CALIFORNIA FIRE SCIENCE CONSORTIUM

**Joint Fire Science Program Knowledge Exchange**

# *Research Brief for Resource Managers*


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| September 2011 | Lindsay Chiono | 510-642-4934 | lchiono@berkeley.edu |

Wildland Fire Science Laboratory, UC Berkeley, 137 Mulford Hall MC #3114, Berkeley CA 94720


# Is prescribed fire an ecological surrogate for wildfire in riparian and stream ecosystems?


*Arkle R.S., Pilliod D.S., 2010. Prescribed fires as ecological surrogates for wildfires: a stream and riparian perspective. Forest Ecology and Management 259: 893–903.*
http://hdl.handle.net/10113/39376


## Management Implications

- Early season prescribed burning allows fuels reduction in upland forests while minimizing disturbance to riparian and stream ecosystems.
- However, if restoration of structural components and natural processes are goals of management, low-intensity prescribed fire may not be an effective surrogate for wildfire.

Wildfire disturbance was once a common feature of many riparian and stream ecosystems in the western U.S. Prescribed fire is now used to mitigate the risk of high-severity wildfire. It is also applied as a restoration tool, based on the largely unexamined hypothesis that prescribed fire is an effective ecological surrogate for wildfire in fire-dependent communities.

A study published in *Forest Ecology and Management* by researchers from USGS, USDA Forest Service, and California Polytechnic State University offers insight into the impacts of prescribed and wildfire on stream and riparian systems.

An early season prescribed burn in the South Fork Salmon River drainage in Idaho was ignited in upland areas and allowed to burn into the riparian zone. The fire, which burned with low to moderate severity and left much of the riparian vegetation unburned, had no effect on in-stream or riparian habitat variables (e.g. riparian cover, large woody debris, water chemistry, stream temperature), benthic macroinvertebrate community composition, or vertebrate population densities. Wildfire impacts on abiotic and biotic stream characteristics were not assessed in this study, but another study conducted nearby concluded that wildfire significantly altered stream and riparian habitat as well as in-stream communities (Arkle et al., 2010).

The study also compared patterns of burn severity and extent between a wildfire and three prescribed fires that burned in the South Fork drainage. The area of riparian vegetation burned by wildfire within a catchment was proportional to the catchment area burned. In contrast, a much smaller proportion of the riparian forest was burned by prescribed fire than would be expected for a wildfire of equivalent size (fig 1a). Furthermore, while the prescribed fires did not

burn any of the riparian forest at high severity, there was a positive relationship between percent of the catchment burned by wildfire and the percent of riparian forest burned at high severity (fig. 1b).

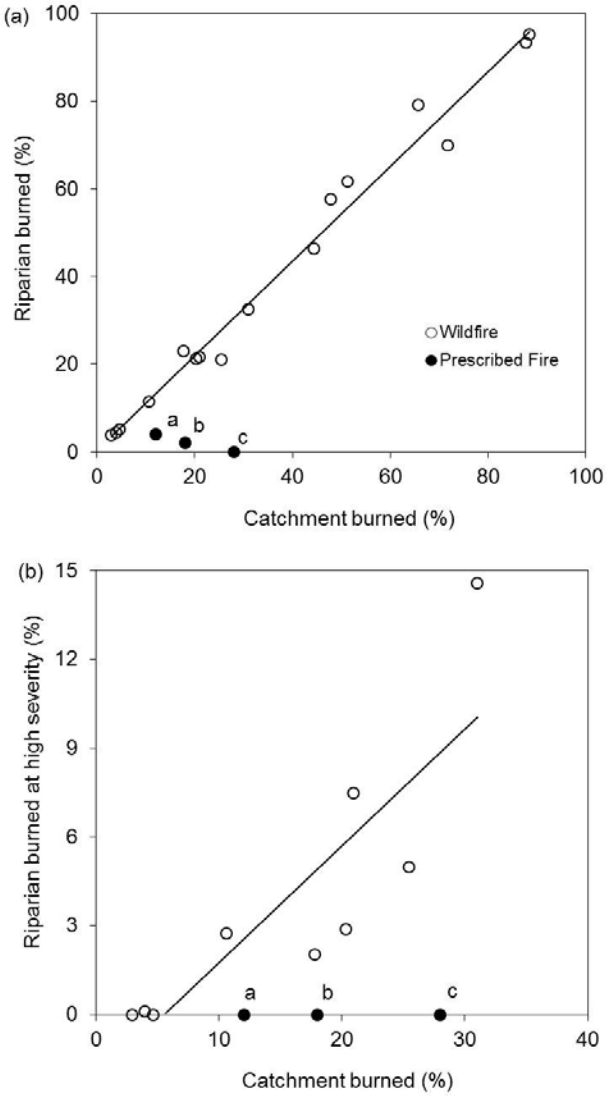


**Figure 1.** (a) The percentage of each catchment's riparian forest burned against the total percentage of each catchment burned by wildfire (open circles) and by prescribed fire (filled circles, labeled a, b, and c). (b) For wildfire catchments where 30% or less of the catchment burned, the percentage of each catchment's riparian forest burned at high severity against the total percentage of each catchment burned by wildfire and by prescribed fire.

These results suggest that low-intensity prescribed fires may not effectively replicate the disturbance role of wildfire, as post-fire conditions and patterns of burn severity and extent were not similar. The consequences of altering riparian and stream disturbance regimes in these fire-adapted systems, whether by excluding fire or managing for fire of uncharacteristic severity, are largely unknown.

## Suggestions for further reading:


Arkle RS, Pilliod DS, Strickler K, 2010. Fire, flow and dynamic equilibrium in stream macroinvertebrate communities. Freshwater Biology 55: 299–314.

Bêche LA, Stephens SL, Resh VH, 2005. Effects of prescribed fire on a Sierra Nevada (California, USA) stream and its riparian zone. Forest Ecology and Management 218: 37–59. http://www.cnr.berkeley.edu/stephens-lab/Publications/Beche%20et%20al%20riparian%20FEM%2005.pdf

Dwire KA, Kauffman JB, 2003. Fire and riparian ecosystems of the western USA. Forest Ecology and Management 178: 61–74. http://www.fs.fed.us/rm/pubs_other/rmrs_2003_dwire_k001.pdf

Pettit NE, Naiman RJ, 2007. Fire in the riparian zone: characteristics and ecological consequences. Ecosystems 10: 673–687.

Stone KR, Pilliod DS, Dwire KA, Rhoades CC, Wollrab SP, Young MK, 2010. Fuel reduction management practices in riparian areas of the western USA. Environmental Management. 46: 91–100. http://www.treesearch.fs.fed.us/pubs/35928

Van de Water KM and MP North, 2010. Fire history of coniferous riparian forests in the Sierra Nevada. Forest Ecology and Management. 260: 384–395. http://www.fs.fed.us/psw/publications/north/psw_2010_north003.pdf

Van de Water KM and North MP, 2011. Stand structure, fuel loads, and fire behavior in riparian and upland forests, Sierra Nevada Mountains, USA; a comparison of current and reconstructed conditions. Forest Ecology and Management 262: 215-228. http://www.fs.fed.us/psw/publications/north/psw_2011_north%28vandewater%29001.pdf