



## Research Brief for Resource Managers

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**Contact:**  
Amarina Wuenschel

**Phone:**  
p: 559-877-2218 x3197

**Email:**  
amarina.e.wuenschel@usda.gov

Sierra Nevada Consortium Region | 57003 North Fork, CA 93643

# How Sierra Nevada Tree Mortality changed with Management, Precipitation and Forest Density

*Restaino, C., Young, D., Estes, B., Gross, S., Wuenschel, A., Meyer, M., and Safford, H. 2019. Forest structure and climate mediate drought-induced tree mortality in forests of the Sierra Nevada, USA. Ecological Applications 29(4):e01902. 10.1002/eap.1902*

This paper compares tree mortality patterns in treated (thinned and/or burned) forested stands to untreated stands to evaluate our common management practices in the context of large disturbance and to inventory our dramatically changed forest conditions.

Since 2012, California has experienced extreme drought. Drought conditions in combination with insect outbreaks have fueled extensive tree mortality (especially in pines) across the forests of the Sierra Nevada. Because climate models predict longer and hotter droughts, it is important that we understand how management actions can potentially mitigate drought impacts on forests.

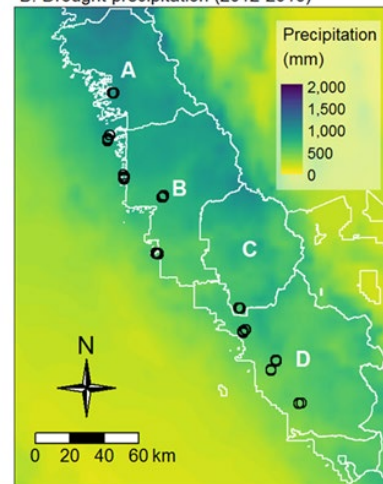
Forest stands in the Sierra Nevada used to be much more open. Forests have gotten denser mostly due to fire suppression. Forest treatments like prescribed burning and thinning are designed to restore natural forest structure. We know this allows forests to be more resistant to wildfire, but we are not sure how forest treatment changes how forests respond to drought. In 2016, the US Forest Service (USFS) R5 Ecology Program in partnership with University of California, Davis were granted funds from the USFS R5 State and Private Forestry organization to investigate this question.

### Management Implications

- Fuel reduction treatments were effective for mitigating drought impacts to ponderosa pine, the hardest hit in the drought.
- Maintaining a diversity of tree species can help buffer drought impacts

Our hypothesis was that treatments designed to reverse forest densification occurred due to fire suppression will reduce drought mortality by allowing there to be more water available to each remaining tree. In 2017, we collected plot data at 10 paired (treated vs. untreated) sites in pine-dominated stands. At each site there were 16 plots. We measured tree data, fuels and seedlings and saplings at each 12.6 m radius plot. Fig. 2 shows the mortality rates for four tree species under different densities, treatments, and given precipitation rates.

B. Drought precipitation (2012-2016)



*Fig. 1 Map showing monitoring sites across the central Sierra Nevada ranging from the Eldorado NF(A) to the Sierra NF (D).*

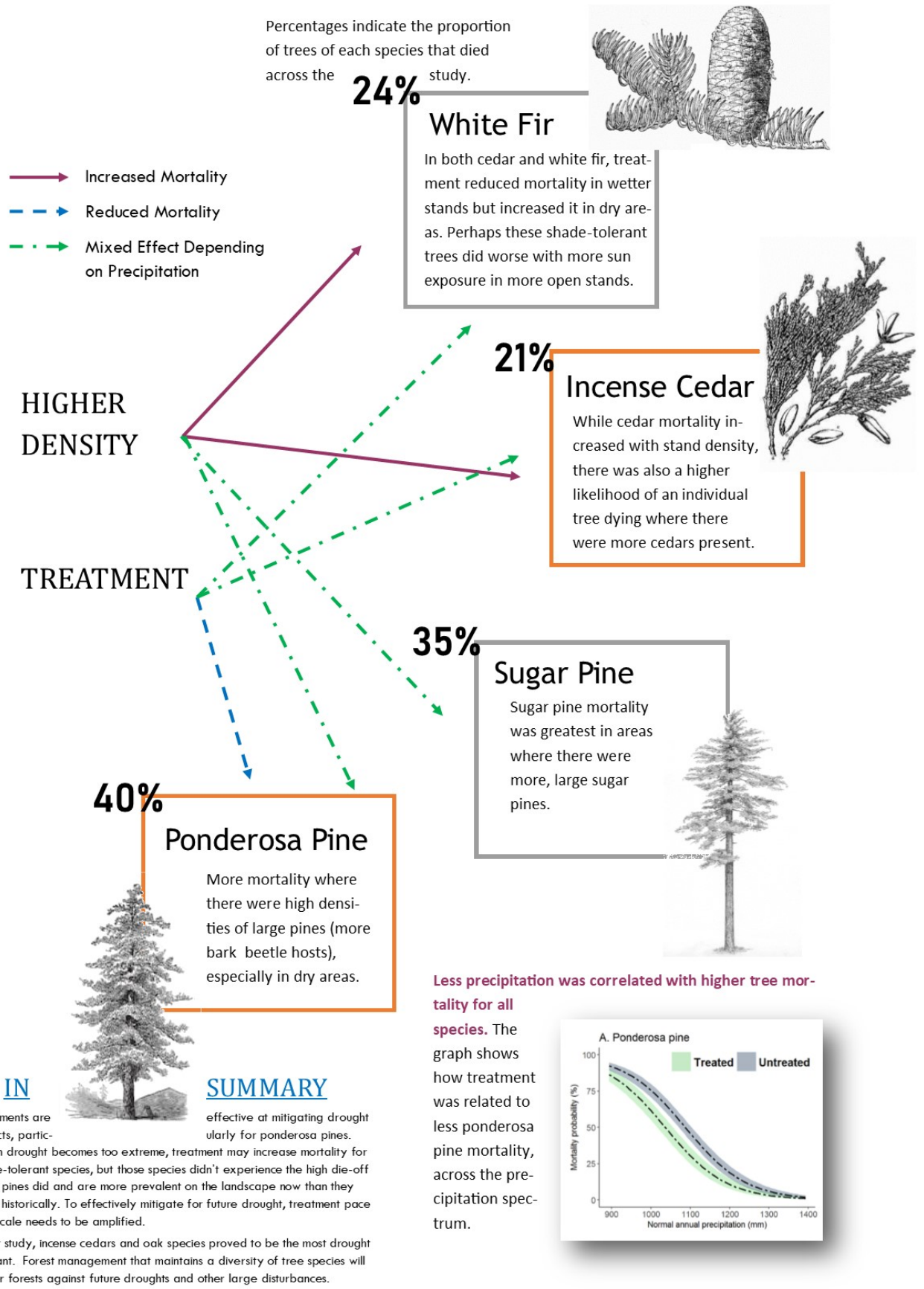


Fig. 2 Summary of the research results.