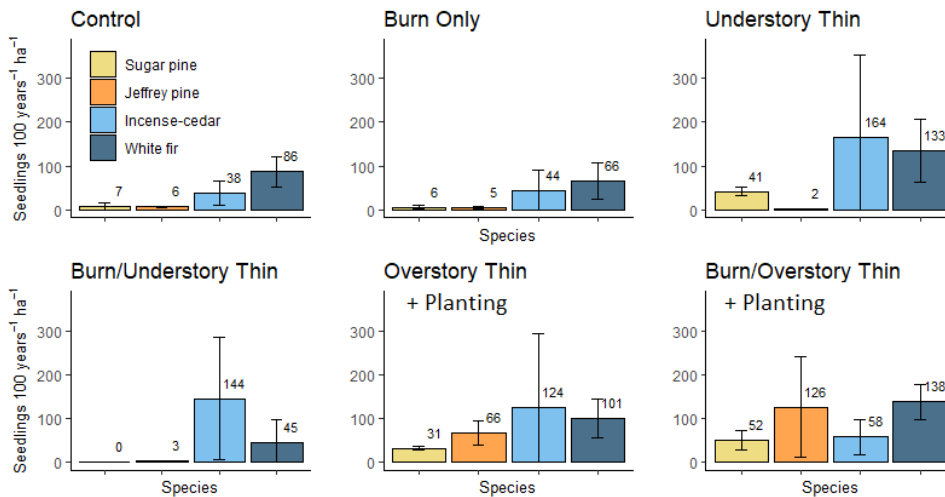


# Earth Systems Ecology Lab



THE UNIVERSITY of  
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Estimates of Sierra Nevada mixed-conifer seedling recruitment to the midstory (5 cm DBH) per hectare scaled over 100 years, by species and treatment. Mean recruitment rates are calculated from records of new trees tagged and mapped from 2002-2003 to 2018-2019.

## Repeated burns fail to restore pine regeneration

Long-term fire suppression in the Sierra Nevada has led to the dominance of shade-tolerant fir and incense-cedar over shade-intolerant, fire-adapted pine species. Thinning and prescribed burns are often implemented with a goal of restoring pre-suppression structure and fire as an ecological process to dry forests. We analyzed long-term seedling and sapling data from the Teakettle Experimental Forest to determine the tree regeneration and midstory recruitment responses to repeated prescribed fire in combination with thinning. Treatments included overstory and understory thinning completed in 2000-2001, and prescribed burns in 2001 and 2017. The full factorial design included six different treatment combinations, including a no thinning or burning control. Overstory thinned plots were planted proportionally to their pre-treatment overstory dominance in 2002 following common management practice at the time.

We found repeated burns led to modest increases in sugar pine and substantial increases in incense-cedar seedling densities four years post-burn. No significant differences in seedling densities were detected for Jeffrey pine or white fir. Additionally, estimates of natural midstory recruitment were much higher among white fir and incense-cedar than pines, even following treatments. The estimates of pine midstory recruitment from natural regeneration alone at our site ranged from 0-7 trees per hectare per century, rates too low to support a pine-dominated overstory. However, we found that treatments that included post-harvest planting had much higher midstory recruitment rates, which were compatible with potential restoration to a pine-dominated overstory. We conclude that thinning and burning alone may not restore historic species compositions in Sierra Nevada forests, but planting pine following treatments may substantially increase pine recruitment.

## Management Implications

Repeated prescribed burns may not achieve management objectives to increase pine regeneration and restore a pine-dominated overstory.

Additional thinning of mature shade-tolerant species may be required to reduce seed production, thereby reducing recruitment.

Planting pine post-treatment may be an effective method for increasing low pine recruitment rates.

## Publication:

May, C.J., Zald, H.S.J., North, M.P., Gray, A.N. and Hurteau, M.D. (2023), Repeated burns fail to restore pine regeneration to the natural range of variability in a Sierra Nevada mixed-conifer forest, USA. *Restoration Ecology*, e13863. <https://doi.org/10.1111/rec.13863>

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