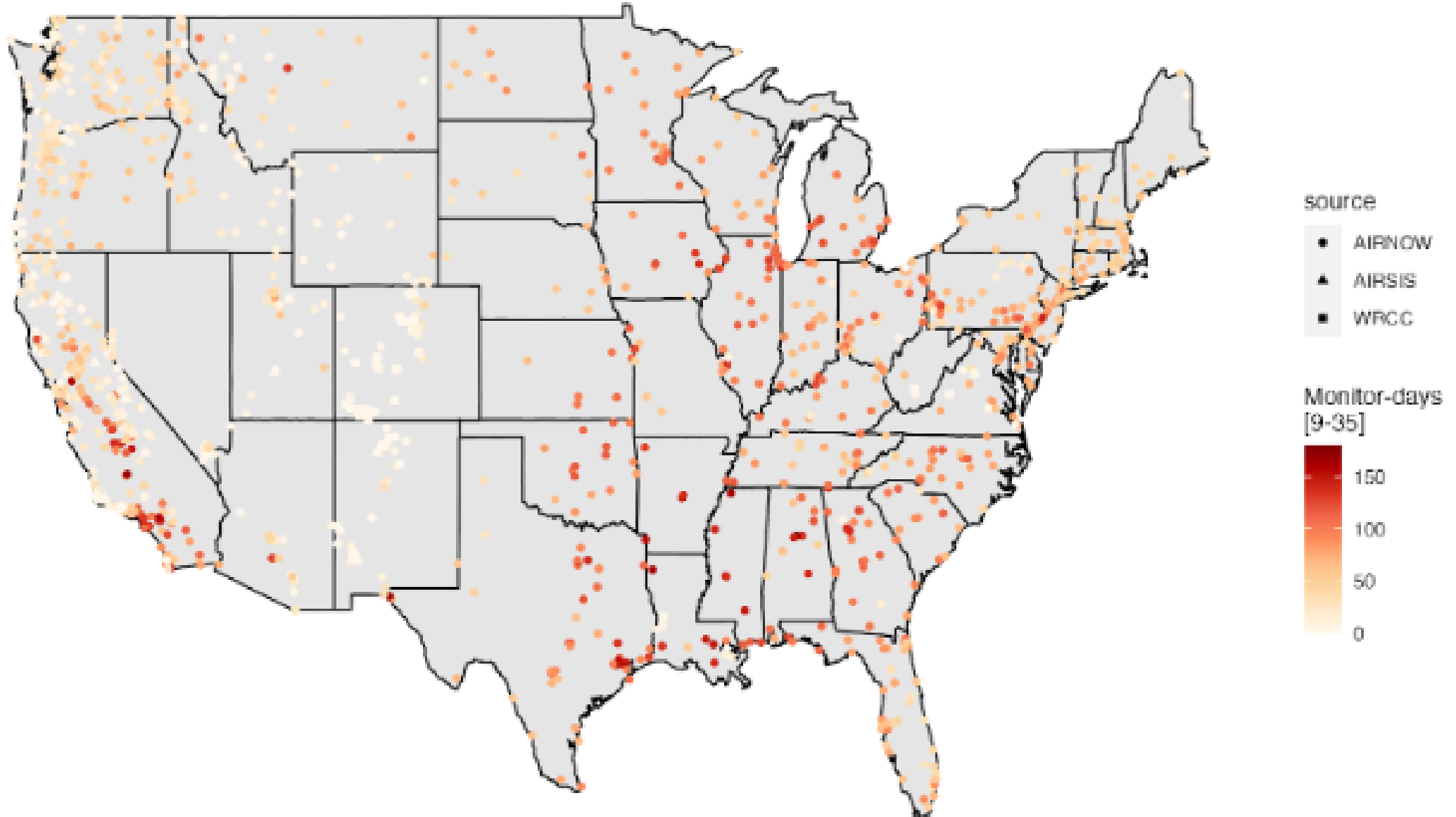
2023 (May 1-November 30) Some Wildfire Smoke Influences in the 9-35 Range?

***No FEM/FRM data correction applied

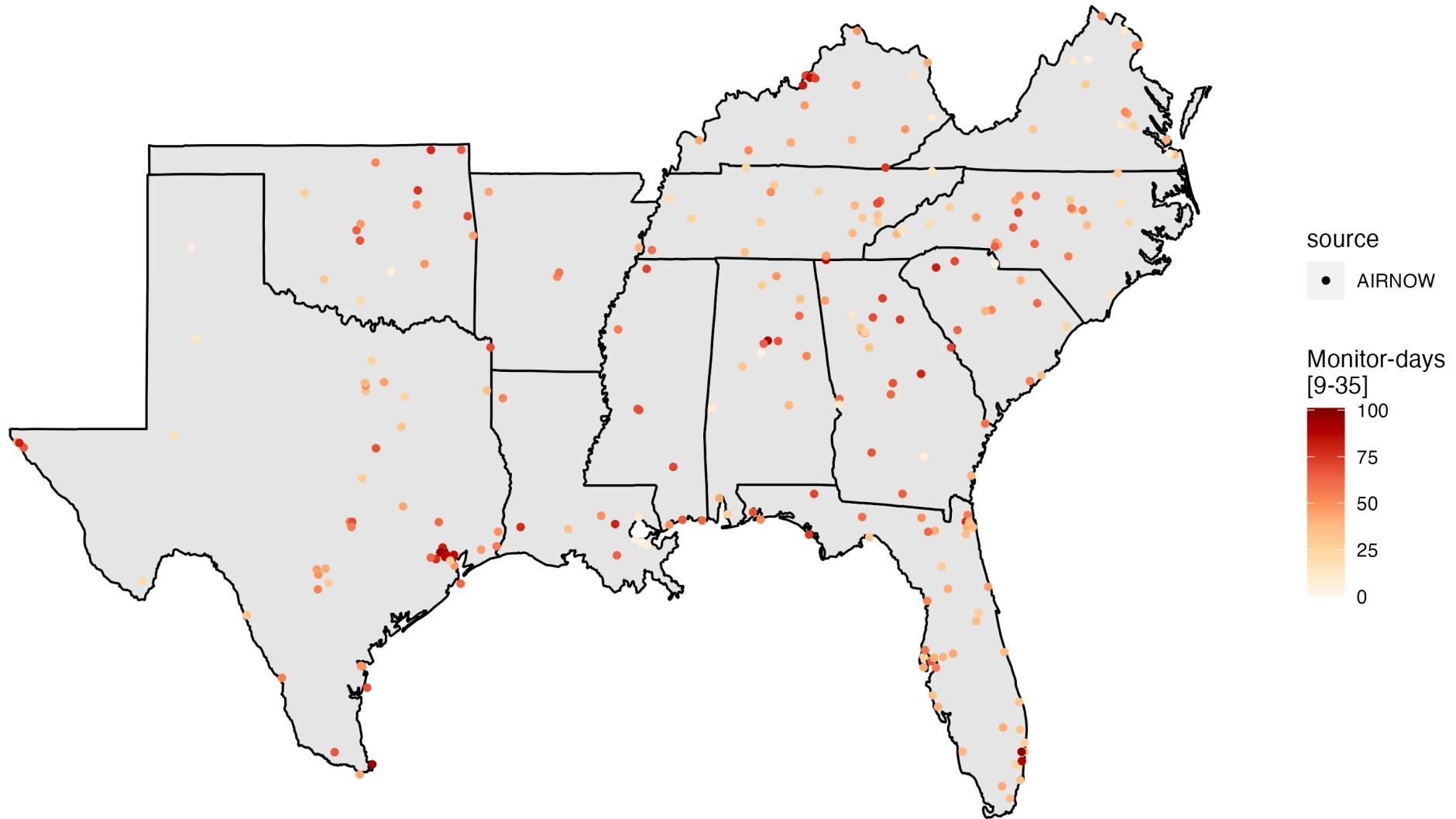


2023 (May 1-November 30) Some Wildfire Smoke Influences in the 9-35 Range?

***No FEM/FRM data correction applied



2023 (December 1-31 and January 1-May 1) Some Prescribed Fire Smoke Influences in the 9-35 Range???*??





