



Northern Rockies Fire Science Network

A JFSP FIRE SCIENCE EXCHANGE NETWORK

Prescribed fire generally does not reduce net smoke emissions

RESEARCH BRIEF 20 • July 2026

As wildfire smoke seasons worsen, harm to human health from fine particulate matter (PM_{2.5}) will grow dramatically. Prescribed fire, which has many proven benefits for forest and fire management, is increasingly promoted as a strategy to reduce these increasing smoke impacts. It seems straightforward—accept a little smoke now to avoid much more smoke later. However, there is growing debate if prescribed fire avoids more smoke emissions than it adds.

This study analyzed the conditions under which prescribed fire could produce a net smoke reduction, focusing on: the chance a treatment is hit by wildfire; the reduction in wildfire smoke when treated areas burn; and the likelihood that treatments help stop or slow wildfire.

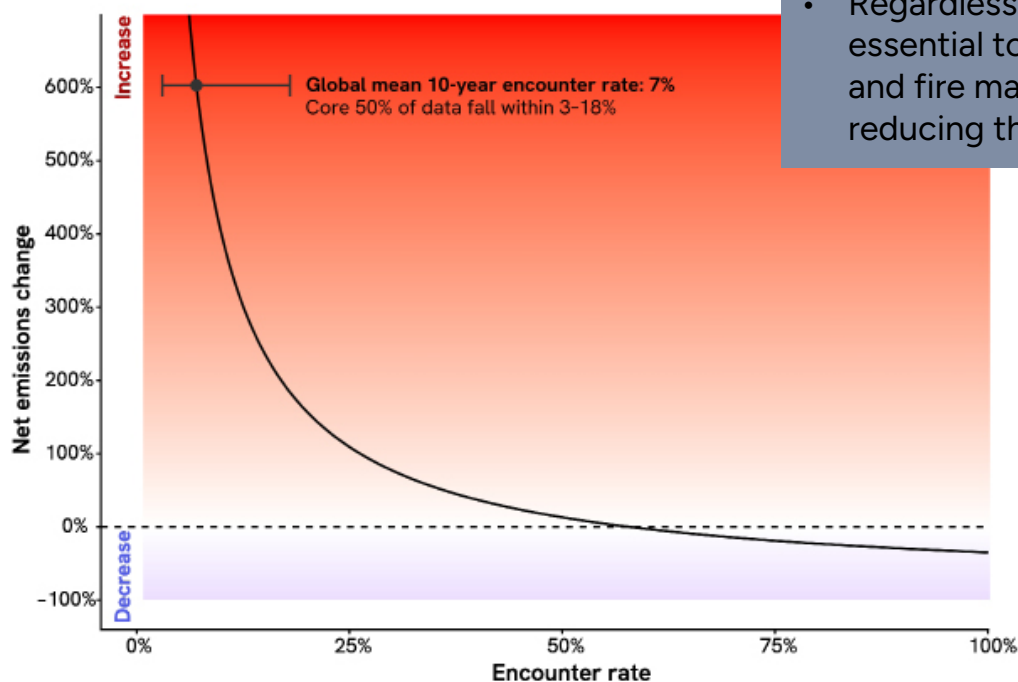


Figure 1. Whether prescribed fire avoids more emissions than it adds depends greatly on the encounter rate (likelihood the area subsequently burns in a wildfire).

KEY MANAGEMENT FINDINGS

- In most places, prescribed fire adds more smoke emissions than it avoids in subsequent wildfires.
- Prescribed fire is like car insurance: the premiums (smoke from prescribed fires) are certain, but the claims (reduced wildfire smoke) only pay out if a wildfire hits a treated area.
- Previous findings that prescribed fire reduces net smoke emissions often rely on methodology that underestimated full treatment emissions or the assumption that all treated areas would subsequently burn in wildfires.
- Regardless, prescribed fire remains an essential tool for its other proven forest and fire management benefits, including reducing the risk of extreme fire events.

The Northern Rockies Fire Science Network (NRFSN) serves as a go-to resource for managers and scientists involved in fire and fuels management in the Northern Rockies. Funded by the Joint Fire Science Program, NRFSN is one of 15 Fire Science Exchange Networks across the country.



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RESULTS

In most places in the U.S. and globally, prescribed fire emits more smoke than it avoids. Even though treated areas that later burn do have reduced wildfire smoke, this reduction is generally far offset by smoke from the prescribed burns themselves, since most prescribed fire treatments are never used in a wildfire (Figure 1). Under average conditions, every ton of prescribed fire smoke only avoids ~0.1 tons of wildfire smoke.

Prescribed fire increases total emissions but reduces the risk of extreme smoke events. It's like car insurance: the premiums (prescribed fires) are certain, while the claims (reduced wildfire smoke) only pay out if a wildfire hits a treated area. Like insurance, prescribed fire is essential, but we shouldn't expect to get back more in claims than we pay in premiums.

This research also shows why some earlier studies concluded that prescribed fire could reduce overall smoke. Many studies did not account for the guaranteed smoke from prescribed burns or assumed every treatment would be subsequently encountered and reduce wildfire smoke. Both assumptions inflate the expected smoke benefit of prescribed fire. When re-estimated with updated assumptions, prescribed fire increases net emissions at 99% of study sites, with a median 10-year increase of 210%.

MANAGEMENT IMPLICATIONS

While prescribed fires generally add more smoke than they avoid, they may still reduce the human health impacts from smoke. Wildfire smoke tends to rise higher, travel farther, and more often reach large population centers. Prescribed fires, by contrast, produce smoke under more predictable conditions. When communities know a prescribed burn is planned, they can take proactive steps to reduce smoke exposure, for example by investing in portable air cleaners or creating community clean air spaces.

Regardless of the smoke tradeoffs, prescribed fire remains essential for forest and fire management. Many of its benefits (increasing



Prescribed burn on the Bitterroot National Forest (courtesy photo)

biodiversity, improving resistance to drought and disease) occur whether or not a treatment later burns in a wildfire. Smoke benefits are the exception: the benefits only occur if a treatment later interacts with wildfire, but the costs (smoke from the prescribed fire itself) happen every time. The question may no longer be whether prescribed fire reduces smoke overall, but how can we maximize the other proven benefits of prescribed fire while minimizing its risks.

ADDITIONAL INFORMATION

M.R. Kreider, S.P. Urbanski, & J. Fargione, Prescribed fire is unlikely to reduce net PM_{2.5} emissions in most locations, *Proc. Natl. Acad. Sci. U.S.A.* 123 (28) e2613722123, <https://doi.org/10.1073/pnas.2613722123> (2026).

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