

Fact Sheet: Forest Restoration Treatments and Fire Behavior

Changing fire behavior is not the only reason to restore fire-adapted western forests: restoration treatments in these forests are intended to restore overall ecological health. Yet lowering the severity of wildfires is one of the most important of contemporary management goals in these forests. How do treatments affect fire behavior?

Thinned Ponderosa Pine Forests Exhibit Less Severe Fire Behavior. Numerous observations of actual wildland fires, as well as computer modeling studies, have shown that fires burn less intensely in ponderosa pine forests with a lower density of trees.¹ Breaking up contiguous fuels in tree canopies is especially important in reducing fire intensity. Fuels can be both horizontally and vertically contiguous, and it is important to break them up in both directions in order to prevent the spread of crown fires.

These real-life prescribed burns set in treated and untreated ponderosa pine stands on the Kaibab National Forest in Arizona show how tree density affects fire behavior.



Burn Only. An unthinned forest burns at a high level of intensity during a prescribed fire. Vertical “fuel ladders” readily allow flames to climb from the ground into tree crowns, while closely ranked trees allow fire to spread from crown to crown without much wind.



Minimal Thinning. Thinning around large trees may spare them from fire, yet flames can still spread fairly readily into most tree crowns.



Full Restoration. Fire generally remains on the ground; it would take a very strong wind to carry it through these more dispersed tree crowns.

Fire is Never Entirely Predictable. A particular thinning treatment cannot guarantee a particular type of fire behavior. Southwestern forests are variable, and so are the conditions of wind, dryness, and topography under which fire burns. During the 2003 Hayman Fire, extremely strong winds at times pushed fire directly through thinned areas that significantly reduced fire behavior when winds were lighter.² Yet lower tree densities generally lower fire severity and provide firefighters with suppression opportunities if needed.

Treatments Can Themselves Increase Fire Danger. Slash left onsite after thinning can increase fire danger. It may need to be pile-burned or otherwise removed so that it does not contribute to fuel loads.³

Prescribed Fire is an Important Element in Fuel Reduction. Prescribed fire after thinning can reduce wildfire severity for up to ten years and, when repeated, can maintain an open forest structure in the long term at low cost.⁴



Treating for the Long Term is Most Cost Effective. Treatments that focus solely on fuels reduction and not holistic restoration don't last – as trees and other plants grow back, fire danger grows again and more thinning becomes necessary. Holistic restoration treatments incorporate low-intensity fire, overall ecological health, and long-term planning.

Treatments Work. During the 2003 Rodeo-Chediski Fire (left), a crown fire dropped to the ground when it reached an area (beyond the road in the right center) that had been thinned to reduce ground, ladder, and crown fuels.

¹ These studies are summarized in *Working Paper 15: Effects of Forest Thinning Treatments on Fire Behavior*.

² Finney, M. A., R. Bartlette, L. Bradshaw, K. Close, B. M. Collins, P. Gleason, W. M. Hao, P. Langowski, J. McGinley, C. W. McHugh, E. Martinson, P. N. Omi, W. Shepperd, and K. Zeller. 2003. Fire behavior, fuel treatments, and fire suppression on the Hayman Fire. Pp. 33-180 in *Hayman Fire case study*, ed. R. T. Graham. General technical report RMRS-114. Ogden, Utah: USDA Forest Service. www.fs.fed.us/rm/pubs/rmrs_gtr114.html.

³ Methods for treating slash are detailed in *Working Paper 13: Treating Slash after Restoration Thinning*.

⁴ Finney, M. A., C. W. McHugh, and I. C. Grenfell. 2005. Stand- and landscape-level effects of prescribed burning on two Arizona wildfires. *Canadian Journal of Forest Research* 35(7):1714-1722.