EPA NAAQS for Particulate Matter

- Nonattainment Designation Process
 - Nonattainment Areas- Initial 2021-2023, Final 2022-2024
 - Exceptional Events Rule Demonstrations for wildfire and prescribed fire anticipated nationally
 - Accurate emissions for WF and Rx (by day and location)
 - 2021 has 3000+ monitor days (mostly west but some Midwest) above NAAQS 24-hr Standard
 - 2022 has 1000+ monitor days (mostly west)
 - 2023 has 3000+ monitor days (more west also national smoke impacts from Canada and Mexico)
 - 2024 has ?????? Important collaboration and documentation opportunity
 - ***No FEM/FRM data correction applied

Interagency Wildland Fire Air Quality Response Program

March 2019 Authorized by US Congress
 S.47 - John D. Dingell, Jr. Act/ (Public Law 116-9)

Air Resource Advisors* – dispatched as part of Incident Management Teams

- **Modeling:** BlueSky smoke dispersion modeling and others
- **Monitoring:** National caches of 50 PM2.5, 200+ CO, 13 COHb units (\$1m+, FS/EPA/FWS)
- **Monitoring:** Data display and analysis including PurpleAir (w/EPA)
- **Messaging:** Daily Smoke Outlooks (local focus via web, fire traplines & meetings)
- **Coordination:** w/state/tribal/local air quality regulatory agencies, public health dept. and impacted communities

Enables: reduction of smoke exposure through behavior modification messages (public & personnel), provide roadway smoke forecasting (when needed)

2020 ARA Smoke Outlooks covered area of 63 million people

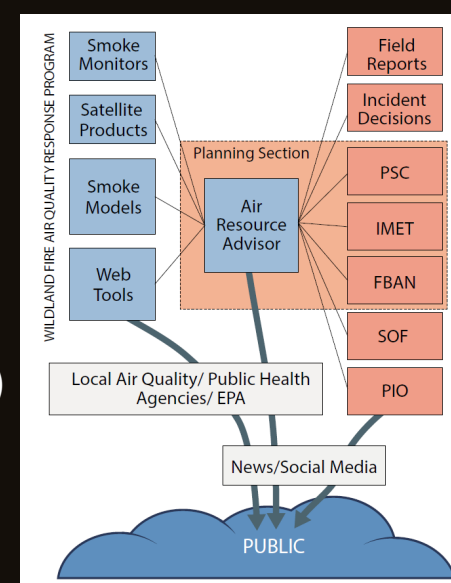
2021 ARA Smoke Outlooks covered area of 33 million people

2023 ARA Smoke Outlooks covered area of 31 million people

*Currently 85 ARA's and 10 trainees with backgrounds of wildland fire, air quality, meteorology, multiple entities represented including: FS, BLM, NPS, FWS, EPA, State Forestry (NC, GA, FL, OR, MO) Tribes, NWS, NRCS, CDC, AD-Contract, State/County, Air/Regulatory/Health (NC,, N Sierra, Placer County)

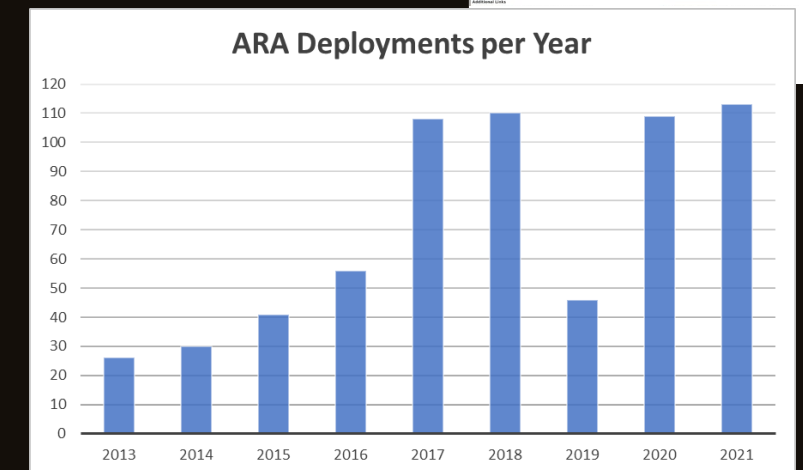
Ordered as a Name Request THSP through the Program Leader (like an IMET)

ARA's work as part of the Incident Management Team –see wildlandfiresmoke.net



Station	Yesterday	Today	Comment for Today - Mon, Aug 30	Forecast*	Mon Tue
Burney	Unhealthy	Unhealthy	Unhealthy conditions expected through the day, impacted by smoke from other fires.	Unhealthy	Unhealthy
Mineral	Unhealthy	Unhealthy	Unhealthy conditions expected through midday, improving in the afternoon.	Unhealthy	Unhealthy
Chico	Unhealthy	Unhealthy	Very Unhealthy air quality through midday with improvement in the evening (due to breeze).	Unhealthy	Unhealthy
Paradise	Unhealthy	Unhealthy	Unhealthy for Sensitive Groups expected midday improving to Moderate in the afternoon/evening.	Unhealthy	Unhealthy
Chico	Unhealthy	Unhealthy	Unhealthy for Sensitive Groups through midday with improvement expected this afternoon/evening.	Unhealthy	Unhealthy
Groville	Unhealthy	Unhealthy	Unhealthy for Sensitive Groups through midday with improvement expected this afternoon/evening.	Unhealthy	Unhealthy
Scarsville	Unhealthy	Unhealthy	Unhealthy air quality through midday with improving conditions this evening.	Unhealthy	Unhealthy
Dayle	Unhealthy	Unhealthy	Unhealthy for Sensitive Groups expected through the day.	Unhealthy	Unhealthy
Paradise	Unhealthy	Unhealthy	Periods of Unhealthy air quality midday with improvement in the afternoon/evening.	Unhealthy	Unhealthy

June 2024 ARA Training Class!



Evolution of the IWFAQRP - March 2019 Authorized by US Congress S.47 - John D. Dingell, Jr. Conservation, Management, and Recreation Act



SEC. 1114. WILDFIRE TECHNOLOGY MODERNIZATION.

(a) PURPOSE.

—The purpose of this section is to promote the use of the best available technology to enhance the effective and cost-efficient response to wildfires—

- (1) to meet applicable protection objectives; and
- (2) to increase the safety of—
 - (A) firefighters; and
 - (B) the public.

(f) SMOKE PROJECTIONS FROM ACTIVE WILDLAND FIRES.

—The Secretaries shall establish a program, to be known as the “Interagency Wildland Fire Air Quality Response Program”, under which the Secretary concerned

- (1) to the maximum extent practicable, shall assign 1 or more air resource advisors to a type 1 incident management team managing a Federal wildland fire; and
- (2) may assign 1 or more air resource advisors to a type 2 incident management team managing a wildland fire.



Air Resource Advisors

Smoke Outlook
9/6 - 9/7

Central Oregon Cedar Creek Fire

Issued: 2022-09-06 10:20 (PDT) U.S. Interagency Wildland Fire Air Quality Response Program
By: Dan Byrd, ARA (240) 778-5278

Special Statement
Red Flag Warning in effect for today for dry and very unstable conditions. 3 Day Smoke outlook available at: <https://outlooks.airfire.org/outlook/7f95b6c6?preview=true>

