

Promising Practices and Policy Gaps: Advancing Responses to Air Quality in the Context of Wildfires and Prescribed Burns at the Community Level

Nicholas Perry
Adele Cassola
Michael McCormack
Jody Heymann

WORLD Policy Analysis Center
June 2026

This work made possible by funding from the Gordon and Betty Moore Foundation

Executive Summary

The scale and intensity of wildfires and unhealthy and dangerous smoke conditions in North America is increasing year after year, endangering human health and well-being and with significant consequences for ecosystems. Populations are increasingly affected by the smoke from local wildland fires, fires at the wildland-urban interface, and from distant fires across borders. In the last 10-15 years, many communities have developed policies to monitor, forecast, respond to, and recover from smoke events. In particular, approaches are needed to protect a range of vulnerable and sensitive populations who are at an elevated risk during smoke events, including people with asthma and other lung diseases, people with cardiovascular disease, children, older adults, pregnant women, people with lower incomes, outdoor workers, and more. Additionally, a scientific consensus is emerging that one of the key tools to reduce the risk of catastrophic wildfire and sustainably manage forest ecology is the use of beneficial fire in the form of controlled, planned, and prescribed burns. Yet too often, preparations for prescribed fires, wildland fires, and the resulting smoke events are falling short or have gaps.

To identify and assess what's working to prepare for wildfire smoke events, ensure protection from smoke amidst wildfires and prescribed burns, and reliably measure and address air quality during and after wildfires, we spoke with more 150 stakeholders across the Western United States, British Columbia, Canada, and Victoria, Australia, focused on nine primary geographic case study locations and one topical focus area (paid climate leave). Core findings include:

Promising Practices: Air Quality Monitoring

- Moving beyond PM_{2.5} to more comprehensive models of monitoring
- Comparing indoor/outdoor air quality to ensure buildings are protecting people
- Forecasting the health impacts of air quality degradation to inform health response
- Using small air sensors to monitor air quality at a more localized level
- Reaching rural areas and other historically data-poor populations
- Expansion of monitoring networks to gather additional data for target populations

Promising Practices: Air Filtration, Clean Air Spaces and Clean Air Shelters

- Supporting the creation of a clean air sanctuary at home
- Reducing the costs of at-home air filtration at the population scale
- DIY Air Filters workshops and distribution programs
- Collectively re-imagining community clean air spaces
- Subsidizing retrofits and building clean air into building codes
- Utilizing paid climate leave policies to support and empower workers to protect health

Promising Practices: Advisory and Communications, Outreach, and Education

- Language translation, accessibility, and culturally relevant messaging
- Investing in emerging communities of practice and knowledge sharing networks
- Reframing some public health messaging to show “at-risk” groups are not a small minority of the population
- Using trusted messengers while seeking input from and giving ownership to stakeholders from affected communities
- Utilizing centralized websites, digital hubs, and other forms of streamlining public information sharing
- Integrating smoke and air quality advisories into existing weather and information systems
- Mock evacuations, simulations, and training drills
- Advocating for readiness and preparedness in advance of the smoke season and proactively working with communities to effectively host evacuees and others fleeing smoke and fire.

Promising Practices: Prescribed Burns and Public Health

- Recognition that community smoke readiness is the key pathway to acceptance of beneficial fire
- Public license is a continually evolving, iterative relationship, not a one-time threshold
- Forest collaboratives are a promising model for multi-stakeholder engagement
- Bringing together the expertise of on-the-ground firefighters and technical forecasting experts to evaluate large-scale prescribed burn opportunities
- Framing and leveraging prescribed fires as drills and opportunities to prepare communities

Policy Gaps, Challenges, and Next Frontiers

- Protecting the youngest lungs (children from 0-5 years old) during smoke events
- Engaging networks of caregivers that are the frontline point of contact for key vulnerable and sensitive groups
- Understanding and addressing mental and holistic health in wildfire smoke response

The following policy briefs outline the key lessons for policymakers, advocates, community members, and all working to advance responses to smoke challenges at the community level.

Background

The scale and intensity of wildfires in North America is increasing year after year, with significant consequences for ecosystems as well as human health and wellbeing. Wildfires are becoming more intense, burning larger areas, threatening communities and natural environments, and producing more smoke. Dangerous and unhealthy smoke events are occurring in rural communities, in urban areas, and at the wildland-urban interface, and may be from fires in nearby communities and forests or from hundreds or thousands of miles away. Year-by-year data from across the United States (Figure 1) shows an expansion in the parts of the country that are experiencing smoke events.¹ While the amount of wildfire varies annually, the long-term data shows an increase in scale and intensity of wildfire and the resulting smoke.

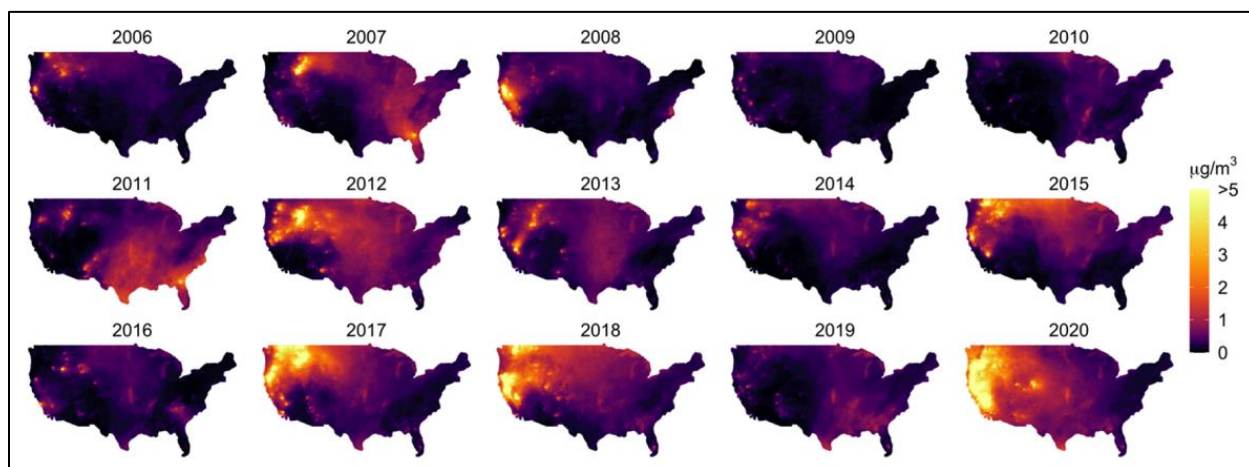


Figure 1: Daily average PM_{2.5} from smoke by year. Each panel shows average daily smoke PM_{2.5} in each location and each year, computed as the average over all days in each grid cell in each year.²

Wildfire smoke contains particulate matter (PM) that can be easily inhaled and lead to a range of health effects that have been well established by decades of research on ambient PM_{2.5} exposures.³ In addition to PM_{2.5}, wildfire smoke is a complex mixture composed of water vapor and numerous pollutants, gases, volatile organic compounds, and a range of particulate matter sizes, many of which can affect health.⁴ The exact smoke composition in a particular event varies based on location, severity, what the fire consumes, and a range of other factors.

The emerging epidemiological evidence on the health impacts of the increase in wildfire smoke exposure is significant: a recent study in *Nature* found that wildfire smoke already contributes to some 40,000 deaths each year in the United States, with expected increases under a variety of different future warming scenarios.⁵ Additionally, a scientific consensus is emerging that one of the key tools to reduce the risk of catastrophic wildfire and sustainably manage forest ecology is the use of beneficial fire in the form of controlled, planned, and prescribed burns.⁶

Every community has members of their population who are at-risk during smoke events. Certain populations and people in particular life stages are at greater risk of experiencing health effects and may experience more severe effects due to wildfire smoke. Epidemiologic evidence indicates that the risk of PM_{2.5}-related health effects varies throughout a lifetime, and that members of at-risk populations experience disproportionate health effects from smoke. These groups are commonly referred to as “at-risk” or “vulnerable and sensitive” populations, as defined in US Environmental Protection Agency (EPA) Air Quality Index (AQI).⁷ These include, but are not limited to:

People with chronic diseases

- *Asthma and other lung diseases:* Smoke exposure can trigger severe breathing responses in people with lung diseases.
- *Cardiovascular disease:* Smoke exposure can trigger severe cardiovascular events in people with underlying cardiovascular diseases and related conditions.

Life stages

- *Children:* Children are at greater risk of smoke-related health effects, because their lungs are still growing. In addition, compared to adults, they are more likely to be exposed to smoke because they spend more time outdoors. Children also engage in more vigorous activity and inhale more air per pound of body weight than adults, both of which affect the dose of smoke they experience and their risk of health effect.
- *Older adults:* Adults ages 65 and older are at greater risk, because they are more likely to already have chronic heart or lung disease. In addition, the body’s ability to respond to health challenges generally declines with age.
- *Pregnant women:* Changes in the body that happen with pregnancy (e.g., increased breathing rates) may increase sensitivity to smoke exposure. During pregnancy, the fetus may be more sensitive to smoke exposure.

People with higher exposure may experience worsening of underlying health conditions. Higher smoke exposures can lead to increased risk of respiratory- or cardiovascular-related trips to the emergency department or hospital stays and to death.

