CALIFORNIA FIRE SCIENCE CONSORTIUM

JOINT FIRE SCIENCE PROGRAM

Joint Fire Science Program Knowledge Exchange

Research Brief for Resource Managers

Release:	Contact:	Phone:	Email:
June 2014	Becky Estes	530-642-5161	bestes@fs.fed.us

Sierra Nevada Fire Science Delivery Consortium | 2132 Wickson Hall, One Shields Ave., Davis, CA 95616

Characteristics of stand-replacing patches

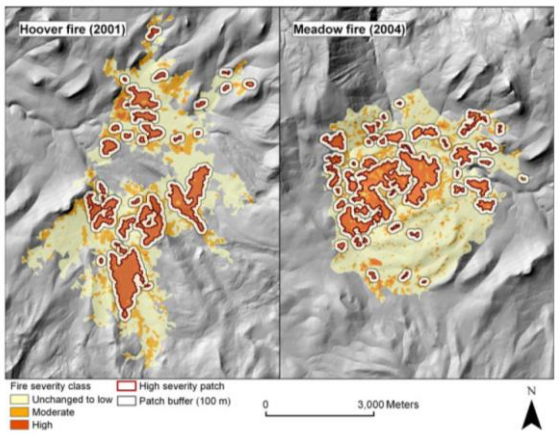
Collins, Brandon M. and Stephens, Scott L. (2010). Stand-replacing patches within a 'mixed severity' fire regime: quantitative characterization using recent fires in a long-established natural fire area. Landscape Ecology 25: 927-939.

High severity (stand-replacing) patches are components of all forest fire regimes. The question that remains is how large and abundant these patches can be before being considered outside of the range of natural variation for a given forest type. Collins and Stephens found that stand-replacing patches were highly variable in a high elevation mixed conifer landscape in the Sierra Nevada. Stand replacing patches made up 15% of the two fires and were largely driven by variation in vegetation type and fuels, and secondarily by topography and disturbance history.

Collins and Stephens studied stand-replacing patches that resulted after the Hoover and Meadow fires in Illilouette Creek basin in Yosemite National Park and the mechanisms that contributed to their creation. The park has been managing natural ignitions for several decades and can provide insight into the natural range of variation in other Sierra Nevada landscapes. Collins and Stephens first identified contiguous areas of high fire severity, then they assessed the influence of a suite of variables on patch size, including topography, pre-fire vegetation type, fire weather, fire history, and adjacent vegetation.

Management Implications

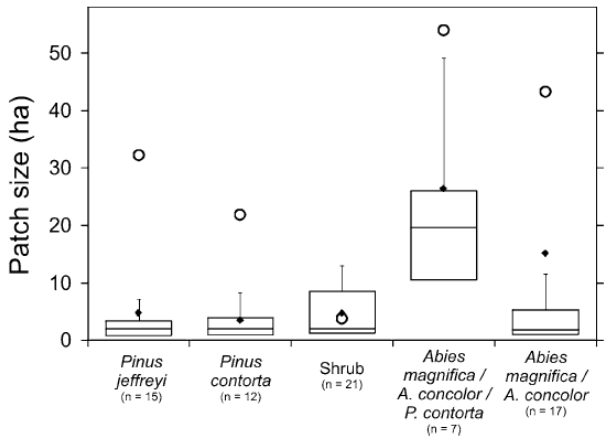
- Stand-replacing patch size was highly variable in a high elevation mixed conifer forest in the Sierra Nevada with a range of variation dominated by many small patches < 10 acres (4 ha) and few large patches >148 acres (60 ha).
- Prescribed fire or managed wildfire should aim to create small infrequent stand replacing patches across the landscape.
- Silvicultural techniques may be utilized to alter fuel regimes so that the reintroduction of fire results in small stand replacing patches.



Stand replacing patches in the Hoover and Meadow fires, Illilouette Creek basin, Yosemite National Park.

They looked at relationships of all variables using a regression tree analysis.

In the Illilouette fires, 72 stand-replacing patches were identified ranging from 1 to 230 acres (0.54 to 93 hectares) in size, with a median of 5.4 acres (2.2 hectares). Small patches (<4 ha) made up 60% of the total patches. These smaller patches were mostly dominated by shrubs and pines, while patches dominated by white fir were much larger. This difference in patch sizes can be attributed to variability in forest structure, with fire in shade-tolerant fir having a greater tendency to transition from surface fire to crown fire due to vertical and horizontal continuity of fuels.



Stand-replacing patch size by dominant vegetation types in the 2001 Hoover and the 2004 Meadow fires in Illilouette Creek Basin, Yosemite National Park, California, USA. Open circles represent mean vegetation patch sizes, demonstrating that for most types stand-replacing patch size was much lower than the underlying vegetation patch.

Although vegetation type was the primary driver of the size of stand-replacing patches, topography and prevailing fire weather were also variables that influenced patch size. Large patches were found primarily on mid and flat slopes especially when weather conditions were extreme (higher burn indices). In addition, larger stand replacing patches tended to occur in areas that hadn't burned in the recent past (between 17 and 30 years). Conversely, small stand replacing patches were found on lower and upper slopes and in areas that had burned more recently.

Complexity in individual fires is driven by heterogeneity in fuels (vegetation type and structure as well as time since last fire), topography, and prevailing fire weather. Understanding the mechanisms driving this complexity is difficult in landscapes where fire has been actively suppressed for the past 100 years, leaving altered fire/fuel regimes. Considerable knowledge can be gained from studying those rare reference landscapes that continue to experience a frequent fire regime. Such knowledge can be used to inform management strategies.

Suggestions for further reading:

Beaty, R.M. and Taylor, A.H. 2008. Fire history and the structure and dynamics of a mixed conifer forest landscape in the northern Sierra Nevada, Lake Tahoe Basin, California, USA. Forest Ecology and Management 255, 707-719

Collins, B.M. and Stephens, S.L. 2007. Managing natural wildfires in Sierra Nevada wilderness areas. Front Ecol Environ 5,523-527.

Dillon, G., K., Holden, Z.A., Morgan P., Crimmins, M.A., Heyerdahl, E.K., and Luce, C.H. 2011. Both topography and climate affected forest and woodland burn severity in two regions of the western US, 1984 to 2006. Ecosphere 2:1-33.

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

Van Wagtendonk, J.W., Lutz, J.A. 2007. Fire regime attributes of wildland fires in Yosemite National Park, USA. Fire Ecol 3, 34-52.