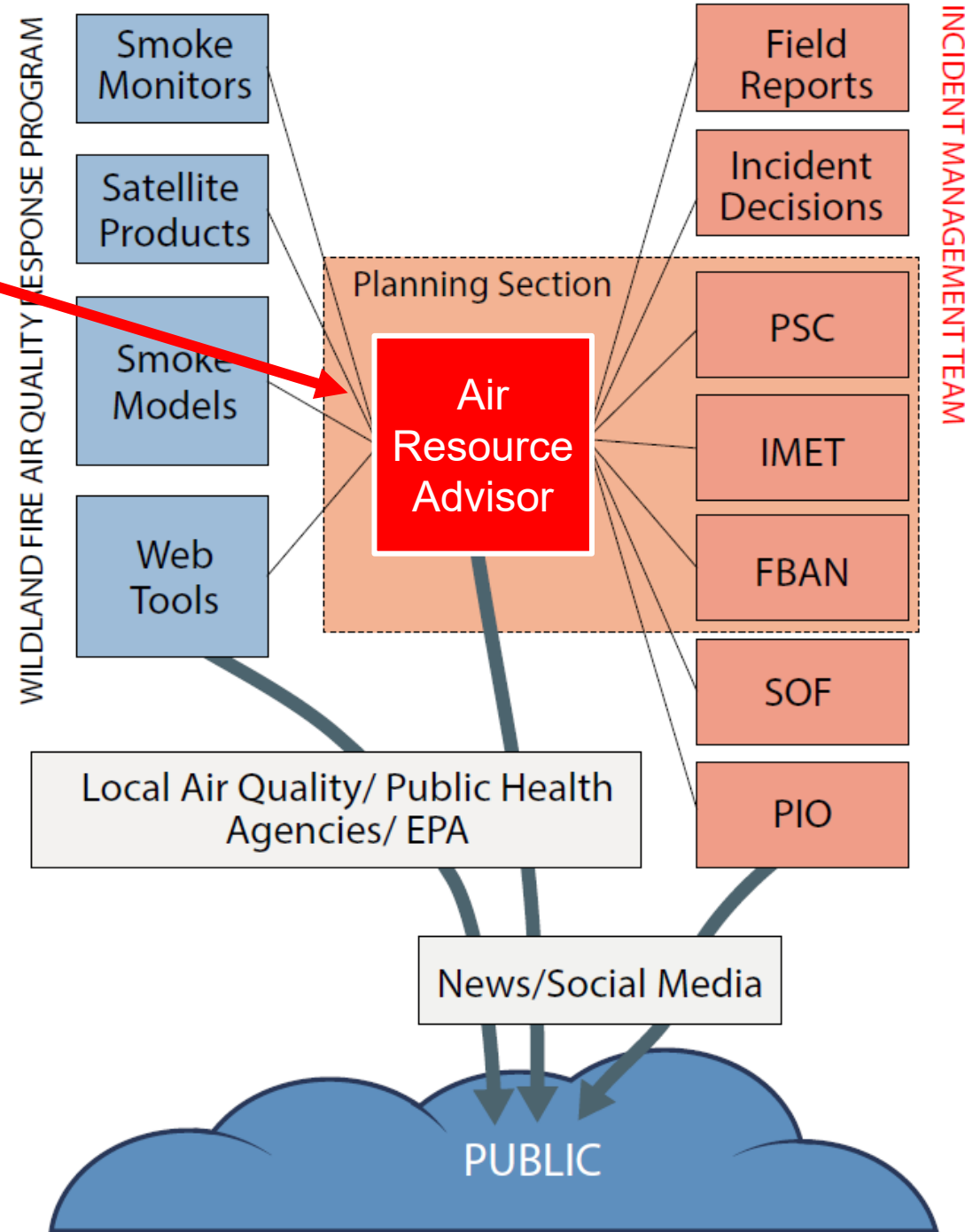
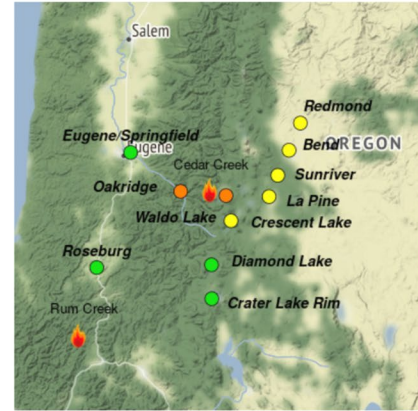
Fire
The Cedar Creek Fire in Central Oregon is 18,143 acres with 12% containment. The fire grew 518 acres yesterday. We are expecting active to very active fire activity today, with hot temperatures, lower relative humidity values and a very unstable atmosphere.

Smoke
Areas east of the Cedar Creek fire will continue to have the greatest smoke impacts today with La Pine, Sunriver and Bend in the moderate range. Oakridge will have an increase in smoke impacts today with USG to unhealthy this morning into the afternoon hours. Easterly flow may bring increasing smoke to Eugene/Springfield early on Wednesday. Expect moderate, possible USG conditions in the morning, improving to moderate to good in the afternoon.

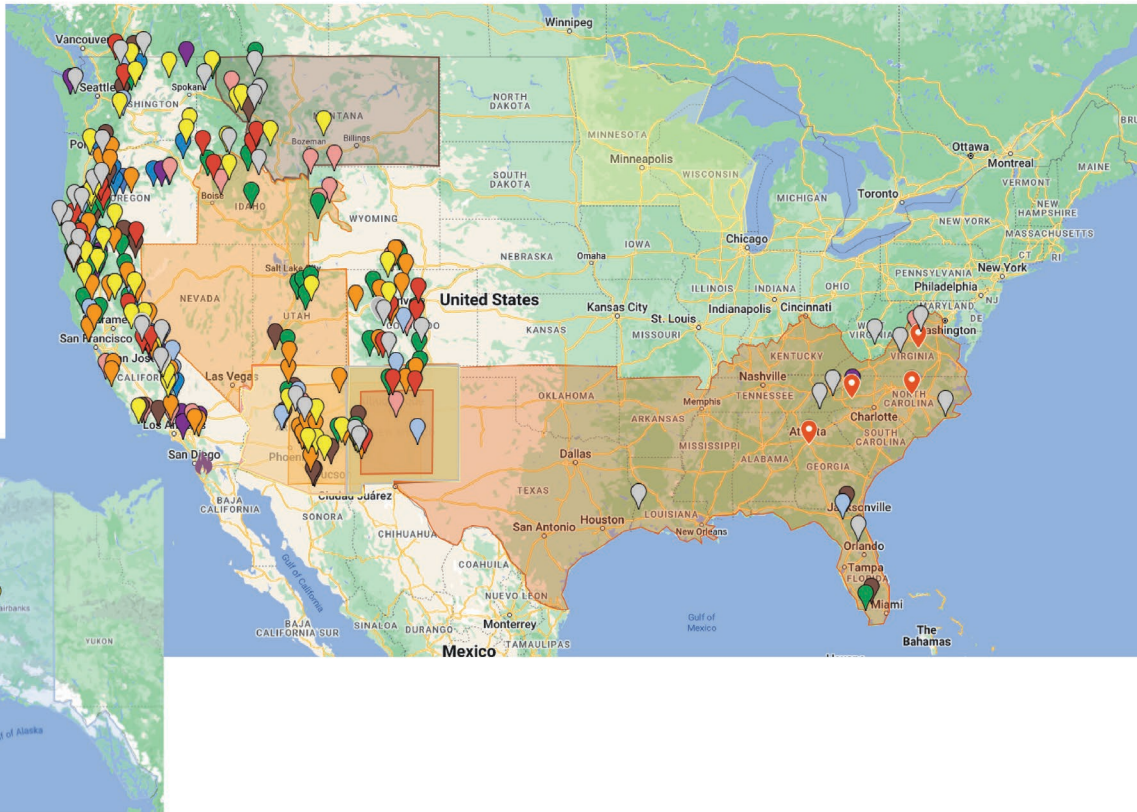
Health and Safety Message
Do you know how to check your local air quality? Try out the map at fire.airnow.gov for current conditions. For real time information see Fire.airnow.gov, oakridgeair.org, and LRAPA - Today's Current Air Quality.

Oakridge
Sunriver
Redmond
La Pine
Diamond Lake
Roseburg
East Waldo Lake
Eugene/Springfield

Crescent Lake
Crater Lake
Bend

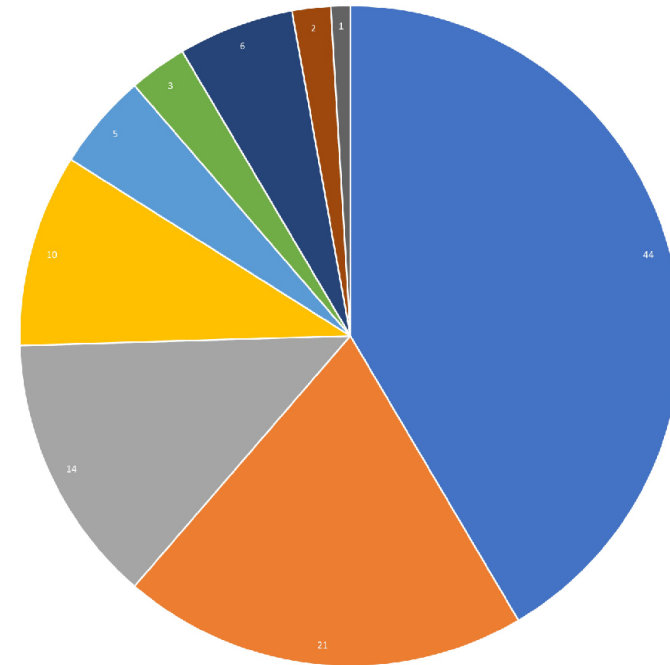


Annual ARA Deployments



- 2014
- 2015
- 2016
- 2017
- 2018
- 2019
- 2020
- 2021
- 2022
- 2023
- Prescribed Fire '22
- Prescribed Fire '23

