USDA Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Rocky Mountain Research Station

Science You Can Use *(in 5 minutes)*

JUNE 2024

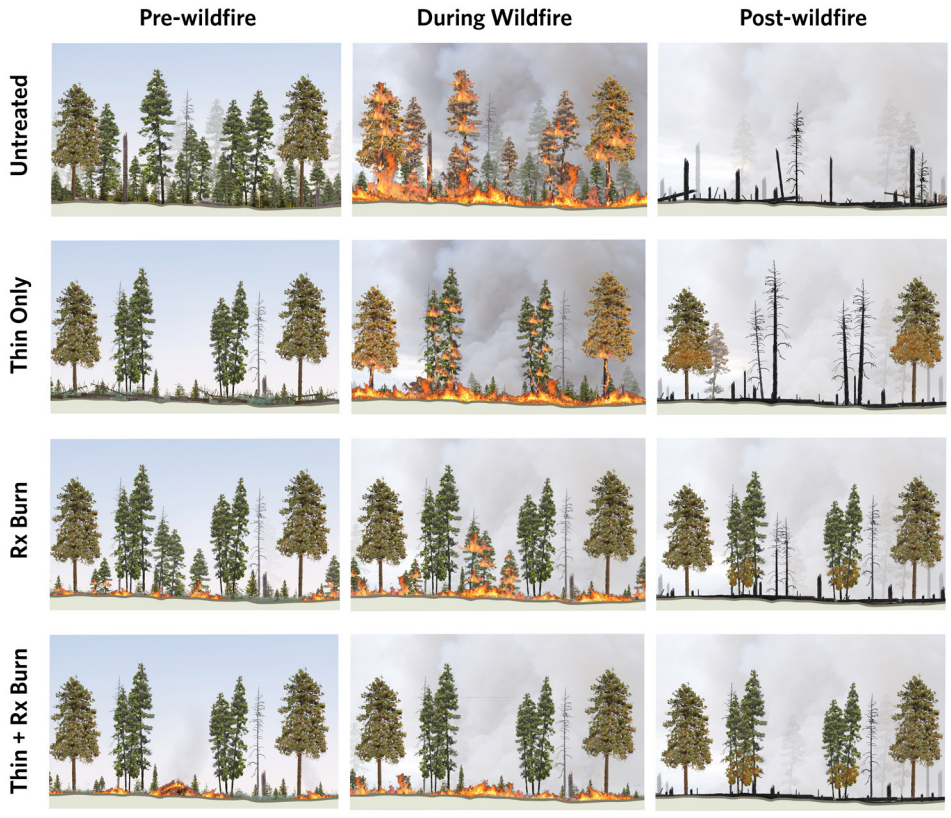
Burning Questions Answered: New review examines 30 years of fuel treatment effects on wildfire severity

More high-severity wildfire is occurring in the U.S. West and affecting people and forests in challenging ways. In places where mitigating high-severity wildfire is desirable, returning low-severity fire through fuel treatments is common practice. The last quantitative review of fuel treatment research happened 10 years ago. Much has been learned since then.

A recently published review, led by Kimberley Davis, Research Ecologist at the USDA Forest Service's Rocky Mountain Research Station, and collaborators at the University of Montana and The Nature Conservancy, brings together results from 40 studies for a rigorous analysis of fuel treatment efficacy.

The studies occurred across 11 western States and featured three forest types (California mixed conifer, Intermountain mixed conifer, and ponderosa/Jeffrey pine). Researchers asked how treated areas reduced subsequent wildfire severity compared to untreated areas. They analyzed how wildfire severity changed with treatment age, forest type, and treatment type (thinning, prescribed fire, thinning and prescribed fire combined, thinning and pile burning, and prior wildfire). Finally, they examined how fire weather conditions impacted fuel treatment efficacy.