- *People with lower incomes:* People with fewer financial resources often have less access to health care, which can lead to untreated or inadequately treated underlying health conditions. They may also have higher smoke exposure due to less access to measures to reduce wildfire smoke exposure (e.g., ability to work from home, use air cleaners), living in poor quality housing that can lead to higher indoor smoke concentrations, being unhoused, or spending more time outside traveling to work.
- *Outdoor workers:* Outdoor workers can be exposed to high concentrations of smoke for extended periods of time.⁸

Communities are necessarily developing policy responses to smoke events, including developing community readiness and response plans, hiring smoke readiness practitioners, expanding new monitoring networks, testing new messaging approaches, creating public health interventions and campaigns, and much more. The expansion of policy in the last 10-15 years has been rapid, but this hasn't always been accompanied by the sharing of evidence on what is working across jurisdictions or an understanding of what community level innovations are scalable and adaptable in a variety of contexts. Too often, governments' preparation for fires and the resulting smoke events are falling short or have significant gaps.

Our Approach: Understanding What is Working at the Community Level to Respond to Smoke Events

Our team at the WORLD Policy Analysis Center (worldpolicycenter.org) worked to identify and assess actions communities are taking to prepare for wildfire smoke events, ensure protection from smoke amidst wildfires and prescribed burns, and reliably measure and address air quality during and after wildfires. To map this space, we seek to understand:

- What is working in communities that are taking leading approaches to wildfire and smoke preparedness?
- What can other communities learn from one another in response to smoke events (both wildfires and prescribed burns)?
- What innovative or small-scale approaches are scalable for greater impact?
- What are the key knowledge and policy gaps that should be the next frontier of learning?

Throughout our project, we highlighted what is or is not working for reaching vulnerable and sensitive populations within communities.

We started with a broad scoping of geographies that have faced wildfire challenges in the recent past, with the U.S, Australia, Chile, and Canada among the five countries worldwide with the highest number of wildfire disasters since 2000. We identified geographies with policies and approaches that early research indicated were particularly advanced or innovative. We worked to identify promising practices and approaches at the community level, identifying 9 primary geographic focus areas and one topical focus area:

- Central Montana (primarily Missoula, Montana)
- Central Colorado (primarily Denver, Colorado)
- Central Washington (primarily Chelan/Douglas Counties)
- Puget Sound, Washington (primarily King and Tacoma/Pierce Counties)
- Northern Oregon (primarily Hood River and Multnomah Counties)
- Central Oregon (primarily Deschutes County and Jackson Counties)
- Western British Columbia (primarily Vancouver, British Columbia)

- Inland British Columbia (primarily Kamloops, British Columbia)
- Victoria, Australia
- Topical focus on paid climate leave policies

Next, we developed a formal interview tool and protocol and conducted recorded interviews with 67 stakeholders across 9 primary geographies in the Western United States, British Columbia, Canada and Victoria, Australia. Additionally, we engaged in consultations and conversations with more than 100 additional stakeholders and community members through meetings, collaboratives, and community events. We also conducted extensive reviews of policy documents from target geographies, including analyzing resources and documents shared by study participants.

The stakeholders who provided input included:

- County, community, state, and provincial level public health and fire officials
- County, regional, and statewide air quality and forecasting experts
- Community-based organizations representing a range of populations that are at-risk, sensitive, and vulnerable during air quality degradation events
- Academics and researchers working across a range of disciplines, including public health, environmental epidemiology, mechanical and materials engineering, environmental and occupational sciences, atmospheric sciences, public policy, health administration, environmental law, and more.
- Local level and regional air quality improvement practitioners
- Community groups and collaboratives working to balance community fire preparedness, resiliency, sustainability, forest management, and public health

We then developed findings to share with stakeholders from our conversations as well as a wider range of policy and community actors. We grouped the findings into five primary themes that emerged from the case study investigation phase of work:

- ❖ Promising Practices: Air Quality Monitoring
- ❖ Promising Practices: Air Filtration, Clean Air Spaces, and Clean Air Shelters
- ❖ Promising Practices: Advisory and Communications, Outreach, and Education
- ❖ Promising Practices: Prescribed Fires and Public Health
- ❖ Policy Gaps, Challenges, and Next Frontiers



An aerial photo of the smoke plume of Eaton Fire above the Los Angeles basin in January 2025. Photo credit: USDA Forest Service

A Note of Thanks

This project is deeply indebted to a great many individuals without whom it would not be possible. First and foremost, thanks to the Gordon and Betty Moore Foundation and Marion Whitman, Genny Biggs, and Elise Ford for the funding, vision, guidance, partnership, and collaboration to bring it to fruition. Thank you to the smoke readiness and wildfire resiliency movements and emerging communities for practice for bringing us forward into the future where we can protect our communities, our forests, our natural environment, our loved ones, and our future. Thank you to the more than 150 individuals who gave their valuable time, energy, patience, expertise, and wisdom as part of the interview and case study process. Thank you to the forest ecology, land management, sustainability, and environmental communities for ensuring a sustainable natural world for all to enjoy now and into the future. Thank you to the frontline community-based-organizations representing the historically underrepresented, under resourced, and undervalued and giving voice to so many who for so long have been forgotten or ignored. Thank you to all those who look to what is working elsewhere to improve their own community. Thank you to the whole project team at the WORLD Policy Analysis Center and to Equal Futures for partnership on the comparative leave policy data. Thank you to the survivors of severe fire and smoke events, for courage, perspective, perseverance, optimism, and hope.

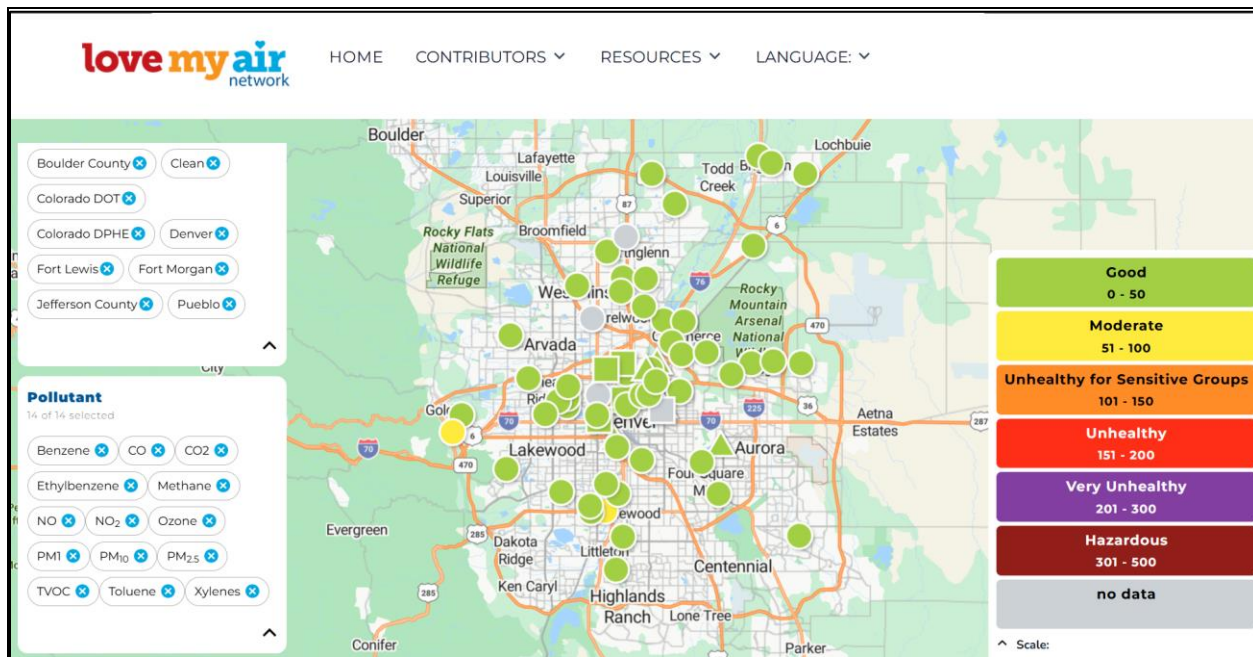
How do communities know if the air is unhealthy or dangerous?

Promising Practices: Air Quality Monitoring

Across our case study respondents, there is a consensus on the need for high quality air monitoring and forecasting as foundational to protecting communities and environments during smoke events. This includes acknowledgement that the ability to reach vulnerable and sensitive members of their communities during smoke events, such as people with asthma, people with cardiovascular risks, outdoor workers, older adults, persons with disabilities, and children, is dependent on having reliable, accurate air quality data to inform action. The ability to support these communities is dependent on data on the risks they face. Promising practices from our study in this space include:

Moving beyond PM_{2.5} to more comprehensive models of monitoring.⁹ There is an extensive scientific evidence base demonstrating a relationship between numerous adverse health outcomes and PM_{2.5}, including respiratory- and cardiovascular-related morbidity and pre-mature mortality.¹⁰ However, emerging evidence suggests that PM_{2.5} is not the only aspect of smoke in need of monitoring, particularly when there are structure fires and other anthropogenic sources in the smoke mix.