ARAs by Agency



- US Forest Service - 44
- AD - Casual Hire - 21
- DOI - 14
(BLM, NPS, OWF, USFW, USGS)
- Environmental Protection Agency - 10
- State/Local Air Regulatory - 6
- State Forestry - 5
- National Weather Service - 3
- CDC - 2
- Tribal - 1



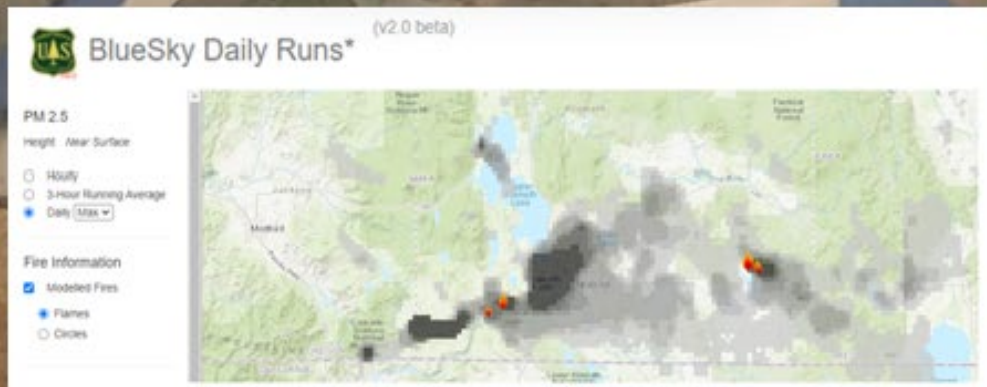
Contributions from ARA's



Monitoring



ARA Ali Kamal (EPA) on the Monument Fire



Modeling

"Thanks so much for your work! It has been truly amazing to see the improvement in communication on these fires over the last decade."

Liz Walker, Director Clean Air Methow.

Smoke Outlook for 8/30 - 8/31
Eastern Sierra - Dixie Fire
 Issued at: 2021-08-30 18:38 PDT

Special Statement
 The National Weather Service has issued a Red Flag Warning beginning at 2pm today (Monday) lasting through 2:00pm tomorrow (Tuesday).

Fire
 The Dixie Fire is 771,183 acres, an increase of 7,045 acres since yesterday, with 48% Containment. Active to extreme fire behavior is expected on the northern and southeastern perimeters of the fire. Additional information: [Incidents](#)

Smoke
 Moderate to strong westerly winds over the region today will continue to lift and transport lingering heavy smoke, as well as new smoke, off to the northeast. Most communities in the forecast area (shown in the map to the right) should see air quality improve into the Moderate range this afternoon and evening; however, daily averages are expected to be near USG. The exception will be Susanville, downwind of active fire, where dense smoke is expected to persist. Additionally, smoke from other fires in Northern California may drift into the northern end of the forecast zone and impact Burney, limiting their improvement. This trend will continue through tomorrow as generally improved air quality returns.

Daily AQI Forecast* for Aug 30, 2021

Station	Yesterday hourly	Sun 8/29	Forecast* Mon, Aug 30	Mon Tue 8/30 8/31
Burney	No smoke	Unhealthy for Sensitive Groups	Unhealthy conditions expected through the day, impacted by smoke from other fires.	Unhealthy for Sensitive Groups
Mineral	Unhealthy for Sensitive Groups	Unhealthy for Sensitive Groups	Unhealthy conditions expected through midday, improving in the afternoon/evening.	Unhealthy for Sensitive Groups
Chester	Very Unhealthy	Very Unhealthy	Very Unhealthy air quality through midday with improvement in the evening (daily average of Unhealthy).	Very Unhealthy
Quincy	Unhealthy for Sensitive Groups	Unhealthy for Sensitive Groups	Unhealthy for Sensitive Groups expected midday improving to Moderate in the afternoon/evening.	Unhealthy for Sensitive Groups
Paradise	Unhealthy for Sensitive Groups	Unhealthy for Sensitive Groups	Unhealthy for Sensitive Groups through midday with improvement expected this afternoon/evening.	Unhealthy for Sensitive Groups
Chico	Unhealthy for Sensitive Groups	Unhealthy for Sensitive Groups	Unhealthy for Sensitive Groups through midday with improvement expected this afternoon/evening.	Unhealthy for Sensitive Groups
Oroville	Unhealthy for Sensitive Groups	Unhealthy for Sensitive Groups	Unhealthy for Sensitive Groups through midday with improvement expected this afternoon/evening.	Unhealthy for Sensitive Groups
Susanville	Unhealthy for Sensitive Groups	Unhealthy for Sensitive Groups	Unhealthy air quality through midday with improving conditions this evening.	Unhealthy for Sensitive Groups
Doyle	Unhealthy for Sensitive Groups	Unhealthy for Sensitive Groups	Unhealthy for Sensitive Groups expected through the day.	Unhealthy for Sensitive Groups
Portola	Unhealthy for Sensitive Groups	Unhealthy for Sensitive Groups	Periods of Unhealthy air quality midday with improvement in the afternoon/evening.	Unhealthy for Sensitive Groups

Issued 2021-08-30 18:38 PDT by Wendy Wagner, ARA, wendy_wagner@firenet.gov

Air Quality Index (AQI)

AQI	Color	Actions to Protect Yourself
0-50	Green	None
51-100	Yellow	Unusually sensitive individuals should consider limiting prolonged or heavy exertion.
101-150	Orange	People within Sensitive Groups should reduce prolonged or heavy outdoor exertion.
151-200	Red	People within Sensitive Groups should avoid all physical outdoor activity.
201-300	Purple	Everyone should avoid prolonged or heavy exertion.
300+	Brown	Everyone should avoid any outdoor activity.

*Disclaimer: This forecast is based on fire particulates only; smoke is not included. Forecasts may be wrong; use at own risk. Use caution as conditions can change quickly. See your health professional as needed. Smoke sensitive groups should take appropriate precautions.

