NORTHERN ARIZONA UNIVERSITY | Ecological Restoration Institute | UNIVERSITY of WASHINGTON

FACT SHEET

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Adapting western North American forests to climate change and wildfires: Ten common questions

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Introduction

Rapid climate change is bringing warmer, drier, and longer wildfire seasons to western North America, and wildfires have been increasing in severity and area-burned in recent decades. Through years of record-setting wildfires, the key ingredients to big fire years are clear—drought, tinder dry fuels, lightning ignitions, and escaped human-started fires followed by strong wind events. However, what—if anything—we can do about the worsening wildfire problem remains hotly debated in the popular media and a limited set of scientific literature.

There is strong scientific evidence for why and how to adapt western forests to climate change and future wildfires. As part of an invited feature in the scientific journal *Ecological Applications* titled "Climate change and western wildfires," Susan Prichard and coauthors addressed 10 common questions about adaptive forest and wildfire management.

Question 1: Are the effects of fire exclusion overstated? If so, are treatments unwarranted and even counterproductive?

There is strong and broad-scale scientific evidence that 20th-century fire exclusion has markedly changed the composition and structure of fire-prone forests of western North America and predisposes them to large and often more severe wildfires. See Hagmann et al. (2021) for careful documentation of the evidence for changes in forest condition and fire regimes.

- Forests that were once characterized by dynamic patchworks of forest, woodlands, grasslands and shrublands in the early 20th-century gradually became more continuously covered in forest and densely stocked with fuels.
- As a result, many western forests are indeed more vulnerable to wildfire and drought, particularly under a rapidly warming climate.

Question 2: Is forest thinning alone sufficient to mitigate wildfire hazard?

In historically dry, frequent-fire forests, thinning can reduce ladder fuels and make it safer to reintroduce fire. However, forest thinning is not appropriate in all forests and often isn't effective on its own. Without associated reduction in surface fuels, many thinning projects effectively reduce crown fire hazard but still support high-intensity surface fires that contribute to high tree mortality in the event of a wildfire.

Thinning treatments followed by prescribed fire (see above) effectively reduces ladder and surface fuels and lowers the risk of catastrophic wildfire.

Question 3: Can forest thinning and prescribed burning solve the problem?

Combined thinning and prescribed burning are often highly effective at mitigating the severity of subsequent wildfires. Prescribed burning, alone or in combination with mechanical thinning, not only makes fire-prone, dry forests more resilient to future wildfires but can also increase their resilience to drought, insects and diseases. In seasonally dry pine, mixed conifer, and oak forests woodlands, thinning and burning in partnership with local Indigenous knowledge and practice support culturally valued practices, traditions, livelihoods, and food and medicine security. However, the current scale and pace of these treatments do not match the scale required for western forests, and these fuel reduction treatments are not appropriate for all conditions or forest types (e.g., temperate rainforests or cold forests dominated by thin-barked conifers).

Question 4: Should active forest management, including forest thinning, be concentrated in the wildland urban interface (WUI)?

Prioritizing only the WUI for fuel reduction treatments is often too narrow in scope to address wildfire risk and forest health. There is increasing evidence that treating fuels across larger spatial extents in strategically planned locations, rather than immediately adjacent to WUI, can reduce risk to communities. Benefits of this strategy can include increased initial attack and short-term suppression effectiveness, reduced crown fire potential and ember production, reduced smoke impacts to communities, and increased forest resilience. Across complex forest landscapes of the western US, it is more effective to prioritize fuel treatments that maximize benefits across large areas and over long time frames, rather than constrain them to the WUI.

Question 5: Can wildfires on their own do the work of fuel treatments?

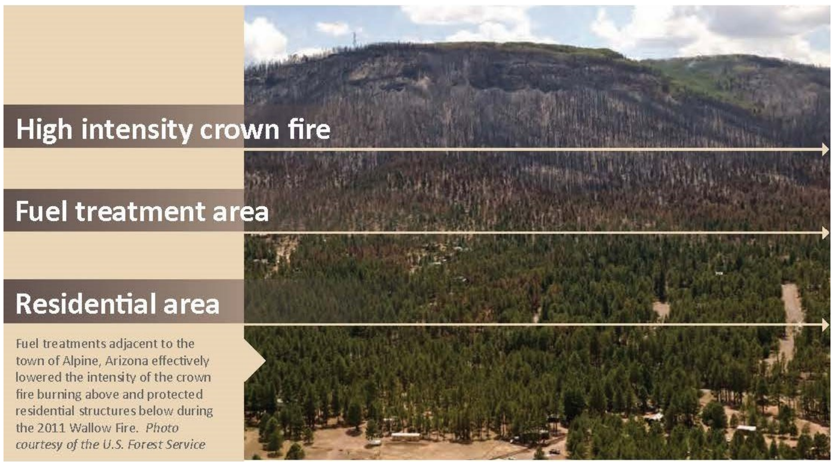
Escaped wildfires generally burn at the height of fire season under extreme weather conditions, often leading to explosive fire growth, leaving large patches of tree mortality. Although 2-3% of fire starts escape suppression, they account for over 90% of annual area burned in the US. Inadvertently, escaped wildfires are now a dominant change agent of western forests and are likely accelerating rates of climate-driven vegetation change. With few exceptions, the current approach to modern wildfire management in the US and Canada is initial attack of unplanned fire starts. However, expanding opportunities to manage wildfires under milder weather conditions holds promise. Some land managers—including those managing national parks and wilderness areas—have designated remote areas where most wildfires are allowed to burn under moderate fire weather and fuel conditions.