Communities directly impacted by a fire at the wildland-urban interface are exposed to various chemicals through the combustion of buildings, plastics, electronics and appliances, vehicles, and artificial structures. Exact chemicals vary depending on the combustion source and fire, but recent work has found elevated levels of heavy metals (e.g., lead), polybrominated diphenyl ethers (PBDEs), per- and polyfluoroalkyl substances (PFAS), and other known carcinogens such as polycyclic aromatic hydrocarbons (PAHs), asbestos, and more.¹¹ Some of our case geographies are already making progress in monitoring beyond PM_{2.5}. For example, the Denver “Love My Air” program monitors nine distinct pollutants, including PM₁₀, ozone, NO₂, CO, and Total VOCs, with plans to expand as new state regulations come online.¹²



Denver's Love My Air is a citywide monitoring network to provide real-time air quality data. In collaboration with community partners, Love My Air provides workshops, trainings, and outreach connecting health to air quality, and expands beyond PM_{2.5} to monitor a range of pollutants.¹³ Image: Love My Air Network

Comparing indoor/outdoor air quality to ensure buildings are protecting people.¹⁴ A foundation of the policy response when air quality is degraded across every one of our study geographies is guidance to the population to seek indoor air that may be cleaner than outside air. However, monitoring and measurement efforts to ensure that indoor air is actually safer than outdoor air have lagged behind. In some geographies, efforts are being made to close this gap, though progress is still needed to reach population scale impact. For example, Vancouver Coastal Health is using new monitoring approaches to assess whether advising people to stay indoors or to go to community centers actually protects them from poor outdoor air quality. The initiative uses small indoor/outdoor air sensors that measure multiple contaminants, not just PM_{2.5}; and critically pairs this data collection with educational outreach programming. In facilities where Vancouver Coastal Health is measuring indoor/outdoor air quality they have signage informing people about the initiative and inviting them to interact with the air quality sensors and learn more. Citizens can ask questions about the health impacts of wildfire smoke and current air quality conditions, learn about services, and more. Additionally, the PurpleAir in Schools Program in Montana enrolled more than 100 schools within its first two years, with over 78 installing and operating paired indoor and outdoor air sensors to guide school-based responses during smoke events. Respondents also noted similar promising programs in Washington and Colorado that target high school-aged students through youth engagement programs utilizing air sensor technology and monitoring as an educational tool.

Forecasting the health impacts of air quality degradation to inform health response.¹⁵ Across a number of communities, there are efforts to forecast the health impacts of smoke events as a way to prepare the health system for the types of patients they are likely to see during the period of high need. For example, BC Centre for Disease Control's (BCCDC) Asthma Prediction System pairs data on PM_{2.5} concentrations with data on asthma-related medical visits and inhaler prescriptions filled, to forecast the health impacts of wildfire smoke events 24-48 hours in advance. Regional Medical Health Officers use this information to prepare for upcoming smoke events, including activating clean air shelters and ensuring pharmacies have adequate supplies of medication. Respondents at the BCCDC credited the system's uptake and use by Medical Health Officers to the fact that it "speaks the language" of the health system. A map is also publicly available. The tool was initially developed following BCCDC studies showing a consistent relationship between PM_{2.5} from wildfire smoke, asthma inhaler dispensations, and doctor's visits for asthma. Elsewhere, respondents from some of the smaller communities in our target geographies noted a lack of capacity to undertake health impact forecasting and other pieces in advance of smoke events, given staffing constraints, financing constraints, and other priorities.

Using small air sensors to monitor air quality at a more localized level.¹⁶ Respondents across our targeted geographies noted the proliferation of PurpleAir, iQAIR, Airthings, as well as many other lower cost, smaller air sensors that often augment the existing regulatory air monitors in a community. PurpleAir sensors contribute to real-time air quality mapping by integrating with platforms like the EPA's AirNow Fire and Smoke Map and Environment and Climate Change Canada's AQHI map.¹⁷ The most dramatic expansion of PurpleAir has come in the last decade – their API boasts continuous data back to 2016. These sensors are available widely and typically cost between \$100 and \$2,500 – a fraction of the cost of regulatory air monitors.¹⁸ While these air sensors are less expensive than a regulatory air monitor, they are also less accurate. Additionally, respondents widely reported concerns with calibration, integration of data, and the challenges of continual upkeep to make sensor network expansions beneficial to communities in the long run. In several geographies, respondents excitedly spoke about one-time funding opportunities, such as EPA or state-based grant programs that installed local sensor networks, paired with concerns about what happens to sensors over time without upkeep, maintenance, and sustainable data use resources and systems in place.

Reaching rural areas and other historically data-poor populations.¹⁹ The expansion of monitoring networks, both advanced and low cost, has enabled more and better data on communities historically left behind in smoke response. Among the historically data-poor populations, commonly cited areas with needs for continued expansion include very rural populations with low density and lower technological reach, unhoused populations, and those living on indigenous, native, and tribal lands and territories. For example, for many First Nations communities in British Columbia, the nearest air monitoring station is four hours away in a different airshed, yielding data

that is not relevant to their communities. The First Nations Health Authority began to address that gap by providing purple air monitors to every community that wanted one. They are now working on how to take that data and turn it into actionable messaging without creating an additional burden for the staff in First Nations communities.²⁰ Continuing the pattern of reaching rural and other populations in need is critical, with different levels of current penetration noted across different geographies.

Expansion of monitoring networks to gather data for target populations, particularly into schools, childcare centers, at-risk neighborhoods, senior centers, and other places where vulnerable and sensitive communities are concentrated.²¹ These expanded networks allow more localized, accurate, up-to-date, and disaggregated data to help guide different populations to respond to changing conditions during smoke events. Much of this expansion adds to the regulatory monitoring systems already in place, which in the United States has been built primarily on the framework of the Clean Air Act and the Environmental Protection Agency (EPA) regulatory mandates. It will be important to stay alert and responsive to potential erosion to much of this regulatory framework that began in 2025. While much of the expansion of monitoring networks has been in urban areas and places with large population centers, respondents also noted rural and citizen-oriented approaches. For example, the local community-based organization Methow Valley Citizens Council's has a Clean Air Ambassadors program in Washington, residents were trained to steward more than 35 PM_{2.5} sensors across a 60-mile rural valley—building one of Washington's largest community-based sensor networks for smoke response.²²



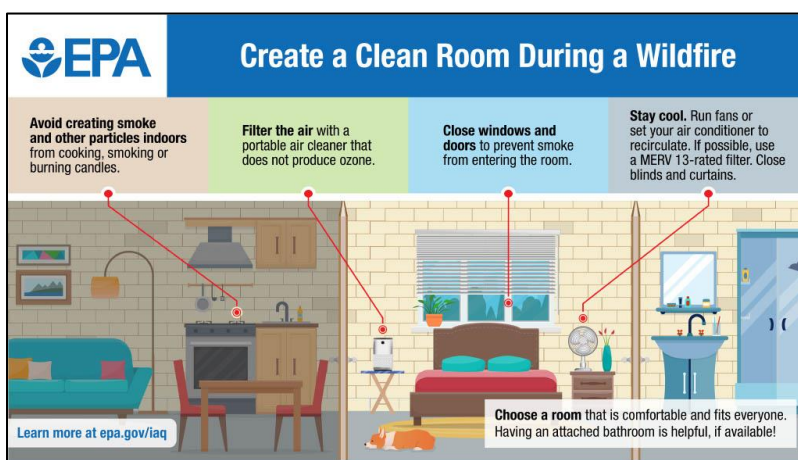
Clean Air Methow works towards solutions for a sustainably clean airshed in North Central Washington and manages the Clean Air Ambassador Program. The program has 22 air quality sensors that report real-time PM_{2.5} and air quality measurements every eighty seconds, with data made available to the public through various mapping platforms. Image credit: Clean Air Methow

When the air is unhealthy or dangerous, how do communities provide clean air to vulnerable and sensitive groups?

Promising Practices: Air Filtration, Clean Air Spaces and Clean Air Shelters

Every community in the study has some level of policy, program, strategy, or guidance to create community clean air spaces, to support clean air spaces at home, and to reduce smoke exposure. Many communities make clean air spaces and shelters a centerpiece of their response, but there is variation in the way these programs are designed and implemented, and too little is known about uptake levels and impacts. The individual costs associated with following health advice during smoke events were repeatedly cited as a barrier, with some policies and programs taking innovative approaches to lowering these barriers. Promising practices in this space include:

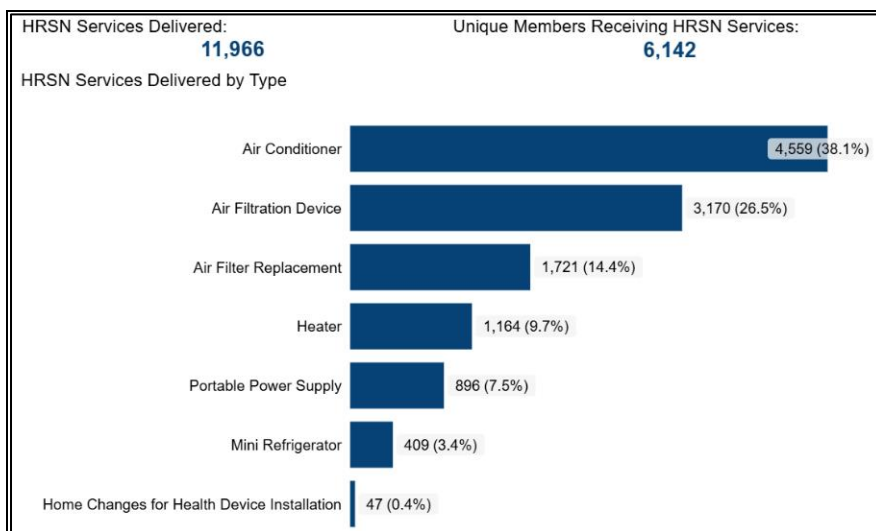
Supporting the creation of a clean air sanctuary at home.²³ Respondents across study geographies emphasized the importance of empowering individuals and households to create a clean air space in their home for use during smoke events. Whole home readiness is preferred, but respondents noted the value of creating at least one room that can provide clean air for an extended period of time. If only one clean room is possible, ideally it would be where members of the family can sleep. The primary approaches outlined by federal guidance and echoed by community level respondents are (1) using a high-efficiency filter through a central heating, ventilation, and air conditioning (HVAC) system, (2) using a commercial portable air cleaner in your clean room, and (3) using a do-it-yourself (DIY) air cleaner in your clean room.²⁴