Additional Links

Messaging



Public Health

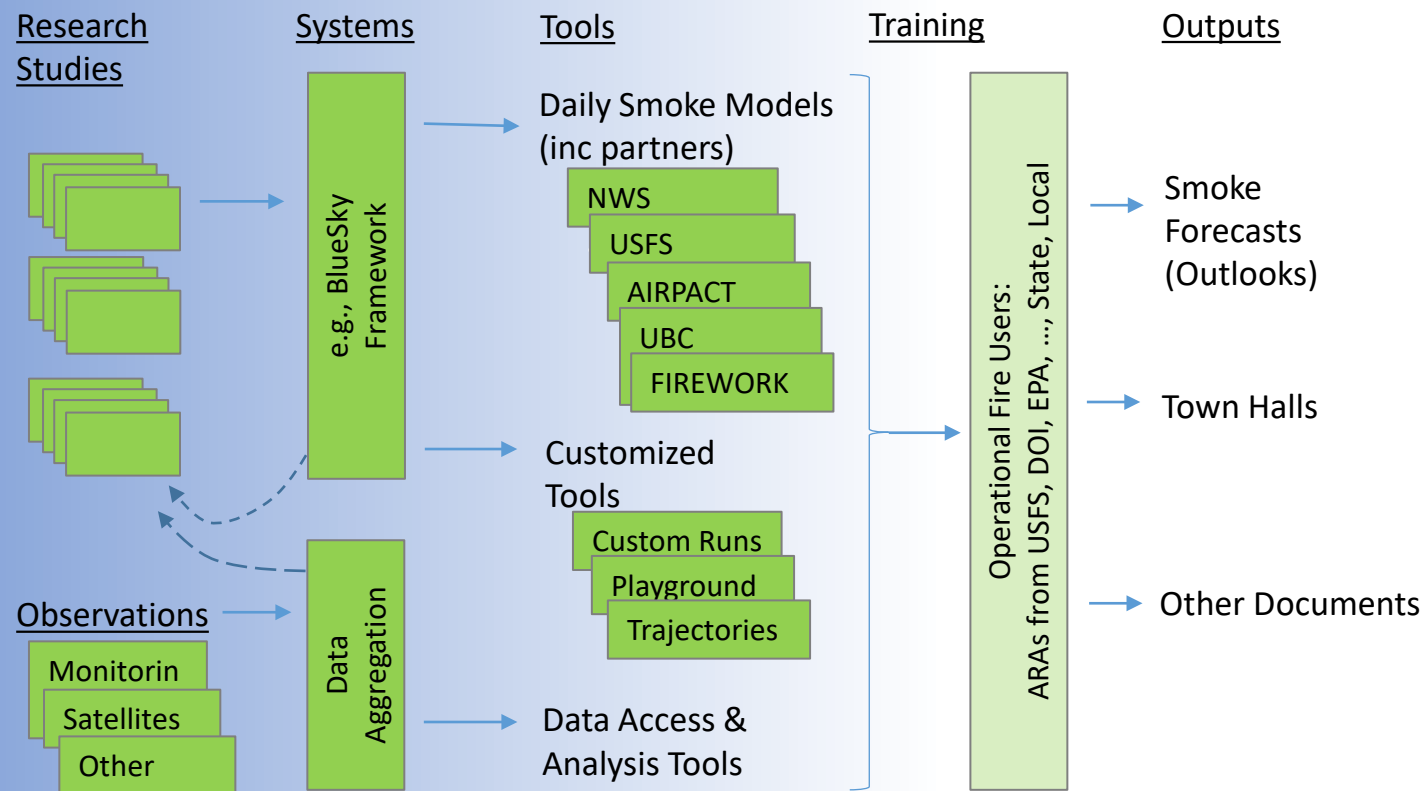


Smoke and Fire

- On average, over 7,000,000 acres of wildfire per year (U.S.)
 - Doesn't count 12,000,000+ acres of prescribed burning
-
- Wildfires are the single biggest source of high-level air quality impacts (in U.S.)
 - Single fires have been known to cause significant impacts to millions
 - But multiple regional fires are common and can collectively impact large areas of the country
 - Fires differentially impact rural communities
 - Also those with respiratory issues (1 in 3 households)
 - E.g. children with asthma, COPD, emphysema
 - Wildfire response efforts have expanded beyond physical property and safety, now includes air impacts



USFS AirFire and Partners' work within the Interagency Wildland Fire Air Quality Response Program



Transportation Safety



Recent fatal road and smoke incidents

- Wildfire and prescribed fire
 - Not just Superfog situations
 - Unexpected smoke on the road that obscures vision
 - Public and fire personnel risk
 - 2024 has incidents too...

Kentucky 11/16



Arizona 10/16



Kansas 2-17



Firefighter Exposure: Safety & Health





IWFAQRP Carbon Monoxide Monitoring and Response Pilot

Preliminary Information for Building a Framework for Understanding CO and its Impacts on the Public and Firefighters

- In 2020 in response to symptom reporting: IWFAQRP drafted a Carbon Monoxide – Emergency Response Plan for Monitoring and Mitigations
- USFS National Technology Development Program assisting IWFAQRP with a pilot cache of CO data loggers (CO Pens) now at our National Rocky Mt Cache
- CO Pens and MSA CO Monitors limited deployment in 2020 growing every year
- Masimo RAD-57 Carboxyhemoglobin (COHb) units available through ARA for IMT's and MEDL's who wanted them
- CO Monitoring and Response continuing in 2023 focused on off-line exposure, especially ICP and Spike Camps
- All PM2.5 cache monitors include CO for 2024



Carbon Monoxide – Emergency Response Plan for Monitoring and Mitigations

The purpose of this plan is to provide the framework for monitoring and mitigating potential Carbon Monoxide (CO) exposure to fire personnel in both Incident Command Posts (ICP) and ground-supported spike camps. Concerns have been raised about possible CO exposure risks at a number of ICP's and spike camps subjected to very high and persistent smoke impacts. In response, the Interagency Wildland Fire Air Quality Response Program (IWFAQRP) has attempted to coordinate a rapid but scientifically supported approach to understanding the risk of exposure, and monitoring to recognize the level of risk and identify possible mitigations. For this plan, the goal is a rapid central incident point of contact, provision of CO monitoring and detection of carbon monoxide poisoning. The Air Resource Advisors (ARA) are the central point for assisting Incident Management Teams and Agency Administrators with monitoring smoke and providing smoke outlooks for fine particulate matter (PM2.5) which with this plan will also support monitoring and helping develop mitigation strategies for CO as needed. The approach here is not aimed at fireline exposure determination, determining health effects of chronic exposure to smoke or for regulatory compliance. ICP and spike camps are the focus because firefighters after their shifts require periods of clean air to recover and individuals in ICP and supporting spike camps may not have the same level of health and fitness and could be more susceptible to CO exposure.

There are several data gaps in designing a monitoring plan for CO. There is uncertainty in the synergistic effects of multiple contaminants that are often present in smoke (CO, NOx, PM 2.5 and the associated constituents: benzene, aldehydes, etc) and how this mixture affects fire personnel since most risk levels are determined based on studies of individual contaminants. Reactions to CO exposure vary significantly between individuals. As a result, it is imperative that those individuals addressing CO exposure in camps use multiple metrics in their evaluation, from ambient measurements of CO, physical symptoms of CO exposure some of which can be similar to COVID-19, and potentially direct measurements of Carboxyhemoglobin (COHb) on individuals with symptoms to determine what level of rehabilitation or mitigation is required.

Carbon Monoxide Exposure and Symptoms:
The inhalation of combustion fumes (such as wildfire smoke, exhaust from chainsaws, engines, and/or pumps, heaters (salamanders), etc) leads to carbon monoxide exposure which can build up in the bloodstream. When exposed to high levels of CO, the body replaces the oxygen in red blood cells with carbon monoxide. This prevents oxygen from reaching tissues and organs.

- Symptoms of excessive CO (Poisoning) exposure is:
- Dull headache
 - Weakness
 - Dizziness
 - Fatigue
 - Nausea or vomiting
 - Shortness of breath
 - Confusion and impaired judgment
 - Blurred vision
 - Loss of consciousness

The display of symptoms varies widely from individual to individual and may occur sooner in susceptible individuals (younger or older people), people with preexisting lung or heart disease.





Interagency Wildland Fire Air Quality Response Program- 2023

Season in Review-

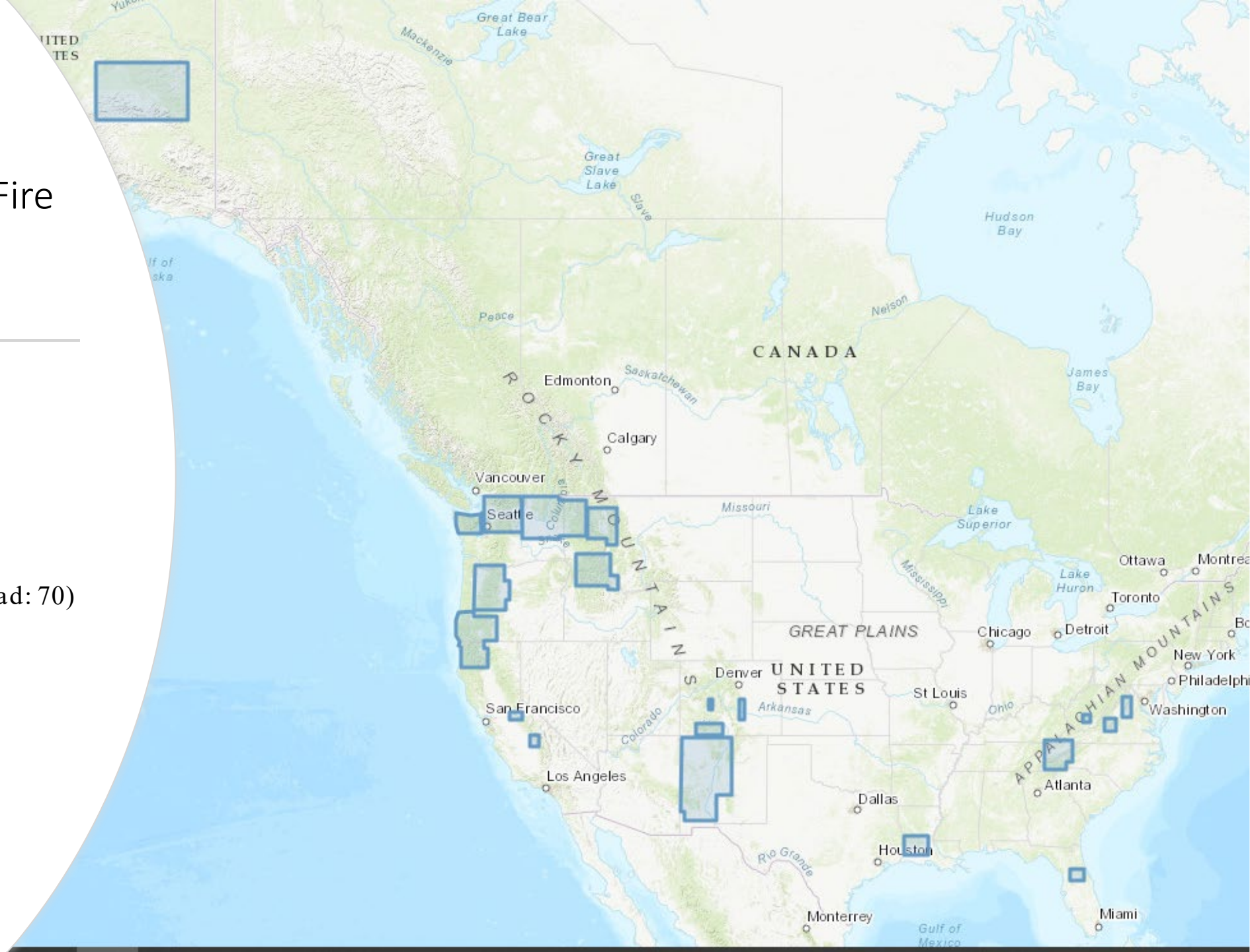
Incident total: 44
(2022 had: 30)