Question 6: Is the primary objective of fuel reduction treatments to assist in future firefighting response and containment?

Fuel treatments are not designed to prevent or stop fires but to moderate fire behavior when fire inevitably returns. However, there is a frequent misconception that fuel treatments should facilitate suppression and limit the size of wildfires. If fuel treatments simply assist fire suppression, then wildland fuels will continue to accumulate, creating even more hazardous conditions. However, if fuel treatments are designed such that the next wildfire can be allowed to burn with limited or no suppression, then three economic and ecological objectives can be achieved: reduced suppression costs and actions; management of future wildfires as effective fuel treatment maintenance; and favorable ecological outcomes in areas treated before wildfire. As the pace and scale of fuel treatments increases, emphasis on resilient forest structure and composition, long-term reduction of surface and canopy fuels, and adaptation to climate change are critical components of treatment objectives rather than creating conditions that are simply more conducive to fire suppression.

Question 7: Do fuel treatments work under extreme fire weather?

There is strong scientific evidence that even under extreme weather conditions, fuel treatments are effective at moderating fire severity across a range of forest types and wildfire events. Treatment areas within large fires are associated with increased conifer survival and reduced severity compared with adjacent, untreated areas. Past wildfires are also effective at mitigating wildfire severity. While fuel reduction treatments, including managed wildfires, are designed to mitigate future wildfire intensity and effects, they are not necessarily intended to impede fire spread or reduce fire size. Large fires have always been a part of fire-prone forests, and within large fire events, fuel treatments can allow fires to continue burning but mitigate fire severity and enhance the variability of fire effects.



Fuel treatments adjacent to the town of Alpine, Arizona effectively lowered the intensity of the crown fire burning above and protected residential structures below during the 2011 Wallow Fire. *Photo courtesy of the U.S. Forest Service*

Question 8: Is the scale of the problem too great — can we ever catch up?

There is strong scientific evidence that fuel reduction treatments, including prescribed burning, cultural burning, forest thinning combined with prescribed burning, and managed wildfires, are effective approaches for mitigating future fire severity. However, we can't expect them to work if we are only applying them to a small percentage of western forest landscapes. In fact, recent analyses of fuel treatment effectiveness demonstrate that at landscape and regional scales, fuel treatments account for only a small fraction (~1%) of the area burned by wildfires. At this current pace and scale of treatment, wildfires may rarely encounter treated areas while the treatments are still potentially effective. There is no single management tool adequate to increase the resilience of western forests to wildfire. However, with expanded investment and with the use of managed wildfires, treatments can be used strategically to multiply their benefits and promote greater opportunities for applying wildland fire across landscapes.

Question 9: Will planting more trees mitigate climate change in western forests?

In fire-adapted dry pine and mixed-conifer forests, dense tree plantations are highly susceptible to future wildfires and drought. A promising alternative approach to retaining and sequestering carbon in dry, fire-prone forests is to thin forests and retain the larger, more fire-resistant trees (for example, ponderosa pine or western larch) to increase their productivity and improve their chances of survival from drought, insects, disease, and wildfires.

Question 10: Is post-fire management needed or even ecologically justified?