The US EPA, along with other agencies including the CA Air Resources Board, CDC, USFS, DHS, as well as counterparts in Canada and Australia provide guidance on creating a clean room at home that is shared at the local level.²⁵ Image credit: EPA

Reducing the costs of at-home air filtration at the population scale.²⁶ Across geographies, particularly from social service and community-based organization respondents, the costs of at-home air filtration were cited as the primary barrier preventing people from following smoke readiness advice. Many communities noted a reliance on federal and state grant programs to finance local initiatives, while highlighting the uncertainty and variability of such grant-based approaches. However, at-scale approaches for smoke readiness and adaptation are also emerging. For example, since 2024, the Oregon Health Plan (OHP), the state’s Medicaid program, provides qualifying individuals with a medical need or who are facing certain life changes with new climate-related benefits, including air cleaners. This policy is part of Oregon’s federally funded expansion of OHP coverage to include health-related social needs (HRSN) services. Eligible members may receive devices that provide healthy temperatures and clean air such as air filters, air conditioners, heaters, as well as mini refrigeration units for storing medications. Portable power supplies to operate medical equipment may also be available as a new benefit. This innovative policy advances smoke readiness at the population scale to those who qualify for HRSN housing benefits with specific health, living, and financial conditions – individuals who are particularly vulnerable during smoke events. In 15 months, the HRSN home changes for health benefits program extended nearly 12,000 services to over 6,000 members (Figure 2).

Figure 2: Oregon Health Authority Health-Related Social Needs Benefits, Home Changes for Health Benefits Delivered from 3.1.2024 to 12.31.2025



*Figure 2: Oregon’s Health-Related Social Needs (HRSN) benefits in Oregon are Medicaid (OHP) services designed to address social and economic factors—like housing stability, food security, and climate-related needs—that directly affect health. In 2024, OHP created a waiver to get air filtration devices and air filter replacements, among other services, included in the benefit.*²⁷

Even though Oregon’s HRSN benefit program covered a limited population at the time of our study, we heard strong interest from respondents in Oregon to expand the qualifying criteria, as well as interest from stakeholders in other states like to replicate or build upon this model.²⁸

DIY Air Filters workshops and distribution programs create opportunities for low or no-cost access, a direct opportunity to communicate with community members on proper use, and a space to guide them more broadly on how to protect themselves and their households.²⁹ Respondents across geographies noted the local impact of DIY air filter workshops in their communities as a way to increase access to clean air across the socio-economic spectrum. Respondents highlighted effective approaches to targeting specific populations, such as leveraging social services networks that work directly with older persons or partnering with new parents groups to reach very young children.

The DIY air filter workshop model is not without limitations. The primary limiting factor respondents noted are concerns about incorrect use by citizens, primarily not running filters at a high enough speed due to noise levels. Without proper use, DIY air filters do not provide the intended protection. Additionally, respondents noted that many programs have little to no upfront cost for workshop attendees, but do not have an effective way of offsetting maintenance and filter replacement costs. More broadly, discontinuities and irregularities in financing and funding streams can jeopardize the sustainability of the workshop model.

Despite these limitations, there are many models of DIY air filters, including the Corsi-Rosenthal Box (4/5 filters), single-filter setups, 2-filter triangle setups, “The Cocoon,” and more respondents highlighted.³⁰ Generally, there has been a proliferation of designs and instructional videos readily available. Figure 3 shows a sample of a straightforward outreach asset from the Tacoma-Pierce County Board of Health.



Figure 3: A sample outreach visual from the Tacoma-Pierce County Board of Health utilizes straightforward messaging to show community members how to create a DIY box filter fan. Image Credit: Tacoma-Pierce County Board of Health³¹

The most promising DIY filter program approaches pair the creation of an air filter for home use with community outreach, consensus building, and fire and smoke readiness education. For example, the “BREATHE” program in British Columbia originated when the BC Lung Foundation and researchers at the BCCDC sought an effective alternative to commercial air filters for those who could not afford them. BCCDC researchers were initial pioneers of the DIY air filter program, conducting effectiveness tests to establish much of the science. The program now uses DIY air cleaner community engagement workshops to provide resources to at-risk populations, with content that includes education and a hands-on DIY building portion. The program also uses a Train-the-Trainer workshop model, to equip community leaders to host their own DIY Air Cleaner workshops. The program then connects with emergency disaster management teams, environmental health experts, educators, public health officials, municipalities, and other leaders in communities with the sharable learnings from interacting with community members at these workshops.³²

Collectively re-imagining community clean air spaces.³³ Every geography in our study uses community clean air spaces of some kind and has a set of public health recommendations for sensitive and vulnerable populations to seek community clean air spaces as needed. However, respondents repeatedly noted that community clean air spaces simply do not get used at the level it would take to have substantial population impacts. Commonly, community clean air spaces are libraries, schools, civic, and municipal buildings. The challenge with these community spaces is making them welcoming and accessible to the range of at-risk groups, as they often require individuals to make significant behavior patterns changes to come to them. Respondents repeatedly raise concerns of the efficacy of telling community members to go to places they otherwise wouldn’t congregate naturally. To address this, some geographies have begun outreach programs and partnerships with non- and for-profit entities to encourage people to go to more localized non-governmental organization spaces, coffee shops, gyms, and other places that are more physically, culturally, and socially accessible and aligned with their regular routines. For example, in Melbourne, Australia, some public health advice for teenagers includes going to indoor shopping malls that are known to have HVAC systems and air cleaners.³⁴ The tradeoff with this approach, as highlighted by public health officials in multiple geographies, is that the level of control over conditions inside private businesses will not be the same as municipal or public buildings. If the air is not cleaner indoors in a given location than it is outdoors during a smoke event, public health guidance does not build community trust or provide community protection if they are telling members of the community to shelter in that location. Broadly, respondents noted (a) that there needs to be some type of community clear air space built into protection plans as there are members of the community who have no other alternatives (e.g. unhoused population, transient populations, tourists, and more), but (b) the current approach is insufficient to provide meaningful population scale health protection.

Subsidizing retrofits and building clean air into building codes,³⁵ particularly interventions that reach those in naturally occurring affordable housing and communities with low socio-economic status. We heard repeatedly from respondents that the long-term solution to clean air spaces in a community needs to come from structural changes to the housing stock. The key point of intervention impact is in naturally occurring affordable housing where many low-income renters live. These tend to be older buildings that have ineffective ventilation systems, are in most need of general structural updates, and house communities with less control over and fewer resources to change to their lived environment. To address this challenge, the City of Kamloops has a suite of programs targeting retrofits to make housing more energy efficient, comfortable, and healthy for both tenants and owners. They have an Energy Conservation Assistance Program for income-qualifying households to improve energy systems, including HVAC systems. Targeted marketing of this program uses census data, heat vulnerability mapping, and dwelling age mapping to locate the most vulnerable households, and includes messaging both for landlords and for tenants. The City also has a Retrofit Assist program, which is a free home energy concierge service run in collaboration with the Community Energy Association.³⁶ In a similar approach, Metro Vancouver has provided seed funding for the BC Retrofit Accelerator, which is being implemented by a not-for-profit partner in the region. This program provides information and support for building owners and occupants who want to increase energy efficiency, reduce greenhouse gas emissions, and establish clean, cool, indoor spaces in light of wildfire smoke and climate events. Notably, even in contexts where programs are rolling out and innovating, respondents repeatedly underscored the enormity and expense of the challenge of retrofitting old building stock as a critical issue when it comes to reducing exposure to wildfire smoke.

Policy Highlight: Paid Climate Leave

In addition to our comparative research on what's working at the community level, we undertook a case study of a new national and state-level policy innovation: paid climate leave. An established barrier that prevents people from following emergency response and public health recommendations context of fire and smoke events is a lack of leave from work or a fear of losing employment. Workers should not have to choose between losing their jobs and keeping themselves and their families safe. In recent years, we've seen increasing instances of "climate leave" policies or other paid leave policies to provide support and protection for workers who are unable to work or unable to get to their workplace due to extreme weather events, including fires or severe smoke.

To map this policy trend, we systematically reviewed original legislation and statutory guarantees extended to the private sector as of 2026 for all 193 United Nations member states. This review included original labor and social security legislation, complemented and verified by information on social security systems from each UN member state and global sources to collect information about policies for adult labor.

This included policies specific to climate and climate-related weather, as well as the range of policies available worldwide of leave for workers to meet the range of personal health, caregiving, and health needs for workers and family members. For more information on the methodology used to build this dataset, please see <https://equalfutures.org/topics/labor/methods>.