Rx: 3 (2022 had: 2)
Wf: 40 (2022 had: 28)

Total ARAs deployed: 84 (2022 had: 70)

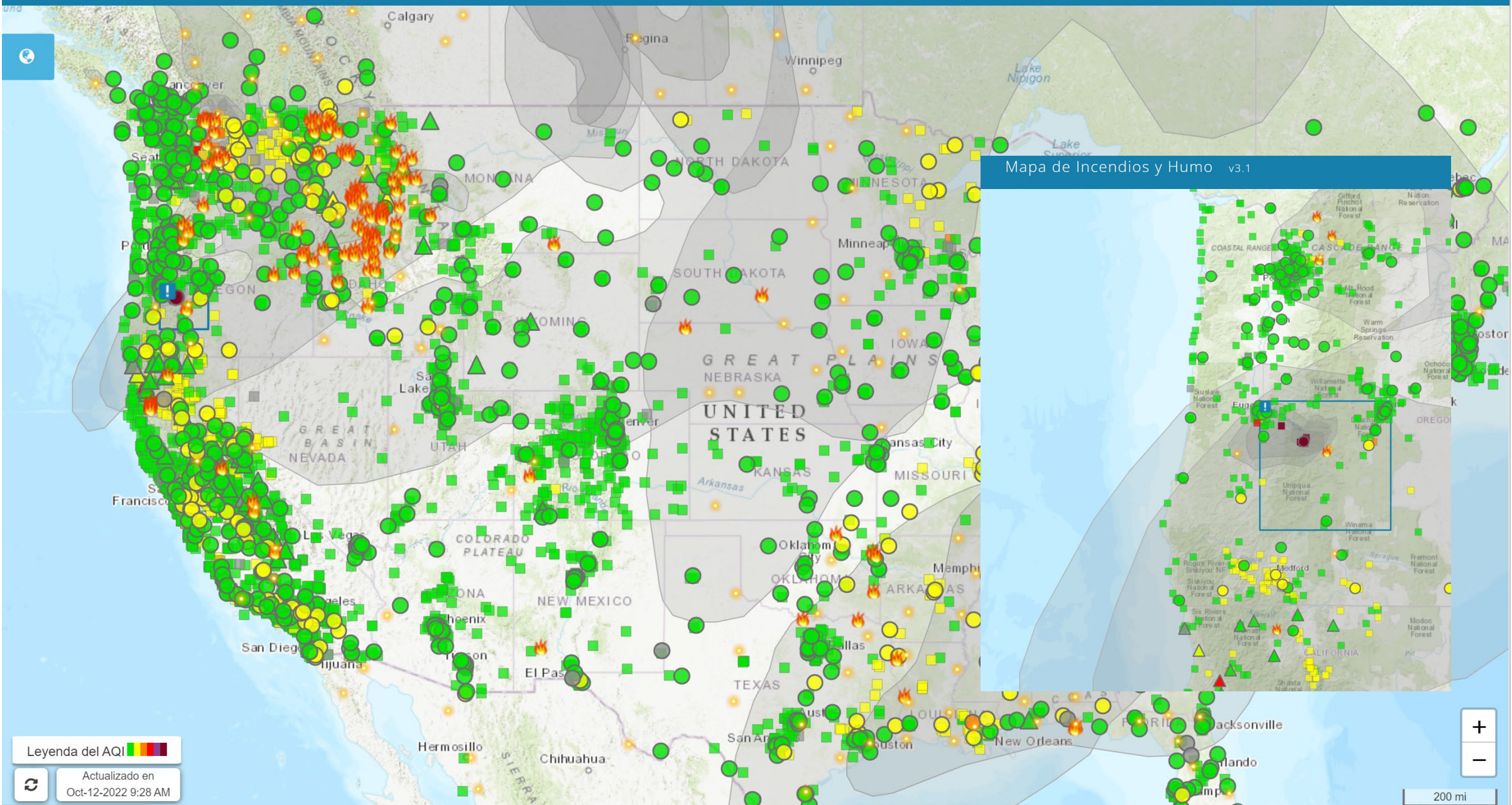
Remote ARA: 1
Canceled: 3
On site ARA: 80