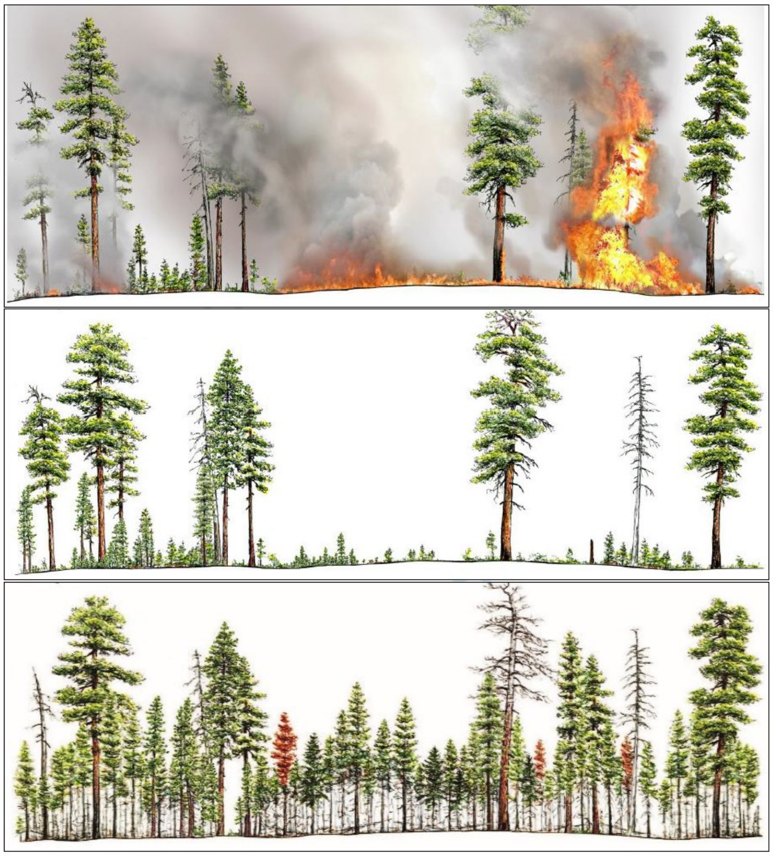
As more area is burned by wildfires, studies found a need to evaluate opportunities to foster greater resilience of these post-fire landscape. After over a century of fire exclusion, recent wildfires are generally not restoring climate and fire-resilient forest landscapes on their own. In patches of high tree mortality, accumulated wood from downed trees can create conditions for high-intensity reburn events that can kill young regenerating forests and delay forest recovery. Even where wildfire effects are variable, post-fire fuels reduction may be required to protect the remaining forest for future forest resilience to disturbance and climate change and to protect valued cultural resources.

Conclusions and Management Recommendations

During this time of rapid environmental change, the impacts of climatic changes on forests and their associated fire regimes cannot be overstated. Intentional management focused on adapting current forest conditions to a rapidly evolving future climate future climate is urgently needed.

Although the management situation for western forests is daunting, review of the scientific literature offers clear guidance. Across a wide range of western forests, landscape-level treatment strategies, including use of managed wildfires and the revitalization of Indigenous burning practices, can promote resilient patchworks and reduce the extent of high-severity wildfires as well as insect and disease outbreaks. These recommendations are in close alignment with Indigenous knowledge, cultural resource values, and desired land management strategies.

- In seasonally dry forests historically dominated by fire-resistant species, restoring open, fire-tolerant canopy structure and composition, favoring larger tree sizes, and reducing surface fuels can effectively mitigate subsequent wildfire and stabilize carbon stocks.
- This restoration work, with ongoing maintenance by fire, can be done strategically across different spatial scales to better allow managed wildfire to appropriately work for added resiliency. In many instances, this will enable future wildfire events to further reinforce resilient forest structure and composition.
- Actively suppressing fire is an active management decision that continues to promote surface and canopy fuel accumulation. While protection of communities and resources will always require suppression, landscape use of fire is needed to develop long-term resiliency. Continued forest infilling and fuel accumulation predisposes forests to high-severity fire when fire inevitably returns.
- Given the urgent need for adaptive forest management in the 21st-century, an intentional merging of Indigenous and western knowledge is needed to guide future forest conditions and restore active fire regimes to western forests.



Conceptual diagram of low and moderate severity fire effects on post-fire residual structure. Top: Frequent fire reduces surface and ladder fuels. Middle: Gradual accumulation of live and dead fuels between fires. Bottom: Conditions after prolonged fire exclusion. Forest are denser and more layered, and high-severity fire is likely. Credit: Robert Van Pelt

This fact sheet summarizes information from the following journal article:

Prichard, S.J., P.F. Hessburg, R.K. Hagmann, N.A. Povak, S.Z. Dobrowski, M.D. Hurteau, V.R. Kane, R.E. Keane, L.N. Kobziar, C.A. Kolden, M. North, S.A. Parks, H.D. Safford, J.T. Stevens, L.L. Yocom, D.J. Churchill, R.W. Gray, D.W. Huffman, F.K. Lake, P. Khatri-Chhetri 2021. Adapting western North American forests to climate change and wildfires: ten common questions. *Ecological Applications*, doi:10.1002/eap.2433

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