



Research Brief for Resource Managers

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Interactions among wildland fires in a long-established Sierra Nevada natural fire area

Collins B.M., J.D. Miller, A.E. Thode, M. Kelly, J.W. van Wagtendonk, and S.L. Stephens. 2009. Interactions among wildland fires in a long-established Sierra Nevada natural fire area. Ecosystems 12:114-128. <http://rd.springer.com/article/10.1007/s10021-008-9211-7>

Throughout much of the Western U.S., fire frequency and extent have been increasing in drier forest ecosystems, including mixed-conifer and yellow pine forests of the Sierra Nevada. A 2009 study by Collins et al. suggests that freely burning fires in upper elevation mixed-conifer forests of the Sierra Nevada may effectively regulate fire-induced effects across an entire landscape.

Collins et al. analyzed interactions between successive naturally-occurring fires in Yosemite National Park. They used mapped fire perimeters and satellite-based estimates of fire severity (a measure of vegetative mortality) for 19 fires burning relatively freely over a 31-year period. The researchers found that fires became 'self-limiting' when they were allowed to burn in upper-elevation mixed-conifer forests, even under high fire weather conditions.

The researchers also found that fires in their study area were always constrained in extent (limited) by previous fires that burned relatively recently (<9 years). They showed an elevated probability of reburning when intervals between successive fires were greater, which was exacerbated under extreme fire weather conditions, owing to the rapid desiccation of fuels and increased fire intensity (heat) under these conditions.

Management Implications

- Fire as a landscape process can exhibit self-limiting characteristics (constraining the spatial extent and lessening the effects of subsequent fires) in an upper-elevation Sierra Nevada mixed conifer forest.
- When the amount of time between successive adjacent fires is under 9 years and fire weather is not extreme, the probability of a latter fire burning into a previous fire area is extremely low.
- There was a fair degree of stability over time in the proportion of area burned among fire severity classes (unchanged, low, moderate, high), suggesting freely burning fires in Sierra Nevada mixed-conifer forests can regulate the effects of future fires across the landscape.

The study did not find a change in the proportions of area burned for each fire severity class over the 31-year period of the study. This suggests that the effects of managed wildfires on vegetation have remained relatively stable throughout the duration of the wildland fire program in Yosemite National Park. It also implies that wildland fire (i.e., prescribed fire and managed wildfire) has the potential to regulate future fire-induced effects across upper-elevation mixed-conifer forested landscapes in the Sierra Nevada, depending on fuel type and site productivity.



Fire is an important ecological process that can exhibit self-limiting characteristics across an entire landscape, such as the Illilouette Basin of Yosemite National Park. *Image Credit: Marc Meyer/USFS.*

Suggestions for further reading:

Collins, B.M., and S.L. Stephens. 2007. Managing natural wildfires in Sierra Nevada wilderness areas. *Frontiers in Ecology and the Environment* 5:523–527.

Collins, B.M., and S.L. Stephens. 2010. Stand-replacing patches within a ‘mixed severity’ fire regime: quantitative characterization using recent fires in a long-established natural fire area. *Landscape Ecology* 25: 927-939.

Collins, B.M., M. Kelly, J.W. van Wagtenonk, and S.L. Stephens. 2007. Spatial patterns of large natural fires in Sierra Nevada wilderness areas. *Landscape Ecology* 22:545–557.

Miller, J. D., H.D. Safford, M. Crimmins, and A.E. Thode. 2009. Quantitative evidence for increasing forest fire severity in the Sierra Nevada and southern Cascade Mountains, California and Nevada, USA. *Ecosystems* 12:16–32.

Teske, C.C., C.A. Seielstad, and L.P. Queen. 2012. Characterizing fire-on-fire interactions in three large wilderness areas. *Fire Ecology* 8(2): 82-106.

van Wagtenonk, J.W., and J.A. Lutz. 2007. Fire regime attributes of wildland fires in Yosemite National Park, USA. *Fire Ecology* 3(2): 34-52.

van Wagtenonk, J.W., K.A. van Wagtenonk, and A.E. Thode. 2012. Factors associated with the severity of intersecting fires in Yosemite National Park, California, USA. *Fire Ecology*: 8(1): 11-31.

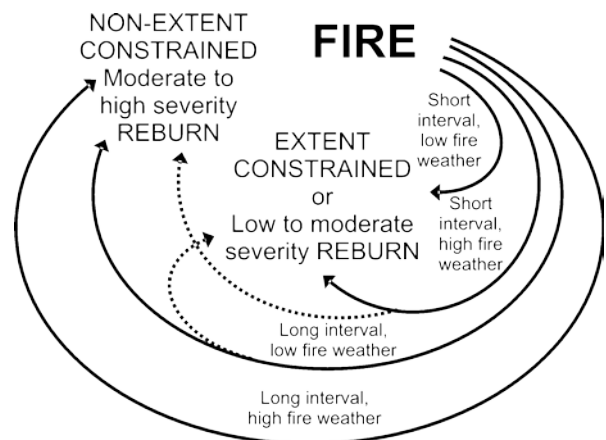


Figure 1. Interactions between successive fires resulting in (1) reduced spatial constraint or fire severity if a previously burned area is reburned, or (2) no influence of a previous fire on the spatial extent or severity of the subsequent fire. The paper authors propose the dominant factors controlling these interactions are the time between successive fires (interval) and fire weather during the latter fire. Solid lines are primary expected pathways and dashed lines are secondary pathways.