Total Daily Outlooks: 584
Total Translated to Spanish: 578

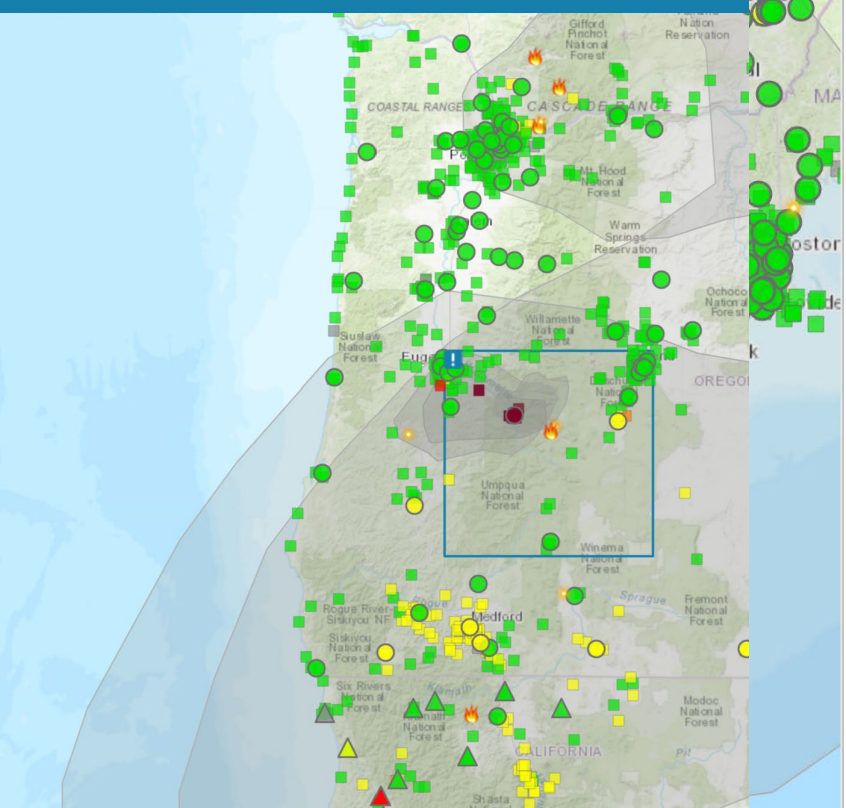




Mapa de Incendios y Humo v3.1



Mapa de Incendios y Humo v3.1



Leyenda del AQI
Actualizado en
Oct-12-2022 9:28 AM

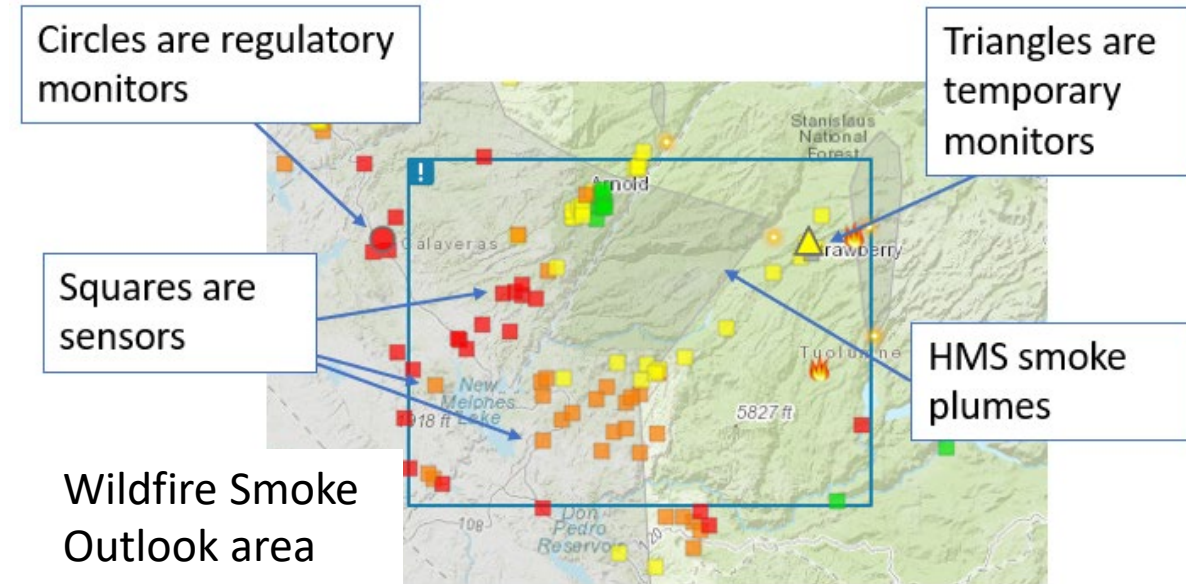


200 mi



Monitor Smoke Effects on Air Quality (PM 2.5)

- Be aware of the locations between regulatory monitors, temporary monitors, and air quality sensors ([Fire & Smoke Map](#)). All are useful in smoke communications and assessment of smoke transport, however only regulatory monitors are used for regulatory decisions, such as an exceedance of a standard.
- Smoke monitors are available for deployment, both within USFS regions and from the Rocky Mountain Cache (RMK) and EPA
 - RMK has 48 monitors for deployment at USFS and DOI sites/incidents, most will have CO sensors in addition to PM 2.5. In addition, RMK has 38 outdoor and 47 indoor Purple Air sensors available to order. Information on how to order monitors is at <https://www.wildlandfiresmoke.net/smoke-monitor-ordering> and more information about sensors can be found at <https://document.airnow.gov/using-air-quality-sensors-for-smoke.pdf>.
 - EPA WSMART program supports monitoring needs of IWFAQRP and states, Tribes and local air agencies with multiple sensor options (PM2.5 and other pollutants) including mobile monitoring tools used by ARA's (VAMMS).
- Fire and Smoke Map has sensors calibrated for smoke
- Many locations added everyday so worth looking in your area.
- Many sensor providers and many not calibrated for smoke!



Version 4.0 of Fire and Smoke Map out soon

Exceptional Event Reporting Support

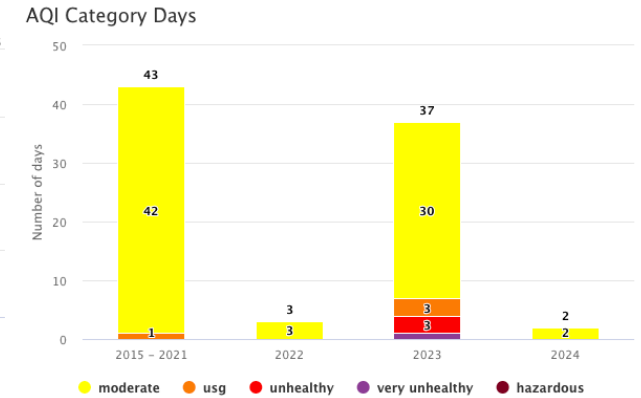
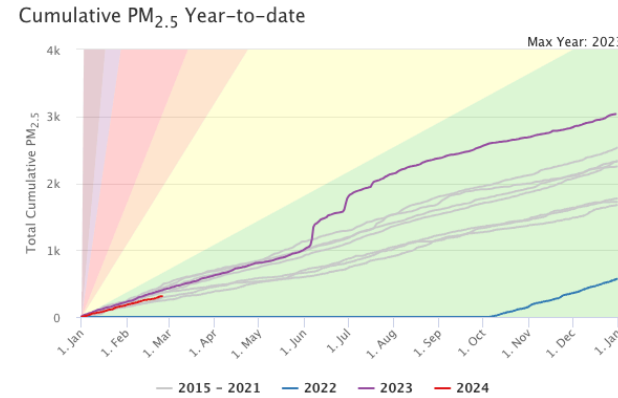
Web tools for EE support

Searchable data access to:

- PM2.5 permanent monitoring site daily averages from AirNow
- Air Resource Advisor Smoke Outlook discussions tied to WESTAR EE Demo Tool
- Smoke plumes (NOAA HMS)
- Other relevant data
- [Monitoring Historical \(prototype\)](#)
amazonaws.com

Onondaga-E Syracuse

New York Dept. of Environmental Conservation
Source: AirNow
Data From: Dec 2015 - Feb 2024
90.08% days reporting



Top 5 years

Year	Cumulative Exposure	Average Concentration
2023	3036.4	8.4
2021	2531.5	6.9
2020	2334.4	6.4
2019	2324.8	6.4
2015	2251.4	6.2

Top 5 Days

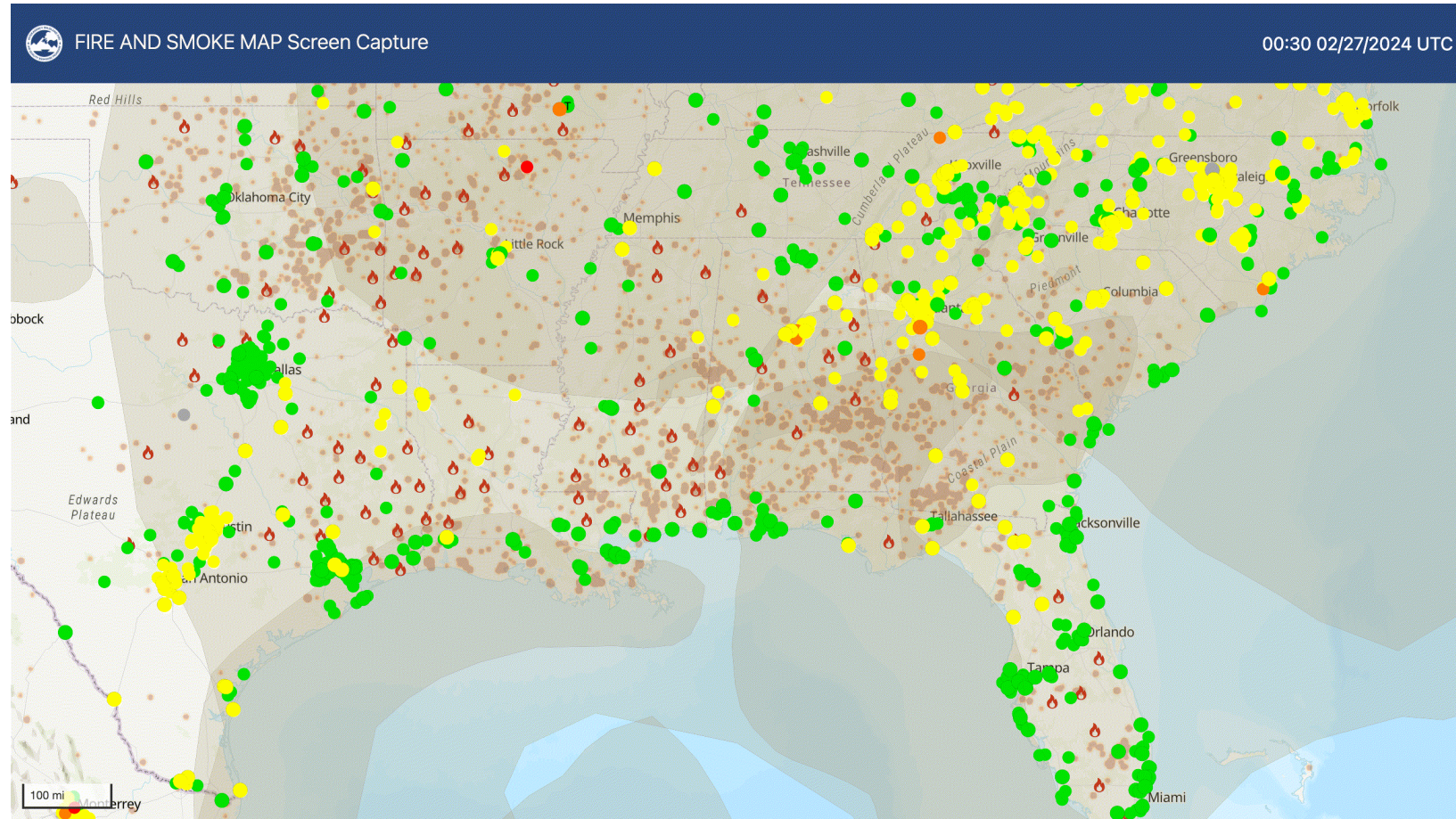
Date	Daily Average	AQI
6/7/2023	181.1	Very Unhealthy
6/6/2023	89.5	Unhealthy
6/29/2023	87.6	Unhealthy
6/30/2023	79.2	Unhealthy
7/17/2023	42.1	USG

2023



Smoke movement over time concept for Rx Fire EER Needs...