"There is overwhelming evidence that reducing tree density and returning low severity fire to dry mixed conifer forests reduces the severity of subsequent wildfires," said Davis. Forest sites that received fuel



This conceptual illustration shows how different treatments can impact the severity of subsequent wildfires in the landscape. Areas that have received thinning and prescribed burn treatments fare better then areas left untreated or with only one treatment. Figure by Erica Sloniker, The Nature Conservancy.

treatments experienced a reduction in wildfire severity by over 60 percent compared to untreated areas. The most effective treatment was the combination of thinning and prescribed fire. This treatment had a mean reduction of 72 percent in later wildfire severity. Thinning and pile burning combined and prescribed burning alone both saw a decrease in wildfire severity of 62 percent. Thinning without removing surface fuels was less effective—an average reduction in fire severity of 27 percent—and in some cases led to higher wildfire severity than in nearby untreated areas.

The review found treatment upkeep is critical. With each passing year, the benefits of fuel treatments are lessened as forests rebuild flammable fuel loads. At the 10-year mark, the reduction in wildfire severity due to fuel treatments fell to 28 percent on average. To sustain treatments' ability to reduce subsequent wildfire severity, the data suggest natural resource professionals repeat treatments every 10 to 20 years, depending on local conditions.

Examining fire weather conditions, the researchers found the impact of treatments didn't change. Treatments were still helpful in lowering wildfire severity overall, even in the studies with the warmest and driest fire weather conditions.

KEY MANAGEMENT CONSIDERATIONS

- Forest treatments aimed at decreasing tree density and surface fuels effectively decrease the severity of later wildfires.
- The combination of prescribed burning and thinning was the most impactful treatment over time in reducing wildfire severity by, on average, 72 percent.
- Prescribed burning alone, and thinning with pile burning, were both effective treatments as well, reducing fire severity by, on average, 62 percent.
- Routine upkeep is key—the ability of fuel treatments to reduce future wildfire severity lowers over time.
- Prior low-to-moderate severity wildfires lower the severity of future wildfires but to a lesser extent than the most effective treatments.

On its own, prior low-to-moderate severity wildfire reduced future wildfire severity by 25 percent. Researchers noted the data support further studies into the ways that managed wildfires can be a beneficial tool to restore resilient forests for people and wildlife.

"Where increasing severe wildfire threatens communities, key habitat, and other natural resources, we need proven solutions for reducing the risk of severe fire," said Joseph Fargione, Science Director for The Nature Conservancy's North America Region, and contributing author to the review. "This comprehensive synthesis lends confidence about the effectiveness of applying treatments, especially thinning with prescribed burning."

FEATURED SCIENTISTS

Kimberley T. Davis is a Research Ecologist for the Rocky Mountain Research Station in the Fire, Fuel, and Smoke Science Program who zeroes in on the ways forest resilience and management are impacted by dynamic shifts in climate and fire regimes.

Jamie Peeler is a Landscape Ecologist and post-doctoral fellow at the University of Montana's Department of Ecosystem and Conservation Sciences Paleoecology and Fire Ecology Lab.

Joseph Fargione is the Science Director, North America for The Nature Conservancy.

Annabelle Moore is the author of this Science You Can Use.

FURTHER READING

Davis, Kimberley T.; Peeler, Jaime; Fargione, Joseph; [et al.]. 2024. Tamm review: A meta-analysis of thinning, prescribed fire, and wildfire effects on subsequent wildfire severity in conifer dominated forests of the western U.S. Forest Ecology and Management. 561: 121885.

Kalies, Elizabeth L.; Yocom Kent, Larissa L. 2016. Tamm review: Are fuel treatments effective at achieving ecological and social objectives? A systematic review. Forest Ecology and Management. 375: 2016.05.021.

Prichard, Susan J.; Hessburg, Paul F.; Hagmann, R. Keala; [et al.]. 2021. Adapting western North American forests to climate change and wildfires: 10 common questions. Ecological Applications. 31(8): e02433. 10.1002/eap.2433.