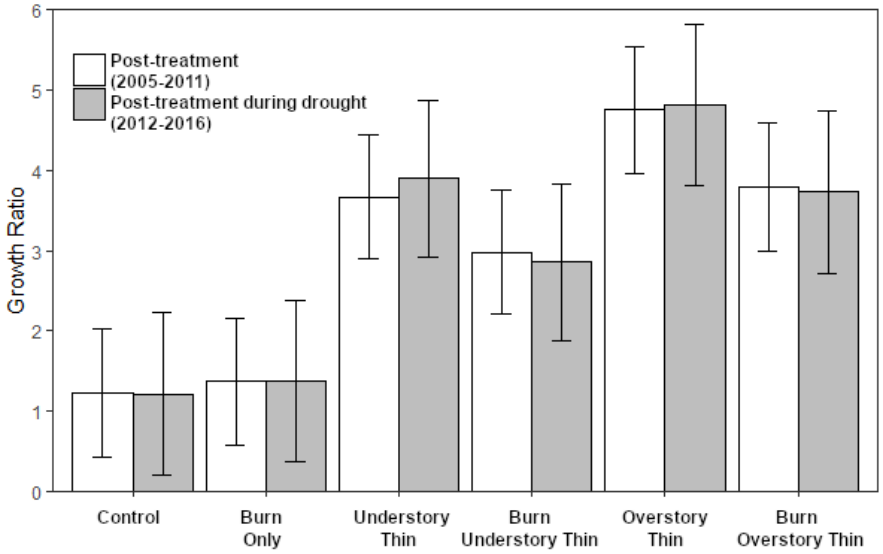
Earth Systems Ecology Lab



Growth ratios of live trees preceding and during the drought period. Growth ratios are basal area increment (BAI) during the specified time period divided by pre-treatment BAI (1995-1999). Error bars are 95% confidence intervals. Treatments are ordered left to right by increasing treatment intensity.

Managing forest resistance to extreme drought

The California Drought of 2012-2016 resulted in over 120 million dead trees in the Sierra Nevada, either directly from drought stress, or from the combined effects of drought and bark beetle outbreaks. Foresters have long recognized that reducing the density of forests a via mechanical thinning and/or prescribed burning reduces competition for residual trees. This has led to thinning and prescribed burning, which are commonly employed in fuel reduction and ecological restoration, to be used to promote resistance to drought stress. However, it is unclear if thinning and prescribed burning are effective at promoting resistance to extreme drought. We utilized a long-term experiment that manipulated stand densities and surface fuel loads. Using tree-ring data collected from over 700 trees, we quantified both the short-term effects of treatments on tree growth, and how those trees grew during the 2012-16 California drought.

Conditional on surviving drought, tree growth increased dramatically in thinned forests, and this growth was sustained during the drought. Treatment longevity was in excess of 15 years with respect to residual tree growth. Thinning intensity did not influence tree growth, and burning alone did not increase tree growth, likely a result of low intensity fire not reducing stand densities. Individual tree size and change in tree growing space were more important that stand-level treatment. Our results demonstrate that forest restoration treatments can promote sustained increases in tree growth that persist even during extreme drought. However, prescribed burning may not be effective in promoting tree growth and drought resistance without increased fire intensity that reduces tree densities, and tree-level factors such as size and growing space may be more important than stand-level prescriptions.

Management Implications

Conditional on surviving drought, trees in thinned forests increased growth that was sustained during the drought

Growth responses were the same in understory and overstory thins

First entry burning did not increase tree growth, likely because low intensity fire did not reduce competition

Publication:

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