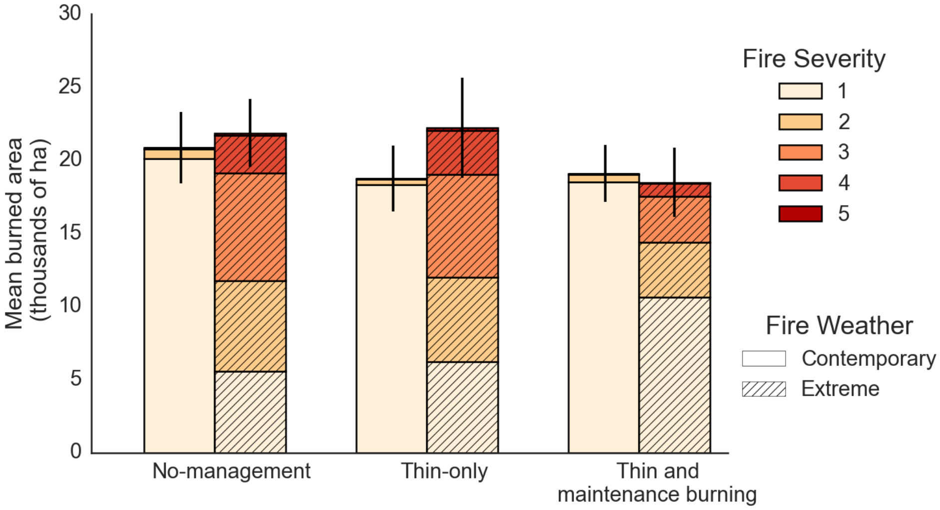
Earth Systems Ecology Lab



Mean burned area by severity class under management and fire weather scenarios. Bars represent the mean total area burned in thousands of hectares over the 100-year simulations. Solid bars represent contemporary fire weather and hashed bars extreme fire weather. Error bars are ± 1 standard error of the mean total burned area.

Restoring Surface Fire Stabilizes Forest Carbon

Weather conditions that can lead to large, severe wildfires are projected to become more common in the Sierra Nevada as the climate warms. These extreme fire weather conditions are compounding the effects of fire-exclusion in the lower and mid-elevation forests of the Sierra Nevada. High-severity wildfire and treatments to reduce the risk of stand-replacing fire both affect forest carbon storage and uptake. We ran simulations of the Dinkey Creek Collaborative Forest Restoration Project area to quantify the effects of treatments (no-management, thin-only, thin and maintenance burning) on fire severity and carbon dynamics under both contemporary and extreme fire weather.

We found that under contemporary fire weather, treatments had little effect on fire severity because of the low probability of fire occurrence and carbon stored on the landscape was lower for both the thin-only and thin and maintenance burning scenarios. However, when we ran simulations with extreme fire weather, the thin and maintenance burning decreased the proportion of the study area that experienced high-severity fire (see figure, classes 4 and 5). The single-entry thin-only was insufficient to modify fire behavior. Regular, ecologically-appropriate maintenance burning is required to maintain surface fuels and shrubs at lower levels. With regular burning, live tree carbon was more stable and carbon uptake was consistent under both fire weather conditions. Whereas under the no-management and thin-only scenarios, live tree carbon stability and uptake decreased under extreme fire weather. We also found that the cumulative emissions from prescribed burning and wildfire under thinning and maintenance burning were significantly lower than the cumulative wildfire emissions of the other two scenarios. By restoring the historic fire regime to these systems, the likelihood of large and severe fires can be reduced significantly, even under the forecasted extreme fire weather events of future climate projections.

THE UNIVERSITY of NEW MEXICO

Management Implications

Mechanical thinning alone is not sufficient to reduce the risk of high-severity wildfire in these systems. Restoring surface fire regimes is an essential component to managing fuels and reducing fire hazard across the landscape.

Under extreme fire weather, the carbon cost of prescribed burning is significantly outweighed by the reduction in carbon emissions associated with wildfire.

Reducing the risk of high-severity wildfire through thinning and restoring surface fire regimes helps maintain carbon uptake under extreme fire weather conditions.

Publication:

Krofcheck DJ, MD Hurteau, RM Scheller, EL Loudermilk. 2017. Restoring surface fire stabilizes forest carbon under extreme fire weather in the Sierra Nevada. Ecosphere 8 (1):e01663

Funded by: Joint Fire Science Program

Project: 14-1-01-2

Contact Information

Matthew Hurteau: mhurteau@unm.edu

Daniel Krofcheck: krofcheck@gmail.com

www.hurteaulab.org