



## Research Brief for Resource Managers

**Release:**

February 2019

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# Comparing Community Smoke Exposure from Wildfires to Prescribed Fire in the United States

Navarro, Kathleen M., et al. 2018. A Review of Community Smoke Exposure from Wildfire Compared to Prescribed Fire in the United States. *Atmosphere*. 9 (5): 185. <https://www.mdpi.com/2073-4433/9/5/185>.

Prescribed fire and wildfire in the Western US have long been critical ecological processes used by humans, specifically Native Americans, to manage the plant species, insects, and diseases present in a landscape. However, policies of fire suppression have led to a decrease in the amount of wildfire and prescribed fire and an increase in fuels in western US forests. Prescribed fire is seen as a tool to manage the build-up of these accumulated fuels on Western US landscapes.

Though prescribed burning has the potential to restore fire-adapted ecosystems across larger areas, it is important to understand the risks that fire management decisions pose on public health. Fine particulate matter (PM<sub>2.5</sub>) from wildfire smoke has been linked to adverse health impacts on both respiratory and cardiovascular systems in humans. Concerns regarding air-quality impacts are one of the constraints to using prescribed fire. However, in ecosystems that are fire prone, smoke from fires, whether they are prescribed fires or wildfires, is unavoidable. This has led to discussions of tradeoffs between wildfire and prescribed fire smoke. The objective of this research synthesis was to examine the differences in community level exposures to smoke from both wildfire and prescribed fire. To do this, the study looked to address 3 questions:

### Management Implications

- Long term exposure to fine particulate matter (PM<sub>2.5</sub>) from smoke can cause adverse health impacts on local communities
- Current research on the concentrations of PM<sub>2.5</sub> from wildfire and prescribed fire smoke differ greatly in their data collection methods (i.e. distance from fire, and time duration), limiting the ability to compare results
- Managers should continue to collaborate with air quality managers to monitor PM<sub>2.5</sub> concentrations in communities near burn sites

- 1) What are the differences in PM<sub>2.5</sub> concentrations between prescribed fire and wildfire smoke exposure?
- 2) How do PM<sub>2.5</sub> concentrations from each exposure scenario compare to National Ambient Air Quality Standards (NAAQS)?
- 3) How long are communities exposed to PM<sub>2.5</sub> during each exposure scenario?

### Methods

The researchers screened over 2,000 scientific journal articles associated with smoke exposure from wildfire or prescribed burns. The inclusion criteria required 1) studies conducted in the United States and 2) studies that reported PM<sub>2.5</sub> concentrations during a specific wildfire or

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prescribed burn event. A total of 16 papers (9 related to a wildland fire and 7 to prescribed fires) met the specified criteria and were included in the synthesis.

### Results and Discussion

It was observed that the methods of data collection for PM<sub>2.5</sub> concentrations differed greatly between prescribed fire and wildfire smoke studies. Studies measuring PM<sub>2.5</sub> exposure from wildfire smoke tended to collect data in nearby communities or cities downwind from the fire (7 to 242.8 km away). Conversely, studies that focused on prescribed burns often measured particulates immediately adjacent to the fire, either in the burn area or along the fire perimeter. Furthermore, the duration of time that was used to average concentration measurements also differed between the two fire types studied. Wildfire studies tended to average PM<sub>2.5</sub> concentrations over a 24hr time period, while prescribed burn studies reported mean concentrations that were sampled over time periods ranging from 1-96 hours, with most of these being less than 24hr. Because of this, shorter-sampled prescribed fire results only captured times of intense smoke emissions and, thus, reported higher average smoke emissions. The longer-sampled wildfire results had lower average PM<sub>2.5</sub> concentrations because they captured both periods of high and low particulate concentrations.

Overall durations of wildfire and prescribed burn events are important to consider. Increases in exposure durations can lead to a higher cumulative exposure to air contaminants and particulate matter. Simply put, the longer a fire burns, the more particulates a person in the area is exposed to. The wildfire events in this synthesis occurred over weeks to months, while the prescribed burns were generally a few days. In addition to duration length, health impacts associated smoke exposure can also be determined through exceedances of the National Ambient Air Quality Standards (NAAQS). During the wildfire events studied, the number of days that exceeded the NAAQS ranged from 2 to 47 days and averaged 11 days. Only one prescribed fire study looked at how prescribed fire impacted

NAAQS, with the result of a single day listed as exceeded.

PM<sub>2.5</sub> concentrations emitted from wildfire smoke appeared to be lower than PM<sub>2.5</sub> concentrations emitted from prescribed fire smoke. However, the authors stressed that the differences in study designs should not be dismissed. There is also a lack of consistent information about contaminant exposure – harmful substances found within smoke aside of particulate matter—from fire smoke, specifically from prescribed fires.

The authors emphasized the importance of developing a better understanding of the health tradeoffs between different smoke events, which requires collecting comparable data for different smoke events.

### Suggested Readings

*Stephens, S.L.; Martin, R.E.; Clinton, N.E. Prehistoric fire area and emissions from California's forests, woodlands, shrublands, and grasslands. For. Ecol. Manag. 2007, 251, 205–216.*

*Quinn-Davidson, L.N.; Varner, J.M. Impediments to prescribed fire across agency, landscape and manager: An example from northern California. Int. J. Wildland Fire 2012, 21, 210–218.*

*Henderson, S.B.; Johnston, F.H. Measures of forest fire smoke exposure and their associations with respiratory health outcomes. Curr. Opin. Allergy Clin. Immunol. 2012, 12, 221–227.*

*Schweizer, D.W.; Cisneros, R. Forest fire policy: Change conventional thinking of smoke management to prioritize long-term air quality and public health. Air Qual. Atmos. Health. 2017, 10, 33–36.*

*Schultz, C., et al. Prescribed Fire Policy Barriers and Opportunities: A Diversity of Challenges and Strategies Across the West. Ecosystem Workforce Program Working Paper Number 86. 2018.*  
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