Globally, in 2024 Spain was first country to pass a specific national level leave policy explicitly tied to climate related weather events (including smoke and fire). This new leave law protects the right of workers not to go to work in the event of catastrophes or climate-related weather alerts that could put them in danger. Workers in Spain are now given up to four days of paid leave if they are unable to get to their workplace due to extreme weather. The policy triggers with an emergency declaration based on severe air pollution, or with another climatic hazard deemed dangerous to mobility, such as a heatwave, heavy snow restricting traffic, torrential rains causing floods, strong windstorms with gusts over 100 km/h, and more.³⁷ Leaders in describing the legislation claimed the new policy was aimed to “regulate in accordance with the climate emergency” so that “no worker must run risks.”³⁸

We have seen a number of stakeholders and policymakers working to emulate the approach taken in Spain. In 2025, unions and advocates in Ireland proposed a statutory maximum working temperature during extreme-weather and pushed for four days of paid “climate leave” if conditions render travel hazardous or workers need to address pressing domestic needs resulting from extreme weather. Also in 2025, at the state level in the United States, Pennsylvania lawmakers introduced The Climate Emergency Paid Leave Act, which aims to provide Pennsylvanians who are directly impacted by a climate-related disaster with a minimum amount of paid leave. This comes in the context of recent flooding across multiple Central Pennsylvania communities, extreme heat, and a large fire in Cumberland County. Representative Ben Waxman, who introduced the legislation, emphasized this legislation aims to create “paid leave in the aftermath of climate disasters [that] is not just a workplace benefit — it is a public safety measure. By ensuring workers can stay home when conditions are dangerous, we protect lives, reduce injury, and give communities the time to recover.”³⁹

Policies that are protective of workers and families during smoke events don’t necessarily have to be explicitly related to climate disasters; they may be discretionary or broader leaves that can be leveraged when needed. When we systematically reviewed original legislation and statutory guarantees, we found that 31 countries (16%) globally provide paid discretionary, family needs or emergency leave policies that might be available during an emergency, such as a severe smoke event or fire event. An additional 19 countries (10%) provide unpaid discretionary, family needs or emergency leave policies that might be available during an emergency.

Additionally, there are range of leave policy approaches that provide protection to at-risk, vulnerable, and sensitive in certain circumstances during smoke and fire events. Examples of how specific policies may provide protection to key populations include:

A worker with a chronic disease, such as asthma and other lung diseases, may need to take paid sick leave unexpectedly. Paid sick leave allows workers to seek essential treatment and better manage their health without sacrificing wages or job security. In the context of smoke and other climate events that may create unexpected or unplanned need, whether these policies are available on short notice is critical. Globally, 76% of countries provide paid sick leave from the first day of illness and another 20% provide paid sick leave, but not from first day of illness. The United States is a global outlier, being one of only 8 countries without a national paid sick leave policy.

A family or individual may opt to take annual leave during a prolonged smoke event or other emergency. We examined the minimum guaranteed level of policy-based annual leave available. Globally, 55% of countries guarantee at least 20 days paid annual leave to workers per year, and an additional 40% of countries provide between 5 and 20 days of annual leave per year. The United States is a global outlier, being one of only 9 countries without a national paid annual leave policy.

Children are at greater risk of smoke-related health effects that need health care. Parental presence is central to children's health and their recovery from illness and health events, yet in the absence of adequate paid leave policies, parents may have to choose between adequate care for their child and job/income security. Globally, 45% of countries provide paid leave specifically for children's health needs. Additionally, smoke and fire may exacerbate an ongoing or chronic health issue for children, such as asthma. Paid leave can enable access to preventive care and allow parents to seek care during standard clinic hours reducing emergency room visits. Globally, 30% of countries provide leave specifically for children's everyday health needs.

When the air is unhealthy or dangerous, how do communities get the information out?

Promising Practices: Advisory and Communications, Outreach, and Education

The challenge of smoke readiness, adaptation, and community resilience communication is complex and evolving. There is significant variation in the techniques different communities are using across our study geographies to get good public health guidance out to all members of the community during smoke events. With patterns of news consumption and technology rapidly changing in recent years, the challenges of educating the public, particularly outside smoky periods, require vigilance, repetition, and constantly changing modalities. Compounding this challenge is that different at-risk and vulnerable communities are likely to receive information and advisories in different formats. Reaching networks of new parents in a community is quite different than reaching older people, which in turn is likely quite different than reaching groups of outdoor workers or those of low socioeconomic status. Despite these challenges, promising practices for those working to ensure public information is reaching all members of the community effectively during smoke events include:

Language translation, accessibility, and culturally relevant messaging, while framing public health and resilience communication to “meet people where they are at.”⁴⁰ There is significant variation in the population size, density, demographic and socioeconomic profile, geography, political orientation, and orientation toward smoke readiness across our study locations, and a common theme was the need to adapt messaging to local community contexts. This includes translation of materials and messaging into locally prevalent languages, especially those that may be disproportionately spoken in target populations. For example, multiple respondents noted needing to translate messages for outdoor workers into Spanish in their communities.⁴¹ Additionally, respondents noted the importance of working with local organizations of persons with disabilities to provide information in accessible formats and distribute materials directly to key messages in the disability community. Finally, culturally relevant messaging is critical across communities, but was particularly highlighted in working with Tribal, indigenous, native, First Nations, and Aboriginal communities. For example, the First Nations Health Authority (FNHA) in British Columbia emphasized messaging on the long-term impact of wildfires on natural, economic, and cultural ecosystems, including implications for traditional medicines and plants, animal species, food security, trading relationships between Nations, and more. The FNHA emphasizes a holistic approach that supports communities with education and awareness about how to carry out cultural and prescribed burns, in order to increase community autonomy and control over wildfire activity in their territory.⁴²

[illegible]

In addition to the formalized networks, a number of community-level respondents emphasized the value of emerging informal communities of practice and direct peer-peer learning around readiness and communications. Multiple respondents noted how valuable it has been for them to be able to be in touch with others in similar roles in different counties. In particular, respondents noted they have sought out approaches from others who have successfully navigated adapting national and state level guidance

in their local context. Furthermore, respondents in Australia, Canada, and the United States emphasized a desire for more international sharing and cross-border collaboration, and interest in the development of a global community of practice.⁴⁶

Reframing some public health messaging to show “at-risk” groups are not a small minority of the population, but factually the majority of the population in many communities.⁴⁷ Across our study geographies, smoke readiness practitioners and those distributing public health messaging use terminology including “at-risk”, “vulnerable”, “sensitive”, “more likely to be affected by smoke”, “more likely to have adverse effects”, and more. Guidance usually leads with messaging for the general population, and then calls for greater action to protect vulnerable populations. Some communities are calling for an upending of this framework. For example, in Hood River County, the non-governmental organization Smoke Ready wanted to more accurately understand the risk profile of their community. They partnered with an epidemiologist at the Oregon Health Authority to analyze the percent of the population the CDC, EPA, and Oregon Health Authority identify as “sensitive groups,” or smoke-vulnerable populations. They found that depending on seasonal variation, the smoke-vulnerable groups make up 60-70% of the local population.⁴⁸ This is noteworthy given smoke sensitive status connotes a minority status, when in fact, the groups make up the majority of the population.

Using trusted messengers while seeking input from and giving ownership to stakeholders from affected communities, including networks of established community-based organizations with public trust.⁴⁹ Across geographies, respondents highlighted the value of trusted messengers within communities as the most efficient and effective way to distribute timely messages, but also receive feedback from community members. The trusted messengers mentioned by respondents varied across geographies. Examples that came up in more than one interview included informal and formal caregivers and caregiver networks, nurses, physicians and other health practitioners, service provision organizations, health advocacy non-governmental organizations, home health care workers, school administrators and local sports coaches, and wildland and community firefighters. While the messaging channels and approaches to reach a rural youth sports coach or an urban home health worker may be very different, these actors can all be key leverage points for disproportionately impacted communities during smoke events. Respondents also highlighted the need for policymakers and local officials to create two-way dialog with these key trusted community nodes rather than simply using them as an information distribution system. These local actors can convey community concerns, challenges, and insights to inform smoke response. While the precise trusted messengers across each community will differ, a structured mapping of the trusted messenger landscape in a given location is a foundation step towards effectively responding to smoke events.