- Fire and Smoke Map image capture timeseries
- Different views (CONUS, regional)
- Being set up now for 2024+
- Will be web accessible / searchable



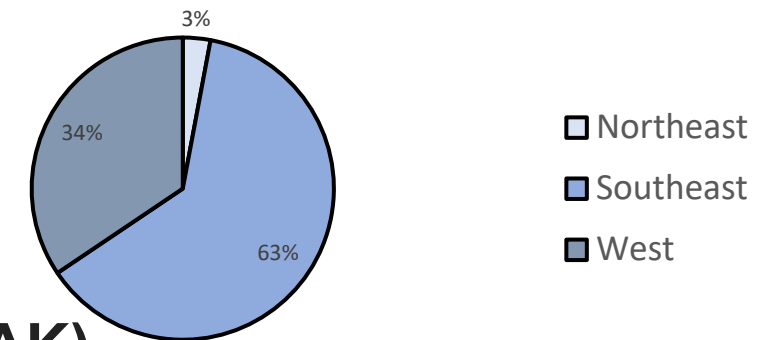
How many acres and how much smoke?

Burn Activity Data Matters



- **EPA 2020 National Emissions Inventory CONUS**
 - **Wildfire 10.3 million acres = USFS FPA FOD**
 - **Prescribed Fire 12.1 million acres**
 - **5.2M acres based on only satellite info (44%)**
 - **6.9M acres based on state or federal info**
 - **GA, FL & KS = 4.5M acres of the 6.9M**

2020 National Forestry
Prescribed Fire Activity by Region



- **Around 44% of all PM_{2.5} in the US CONUS in 2020 (not AK)**
 - **PM_{2.5} emissions are 2WF:1RX (29% WF)**

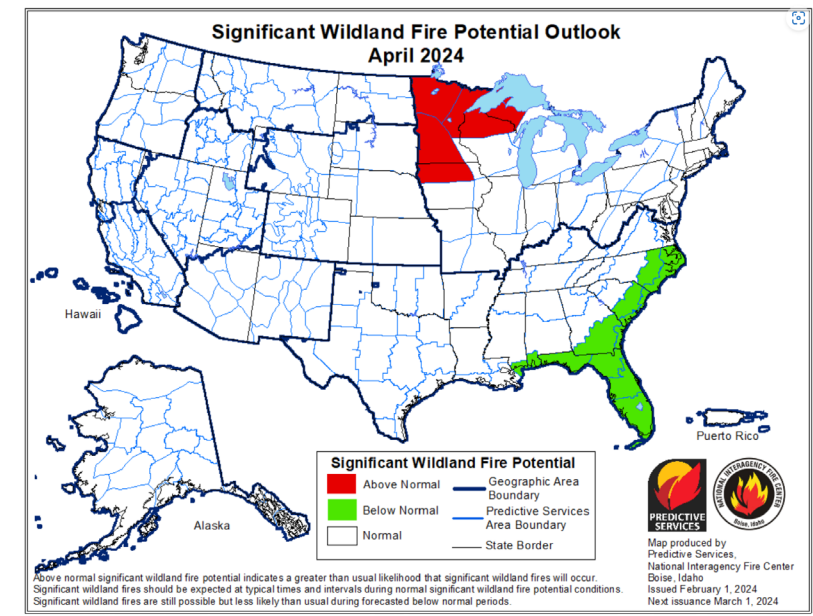
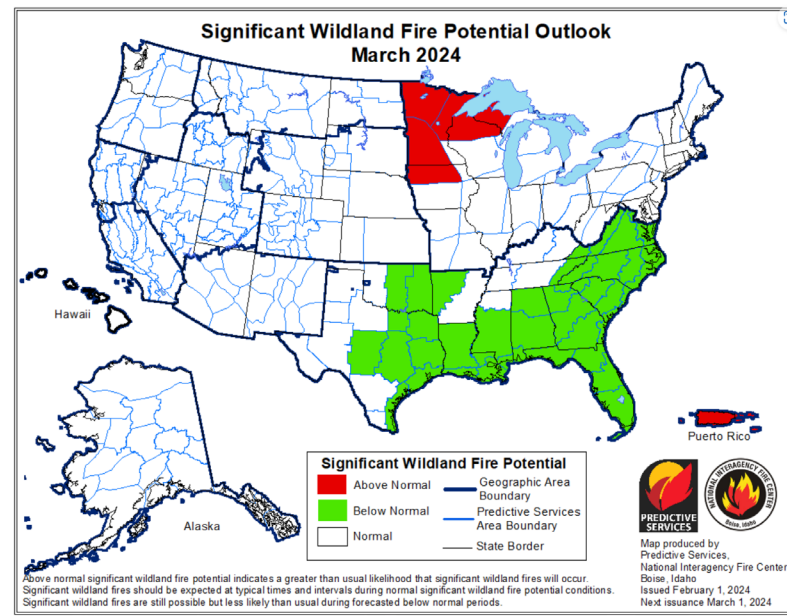
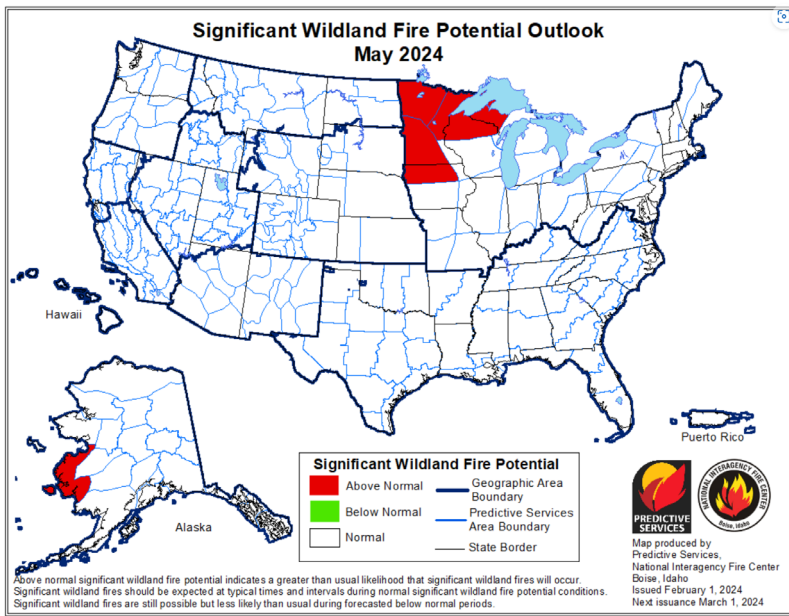
2020 Forestry Prescribed
Fire Activity by Ownership



- **NASF-CPFC 2020 Prescribed Fire 9.4M acres**
- **Temporally (day-specific) & spatially resolved data needed**
- **Fuels consumed: blackened acres needed (not treated)**
- **Near real-time Rx data needed for impact planning & mitigation**
- **The NEI basis of EPA modeling for NAAQS, future progress, regional haze, etc**

2024 Wildfire Seasonal Outlook

Update on the 1st of every month



149 Canadian Wildfires Currently (Zombie Fires and Smoke)

Opportunities for EER Data and Information

- Contact the ARA when a regulatory monitor is impacted for their documentation when available.
- We maintain a folder for each fire and ARA's maintain personal files as well which may have utility for a Demo.
- Continued EE Demo tool coordination and other products.
- Working on Rx Fire related EER tools and information.

Questions and Information

Pete Lahm

Leader - Interagency Wildland Fire Air Quality Response Program

Forest Service, Fire & Aviation Management, Washington Office

Peter.Lahm@USDA.gov

202-205-1084 // 602-432-2614 Cell

Need an ARA? (661)GET-1ARA

