



United States Department of Agriculture  
Forest Service  
Pacific Southwest Research Station

# PUBLICATION BRIEF:

## Variable thinning and prescribed fire influence tree mortality and growth during and after a severe drought.

### Brief Summary

Frequent fire once kept forests of California and throughout the western US relatively open but with a diversity of habitats preferred by a wide array of plant and animal species. After over a century of fire suppression, many such forests are now considerably denser, more homogeneous, and prone to disturbances such as stand-replacing wildfire and drought. Following an extreme drought which killed over 147 million trees statewide, we



Tree mortality in an untreated stand following a drought.

examined tree mortality and growth of mixed-conifer stands that had been experimentally treated with different combinations of thinning and prescribed burning. Two thinning approaches were compared with an untreated control – one a structurally heterogeneous uneven tree spacing (High Variability) with the goal of restoring structures similar to what old growth forests shaped by fire once looked like, and one with more standard even crown spacing (Low Variability). Half of the units were followed up with a prescribed burning. Thinning was implemented in 2011 and prescribed burning completed in 2013. Mortality and growth were followed for the period from 2014 through 2018 – during and immediately after the drought (2012-2015).

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### Key Points/Findings:

- While the 2012–2015 drought was exceptional, excess tree density relative to historical conditions greatly elevated the impact of drought on tree mortality. An average of 34% of trees in the unthinned controls died compared to only 11% in the thinned treatments. Dead trees will add to surface fuel loads and contribute to the already elevated fire hazard.
- The basal area (cross sectional area of live tree stems) in untreated control stands declined 23% between 2014 and 2018, while the basal area in the thinned treatments did not change, with mortality nearly completely offset by growth.
- Both the ‘High Variability’ and ‘Low Variability’ thinning methods were effective at reducing tree mortality and increasing tree growth.
- Prescribed burns, while vital for reducing surface fuels and wildfire hazard, were an added stress that led to some additional delayed mortality. Delayed mortality following burning was especially pronounced in unthinned control stands, suggesting the potential value of thinning prior to prescribed burning.
- Broader stakeholder support for more variable approaches to thinning and apparent lack of downside in terms of tree mortality or growth show that such treatments may be an attractive option for addressing the challenges posed by overstocked forests, especially when maintaining or enhancing habitat is also a goal.



Treated areas, including this stand which was thinned using a ‘High Variability’ prescription and followed up with a prescribed burn, fared much better.

\*For more information, please visit: [https://www.fs.fed.us/psw/topics/forest\\_mgmt/variabledensity/](https://www.fs.fed.us/psw/topics/forest_mgmt/variabledensity/)