Utilizing centralized websites, digital hubs, and other forms of streamlining public information sharing to minimize communication breakdowns and

duplication.⁵⁰ In every study geography, we heard the need for coordinating and collaborating on messaging across jurisdictions, agencies and sectors.⁵¹ The technological proliferation of multiple monitoring sources and the fragmentation of news sources that populations rely upon to receive air quality and public health advisories has increased the possibility of misaligned, misunderstood, and contradictory messaging during high stress periods like fire and smoke events. There are so many stakeholders, across federal, state, and local levels, that some community members don't know where they should turn for clear advice. A set of communities across our case study locations have determined that their messaging will be most effective when provided through a single, centralized website that aggregates actionable, timely information. Examples include:

- smokereadygorge.org, a communication campaign that provides up-to-date information on air conditions in the Columbia River Gorge communities in North Central Oregon with community, university, state, and county health agency collaborators.⁵²
- centraloregonfire.org, which aims to be the single source for comprehensive fire, health, and air quality information in central Oregon. This is structured based on a cooperative agreement between community groups, The Nature Conservancy, USDA Forest Service and agencies of the Department of the Interior — Bureau of Indian Affairs, Bureau of Land Management, National Park Service and U.S. Fish & Wildlife.⁵³
- wasmoke.blogspot.org, which is a partnership between state, county, and federal agencies, and Tribes to coordinate to collectively share information for Washington communities affected by wildfire smoke.⁵⁴
- montanawildfiresmoke.org, which was spearheaded by a single local non-governmental organization, Climate Smart Missoula, but includes important collaborators at local and statewide health agencies.⁵⁵

Commonalities across these centralized hubs are a foregrounding of the most recent wildfire and smoke news, actions community members can take to protect themselves, and channeling community members to local services where appropriate and applicable. Respondents noted that during times of high stress and rapidly changing advice, having coordinated messaging across agencies is streamlined when there are fewer websites and/or locations that need to be updated at the same time.⁵⁶

Integrating smoke and air quality advisories into existing weather and information systems people are already using, including training trusted community sources like local weather presenters, media professionals, and emergency response briefers on air quality and smoke messaging.⁵⁷ Across a number of geographies, respondents noted the value of integration with existing systems, rather than trying to develop new systems of information distribution for smoke readiness and air quality alerts. In the Puget Sound Clean Air District, governmental officials made a specific effort to reach out to local weather presenters to train them on air quality information, how to contextualize unhealthy or dangerous air, and to encourage their media partners

to integrate air quality into routine weather reports.⁵⁸ Similarly, respondents noted the value of weather smartphone apps including the AQI and other air quality data sources alongside temperature, precipitation, wind, and other common weather metrics. Lastly, when smoke is coming from urban fires or fires at the wildland-urban interface, multiple respondents noted that smoke and air quality information can and should be presented along with fire suppression, evacuation updates, and other necessary information from incident command systems or similar interagency coordination structures.⁵⁹

Mock evacuations, simulations, and training drills to build public buy-in for public health and community preparedness plans and provide a connection point to services and information. In other disaster preparedness and public health spheres, mock evacuations and training drills are seen as critical tools to strengthen individual competence, confidence, and familiarity with emergency protocols while identifying gaps in plans.⁶⁰ Although there is not a lot of evidence of this happening in response to smoke events, one example of an existing model is from Kamloops, British Columbia. During their 2021 fire season, one neighborhood in their community, Juniper, was found to have an evacuation bottleneck, so the City of Kamloops, the Thompson-Nicola Regional District, and Tk'emlúps te Secwepemc (the local First Nations Government) did an emergency response coordination and mock evacuation exercise on how to work together in specific events.⁶¹ Information and experience from the exercise in Kamloops is now feeding into the process as the city updates updating its wildfire response plan, along with surveys, open houses, interviews and other community engagement approaches. As part of this exercise, the City and partners included fire-readiness and smoke-readiness messaging into their interfacing with local community. In other major recent fire events, there have been other communities with well-known exit challenges that never utilized community practice and mock evacuations enough to effectively map evacuation routes, with serious repercussions.

Advocating for readiness and preparedness in advance of the smoke season and proactively working with communities to host evacuees and other fleeing smoke and fire.⁶² Across geographies, respondents noted the impact of approaches that prepare communities to respond to smoke events well in advance. Examples include statewide campaigns like “Smoke Ready Week”⁶³ in Washington, where a range of policymakers all work to focus public attention on readiness at the same time at the start of fire season. A more community-based example comes from Deschutes County in Oregon, where smoke readiness and public health education is integrated with visits from emergency responders and fire preparedness education during the Spring at a rotating series of community meetings and visits to rural communities.⁶⁴ Additionally, United Way BC works in communities like Kamloops to proactively prepare and train communities to host evacuees from other communities fleeing fire and smoke. A large focus is on making sure host communities are able to provide for evacuees who are at-risk or particularly vulnerable and in culturally-appropriate ways, which benefits greatly from additional time and planning outside of high-stress windows.⁶⁵

If the air is unhealthy or dangerous because of beneficial fire or prescribed burns, how can communities ensure public health?

Promising Practices: Prescribed Burns and Public Health

In many of our study geographies, there is a recognized tension between the necessity of ecologically beneficial, prescribed, and planned burns and the potential negative health impacts of the resulting smoke. Broadly, there is agreement that historical wholesale fire suppression has been a failure and increases the risk of wildfires, particularly extreme wildfires. Aligning prescribed fire and land management with local needs is increasingly essential to preventing wildfires and managing landscapes. However, the public licensing, acceptance of prescribed burning varies considerably across geographies. The commonality among places with public license, trust, and buy-in for sustainable forest management practices is that public health approaches are in place to ensure that people know how their health and the health of their families are being protected during prescribed burns. The lived experience with air quality and individual agency matter to openness to prescribed burns. Promising practices in this space include:

Recognition that community smoke readiness is the key pathway to acceptance of beneficial fire. Building public acceptance of prescribed burns is not solely a question of notification, checking boxes, and working to ensure controlled burns don't escape and become wildfires. People have to feel that their health and the health of their families is protected during prescribed burns. Prescribed fire education must recognize the inherent tension between the necessity of prescribed burns for ecological health and the potential negative health impacts of the resulting smoke, rather than hiding or obscuring it. A key element of navigating this tension is public confidence that the air quality will be adequate.

Respondents across geographies noted that people's primary lived experience with beneficial fire is not the fire itself, but the resulting smoke. Forest ecologists and land managers often focus on the burn parameters, preparedness, and execution, and track the long-term forest health impacts. This is necessary, but not sufficient. Respondents noted that increasingly, the primary challenges of prescribed fires aren't scientific and logistical, but rather political and social. During the majority of prescribed and planned burns, a vast majority of community members don't engage with the scientific and logistical decisions and execution. They experience the smoke. Making the community feel protected from smoke makes them feel protected from prescribed fire.

Public license is a continually evolving, iterative relationship, not a one-time threshold, among communities, forests, forest managers, fire, and smoke.

Respondents from across our study geographies that were working to promote prescribed and planned burns continually used the term “public license” to reference the permission structure to increase the volume, pace and scale of low-severity fires. This term, while useful, has some limitations. A “license” connotes an official permit or authorization granted by a qualified authority that allows a person or entity to perform an action. But the public license needed for beneficial fire isn’t a one-off permit or allowance. It’s an ongoing, repeated permission structure. It’s also a permission structure that doesn’t come from a single, official source. Permits do need to be obtained from the proper state and local regulatory authorities, but it is just as important to gain acceptance from mothers of new infants, from youth coaches who want to have practices outside, from home health workers who want seniors to walk outside in fresh air, from commuters and outdoor workers, and from the many other community stakeholders who experience beneficial fire primarily through the smoke it creates. All of the relevant constituencies can be engaged with so that they understand the long-term community and ecological benefits of low-intensity, controlled burns. Building public trust takes time and repetition. While some respondents described an evolution of attitudes and changes in community acceptance and sensitivity to smoke, others acknowledged how far they have to go with different constituencies in their community.⁶⁶

Forest collaboratives are a promising model for multi-stakeholder engagement and navigating community tradeoffs, including those associated with prescribed burning and protective health measures due to increased smoke events. In some regions of the U.S., such as Oregon, community-based collaboratives have proliferated and been advanced as an effective model for forest governance because of their capacity to promote democratized decision-making and stakeholder engagement.

Forest collaboratives typically consist of stakeholders with a diverse range of interests and serve as a forum for finding mutually beneficial outcomes, resolving tensions productively, and enabling consensus decision making. For example, the Deschutes Collaborative Forest Project (DCFP) in central Oregon includes 23 local stakeholders, including environmentalists, businesspeople, professional foresters, research scientists, loggers, outdoors lovers, private landowners, elected officials, tribal members, recreationists, and government policymakers.⁶⁷ The DCFP has worked for more than 15 years to generate public buy-in and maintain public license for active management on the forest, including creating space for larger and more beneficial prescribed burns.

The DCFP was one of the partners involved in the planning and execution of The West Bend Prescribed Fire Pilot Project in 2024, which was a successful, ambitious and unique effort to accelerate the pace and scale of beneficial fire in the area.⁶⁸

Respondents noted that throughout the planning, notification, execution, and after action review processes of the burn, key personnel from the Deschutes County Public

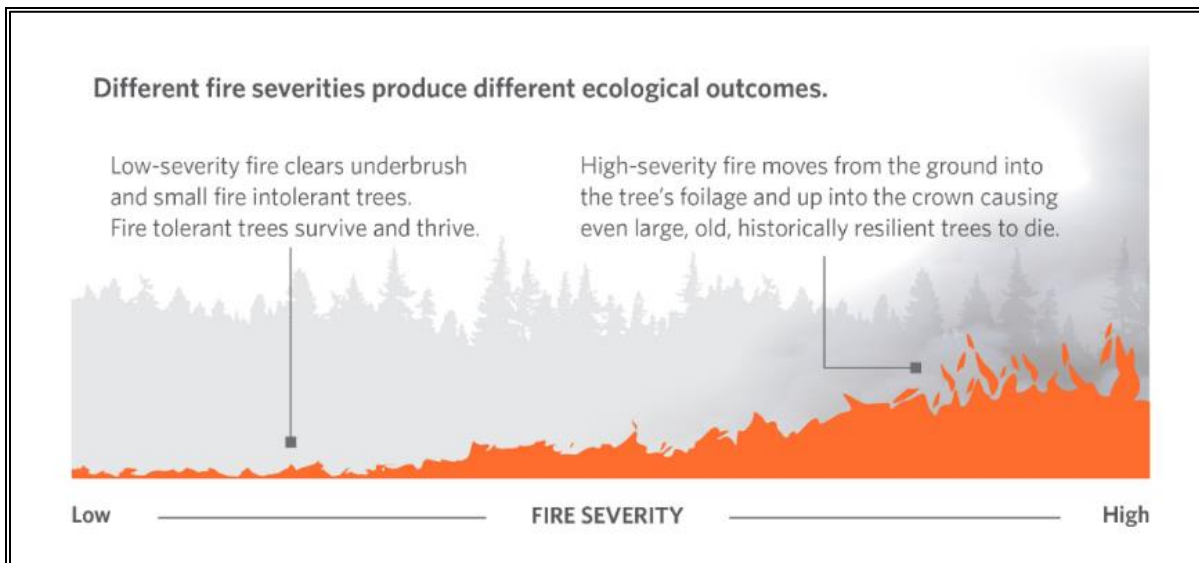
Health department were empowered and included. Respondents also noted that the involvement of key personnel from public health and air quality perspectives throughout the prescribed burn process is not always explicitly planned for and can consequently be underfinanced. The participation of these officials should be built into burn budgets, rather than assumed to be part of their standing mandate, particularly because local public health agencies and officials are stretched thin and cross-pressured with many competing priorities. These competing demands on public officials and the complexity of smoke response make multi-stakeholder collaboratives a particularly important space for preventing sectoral silos. Respondents in other geographies, including Washington State, noted they are looking to replicate the processes and outcomes from the West Bend Pilot project in their communities.⁶⁹

Bringing together the expertise of on-the-ground firefighters and crews and technical forecasting experts to evaluate large-scale prescribed burn opportunities

Beneficial fire policy requires breaking down silos and fostering multidisciplinary, inter-agency and cross-community cooperation. Some respondents across our case geographies noted a historical divide between the air quality monitoring, meteorologist, and forecasting experts who are involved in permitting and planning prescribed burns on one hand, and the on-the-ground crews who conduct prescribed fires on the other. This tension was addressed in Washington State when SB 6120 created a “smoke team” through the Wildland Urban Interface Code.⁷⁰ This team began operating in 2023 as group of meteorologists, forecasters and wildfire analysts in one department within Department of Natural Resources. The team physically goes out in the field and assesses prescribed and planned burns, working in direct cooperation with meteorologists and forecasting. In their experience, there is no similar organizational structure across US states.

Framing and leveraging prescribed fires as drills and opportunities to prepare communities

for significant wildfire disasters and engage in public education and outreach. Respondents across geographies noted that one of the compelling arguments in favor of prescribed and beneficial burns from a community perspective is the opportunity to get experience responding to smoke and fire in a more controlled setting. Planning and executing prescribed burns can utilize incident management structures similar to those used for wildfire events, bringing together public safety and health messengers, emergency responders, land managers, public and private landowners, and federal, state, and local agencies. The outreach and public health messaging that accompany approved burns also present wildfire and emergency response education opportunities.



Educational opportunities around prescribed and planned burns can emphasize the ecological benefits of fire and the community preparedness, planning, and social cohesion benefits.⁷¹ Photo Credit: The Nature Conservancy

What are the key community knowledge gaps or problems for which we don't currently have solutions?

Policy Gaps, Challenges, and Next Frontiers

Across our study geographies, there are a set of policy gaps, challenges, and tensions that remain unresolved. Though many of these insights come from one or a few geographies, they are notable insofar as they don't have clear answers. Many of these gaps, challenges, and tensions were identified by respondents during interviews, and some emerged as notable omissions from policy documents or descriptions of programs from interviewees. Others are thorny policy challenges that may require significant efforts to fully understand, research, and solve.

Protecting the youngest lungs (children from 0-5 years old) during smoke events. While varying degrees of progress have been made at reaching school-age children with smoke readiness approaches across geographies, strategies to protect children in the first 1,000 days of life and to systematically work with early childcare centers and preschools are notably lacking and do not achieve population scale protection. Young children breathe faster, tend to be more active outdoors and, proportionally, take in more air for their body size than adults do. Additionally, young lungs are still developing, which means poor air quality can have a long-term impact on their growth. There are some examples of policies targeting this age group, such as public/private partnership programs to get air cleaners into childcare centers in Missoula, Montana, but no respondent across our study described approaches or programs that are currently operating on a population scale.

Part of this challenge is the dispersed nature of children zero to five. Reaching children before they start compulsory education (often the year of their 5th birthday) requires working with a range of stakeholders, including parent groups, physicians (OB GYNs and pediatricians in particular), social and health services, children's health advocates, local and statewide policymakers, caregivers, early childcare providers, and more. Policy needs to be developed to meaningfully protect young lungs at home and in the places they spend significant amounts of time, including public and private childcare centers. Additionally, policy guidance may need to go beyond "stay indoors if the air is bad" to be meaningfully applicable to balancing the complexities of healthy physical and mental early childhood development in the context of smoke events.

Engaging networks of caregivers that are the frontline point of contact for key vulnerable and sensitive groups, including older persons, persons with disabilities, children, and more. Paid and unpaid caregivers, both of which are

disproportionately female, are integral to protecting sensitive and vulnerable groups. Policies are also critical to caregivers' own health during unsafe periods. If caregivers are not given support to make sure that those receiving care are safe, they are less likely to be able to keep themselves safe.

Part of the challenge with reaching the caregiving community is that they are very dispersed, and the policies and programs necessary to enable smoke readiness can be quite different for different subsets of caregivers. Private, paid caregivers of children need to be able to interface with parents and other guardians to coordinate responses. Unpaid caregivers of children, including but not limited to parents and family members, are often very dispersed and are tough to reach through centralized communication and messaging channels. Paid caregivers of older persons may be concentrated in long-term care facilities and outpatient hospital settings, but also may be spread through networks of in-home care or through paid or unpaid care networks. Individuals providing care and support to persons with disabilities – or persons with disabilities who are caregivers – may have specific transportation, accessibility, and assistive technology needs to enable smoke readiness and be able to respond to public health advice. Broadly speaking, the nuances and perspectives of the caregiving community are inadequately understood and addressed in the context of fire and smoke events.

Understanding and addressing mental and holistic health in wildfire smoke response. Far too little is known about the mental health impacts of smoke, as well as other holistic health impacts, especially among young people and people who have had repeated experiences with smoke and fire. While multiple respondents across geographies raised the mental health aspect of smoke response and readiness, it was commonly in the category of policy gaps and areas where current approaches are inadequate or insufficient. Respondents expressed the opinion that while the studies on the physical health impacts of smoke are progressing, the pace of understanding and data on the mental health impacts lags behind.

A dimension exacerbating the mental health challenges are the confounding and compounding factors often accompanying smoke events. Smoke that comes from a local fire can bring emergency response stress, displacement, and a socioemotional toll, even if there is no physical or financial damage to an individual. Prolonged smoke events, such as those lasting weeks or months, create the need to balance the mental and physical health impacts and economic impacts of prolonged sheltering with exposure to potentially harmful air. When smoke comes at the same time as extreme heat, this can create a public health messaging challenge that is inherently oppositional (e.g. open your windows at night to cool your house vs. keep your windows closed to keep the smoke out).

Additional Gaps and Next Frontiers from our stakeholder conversations include:

- **Increasing clean air shelter and community spaces uptake:** While the provision of clean air shelters and other community clean air spaces increased across our study geographies, significant challenges remain to achieve a level of use or uptake from community members that would meaningfully change population scale health.
- **Indoor air quality verification:** In multiple geographies, there is a lack of capacity to verify that designated cleaner air shelters and other “safe spaces” actually meet HVAC and building standards in many locations, particularly in regions where AC is not ubiquitous, and there are cost barrier to retrofitting the built environment with HVAC systems capable of MERV filtration.
- **Smoke readiness timing challenges:** When systematic outreach efforts, such as coordinated “Smoke Ready Week,” occur months before the actual fires, there can be a disconnect in preparedness.
- **Sustainably funding air filtration:** Many air filter programs have relied on federal, state or private grant funding, but there very few of those grant programs have sustainable funding streams, with particular gaps around maintenance and filter replacement.
- **Reaching outdoor workers:** Many jurisdictions don’t have policies to protect outdoor workers, and even in those that do, such as the states of Oregon and Washington, achieving effective implementation of OSHA and Labor and Industry guidelines protecting outdoor workers remains a challenge, due to fear of lost work and retribution for employees.
- **Protective material reserves and stores:** There is a noted inability at the community level to establish reserves and backlogs of air cleaners, filters, and other protective measures due to demand and storage capacity.

References

- ¹ Childs, M. L., Li, J., Wen, J., Heft-Neal, S., Driscoll, A., Wang, S., Gould, C. F., Qiu, M., Burney, J., & Burke, M. (2022). Daily Local-Level Estimates of Ambient Wildfire Smoke PM_{2.5} for the Contiguous US. *Environmental Science & Technology*, 56(19), 13607–13621. <https://doi.org/10.1021/acs.est.2c02934>
- ² *ibid*
- ³ Why is Smoke a Health Concern? | US EPA. (2025, September 30). US EPA. <https://www.epa.gov/wildfire-smoke-course/why-smoke-health-concern>
- ⁴ Wildfire smoke - a complex mixture | US EPA. (2025, October 6). US EPA. <https://www.epa.gov/wildfire-smoke-course/wildfire-smoke-complex-mixture>
- ⁵ Qiu, M., Li, J., Gould, C. F., Jing, R., Kelp, M., Childs, M. L., Wen, J., Xie, Y., Lin, M., Kiang, M. V., Heft-Neal, S., Diffenbaugh, N. S., & Burke, M. (2025). Wildfire smoke exposure and mortality burden in the USA under climate change. *Nature*, 647(8091), 935–943. <https://doi.org/10.1038/s41586-025-09611-w>
- ⁶ Kelp, M., Burke, M., Qiu, M., Higuera-Mendieta, I., Liu, T., & Diffenbaugh, N. S. (2025b). Effect of recent prescribed burning and land management on wildfire burn severity and smoke emissions in the Western United States. *AGU Advances*, 6(3). <https://doi.org/10.1029/2025av001682>
- ⁷ Who is at Increased Risk of Health Effects from Wildfire Smoke Exposure? | US EPA. (2025, October 10). US EPA. <https://www.epa.gov/wildfire-smoke-course/who-increased-risk-health-effects-wildfire-smoke-exposure>
- ⁸ *ibid*
- ⁹ Respondent interviews in Colorado, Western Washington, and British Columbia
- ¹⁰ Health effects attributed to wildfire smoke | US EPA. (2025, October 14). US EPA. <https://www.epa.gov/wildfire-smoke-course/health-effects-attributed-wildfire-smoke-0>
- ¹¹ Frameworks for Protecting Workers and the Public from Inhalation Hazards. National Academies Press; 2022. doi:10.17226/26372; The Chemistry of Fires at the Wildland-Urban Interface. National Academies Press; 2022. doi:10.17226/26460
- ¹² Respondent interviews in Denver, Colorado
- ¹³ Home page - Love my air. (accessed 2026, April 28). <https://denver.lovemymair.com/>
- ¹⁴ Respondent interviews in Western British Columbia, Northern Oregon, Western Washington, and Montana, authors summary
- ¹⁵ Respondent interviews in Western British Columbia, Northern Oregon, and Central Oregon
- ¹⁶ Respondent interviews in Western BC, Inland BC, Colorado, Montana, Western Washington, Central Washington, Oregon, Australia
- ¹⁷ PurpleAir. From schools to satellites: Who uses PurpleAir and why. (accessed 2026, February 19) <https://www2.purpleair.com/pages/from-schools-to-satellites-who-uses-purpleair-and-why>
- ¹⁸ Air Quality Sensors | Puget Sound Clean Air Agency, WA. (accessed 2026, March 16). <https://www.pscleanair.gov/539/Air-Quality-Sensors>
- ¹⁹ Respondent interviews in Inland British Columbia, Colorado, Central Oregon, Central Washington, Northern Oregon
- ²⁰ Respondent interviews in Inland British Columbia, Western British Columbia
- ²¹ Respondent interviews in Western British Columbia, Montana, Colorado, Central Washington, Central Oregon, Northern Oregon.
- ²² Clean Air Methow. (accessed 2025, December 9). Clean Air Methow. <https://www.cleanairmethow.org/>
- ²³ Respondent interviews in all study geographies (Western British Columbia, Inland British Columbia, Western Washington, Central Washington, Northern Oregon, Central Oregon, Colorado, Montana, and Australia)
- ²⁴ Create a clean room to protect indoor air quality during a wildfire | US EPA. (2025, December 30). US EPA. <https://www.epa.gov/emergencies-iaq/create-clean-room-protect-indoor-air-quality-during-wildfire>
- ²⁵ U.S. Environmental Protection Agency. (accessed 2026, April 29). WILDFIRE SMOKE FACTSHEET. <https://www.airnow.gov/sites/default/files/2022-02/how-to-create-a-clean-room-at-home.pdf>
- ²⁶ Respondent interviews in all study geographies
- ²⁷ Oregon Health Authority: Health-Related Social Needs Benefits: Office of Health Analytics: State of Oregon. (accessed 2026, April 19). Health-Related Social Needs Benefits: Oregon Health Authority. <https://www.oregon.gov/oha/hpa/analytics/pages/hrsn-data-reporting.aspx>
- ²⁸ Respondent interviews in Central Oregon, Western Washington, Central Washington
- ²⁹ Respondent interviews in Western BC, Northern Oregon, Central Oregon, Western Washington, Montana
- ³⁰ Corsi-Rosenthal, B. (accessed 2026, March 11). DIY Box Fan Air Filter. https://aghealth.ucdavis.edu/sites/g/files/dgvnsk261/files/inline-files/DIY%20Air%20Purifier%20Directions_English.Spanish_0.pdf
- ³¹ Respondent interview in Western Washington

- ³² Building resilience to emerging airborne threats and heat events. [Impact Report]. <https://bclung.ca/wp-content/uploads/2024/06/BREATHE-Impact-Evaluation-Report-FINAL.pdf>
- ³³ Respondent interviews in all study geographies
- ³⁴ Respondent interviews in Australia
- ³⁵ Respondent interviews in Western British Columbia, Central Washington, Northern Oregon
- ³⁶ Respondent interviews in Inland British Columbia
- ³⁷ De Meteorological, A. E. (accessed 2026, May 16). Meteorological warnings - State Meteorological Agency - AEMET - Spanish Government. State Meteorological Agency - AEMET - Spanish Government. <https://www.aemet.es/en/eltiempo/prediccion/avisos>
- ³⁸ Diaz, Yolando (2024b, November 29). Spain introduces paid climate leave after deadly floods. The Guardian. <https://www.theguardian.com/world/2024/nov/29/spain-paid-climate-leave-floods>
- ³⁹ Respondent interviews in Pennsylvania; Climate Emergency Paid Leave Act (accessed 2026, March 9). <https://www.palegis.us/house/co-sponsorship/memo?memoID=47204>
- ⁴⁰ Respondent interviews in all study geographies
- ⁴¹ Respondent interviews in Central Washington, Northern Oregon, Central Oregon
- ⁴² Respondent interviews in Northern Oregon
- ⁴³ Respondent interviews in Central Oregon, Central Washington, Northern Oregon
- ⁴⁴ Fire Networks. (2026, March 17). Fire Networks - about - Fire networks. <https://firenetworks.org/about/>
- ⁴⁵ Leverich, A. (2025, September 4). New resources available now for supporting smoke ready communities. Fire Networks. <https://firenetworks.org/new-resources-available-now-for-supporting-smoke-ready-communities/>
- ⁴⁶ Respondent interviews in Australia, Western Canada, Western Washington
- ⁴⁷ Respondent interviews in Northern Oregon
- ⁴⁸ Columbia River Gorge Community Response Plan. (accessed 2026, May 5), Revised February 2026. <https://ormswd2.synergydcs.com/ORMSCMSearchDEQ/Search/RecordViewer.aspx?uri=7033155>
- ⁴⁹ Respondent interviews in all study geographies
- ⁵⁰ Respondent interviews in Central Oregon, Central Washington, Northern Oregon, Montana
- ⁵¹ Respondent interviews in all study geographies
- ⁵² Smoke Ready Gorge. (accessed 2026, February 11). *Home - SMOKE READY GORGE*. <https://smokereadygorge.org/>
- ⁵³ Central Oregon Fire: The Source For Comprehensive Fire, Health, And Air Quality Information In Central Oregon (accessed 2026, May 6). Central Oregon Fire. <https://centraloregonfire.org/>
- ⁵⁴ Robinson, E. (accessed 2026, June 5). Washington Smoke Blog. <https://wasmoke.blogspot.com/>
- ⁵⁵ MONTANA WILDFIRE SMOKE. (accessed 2026, May 6). MONTANA WILDFIRE SMOKE. <https://www.montanawildfiresmoke.org/>
- ⁵⁶ Respondent interviews in Central Oregon, Central Washington
- ⁵⁷ Respondent interviews in Western Washington
- ⁵⁸ *ibid*
- ⁵⁹ Respondent interviews in all study geographies
- ⁶⁰ Biddinger, P. D., Savoia, E., Massin-Short, S. B., Preston, J., & Stoto, M. A. (2010). Public Health Emergency Preparedness Exercises: Lessons learned. *Public Health Reports*, 125(5_suppl), 100–106. <https://doi.org/10.1177/00333549101250s514>
- ⁶¹ Respondent interviews in Inland British Columbia
- ⁶² Respondent interviews in Inland British Columbia, Western Washington, Central Oregon
- ⁶³ Get ready for wildfire smoke season: Smoke Ready Week starts Monday. (2025, June 5). Washington State Department of Health. <https://doh.wa.gov/newsroom/get-ready-wildfire-smoke-season-smoke-ready-week-starts-monday>
- ⁶⁴ Respondent interviews in Central Oregon, Central Washington
- ⁶⁵ Respondent interviews in Inland British Columbia
- ⁶⁶ Respondent interviews in Central Oregon, Inland British Columbia, Australia
- ⁶⁷ Respondent interviews in Central Oregon; Deschutes Collaborative Forest Project. (2026, March 24). *home / Deschutes Collaborative Forest Project*. <https://deschutescollaborative.org/>
- ⁶⁸ West Bend Prescribed Fire Pilot after action review: executive summary
- ⁶⁹ Respondent interviews in Central Washington
- ⁷⁰ Respondent interviews in Central Washington
- ⁷¹ The Pacific Northwest is Missing Wildfire. (accessed 2026, May 6). The Nature Conservancy. <https://www.nature.org/en-us/about-us/where-we-work/united-states/oregon/stories-in-oregon/oregon-forests-need-fire/>