



Overtopped Baker cypress trees grew more slowly and had higher levels of crown mortality than Baker cypress that were not shaded.

There was no evidence that radial thin treatments successfully restored tree vigor.

How does overtopping affect Baker cypress growth and vigor? What are the effects of radial thinning treatments?

Baker cypress is a rare, serotinous conifer known globally from only eleven locations in northern California and southern Oregon. We asked whether overtopping by other conifer species decreased Baker cypress growth and vigor within a large population on the Hat Creek Ranger District of the Lassen National Forest. We additionally monitored the effects of a radial thin treatment that removed conifers that were shading Baker cypress trees.



Fig. 1. Baker cypress tree that is not overtopped by other conifers.



Fig. 2. Baker cypress tree surrounded by eight trees that exceed it in height.

Key Findings

- Overtopped Baker cypress trees grew more slowly than trees that were not overtopped, and had higher levels of crown mortality.
- Tagged Baker cypress trees within a radially thinned mixed conifer stand were revisited two years following treatment (ten years after initial monitoring). Half of these trees were dead or presumed dead after the treatment.
- It is unknown whether extensive cypress mortality in the treated stand was a result of poor tree health prior to treatments, or whether treatments accelerated mortality by exposing weakened trees to windthrow, insects and disease, or other stressors.

Monitoring Plan

The second largest known population of Baker cypress (*Hesperocyparis bakeri*) is located near Burney Mountain, California, on the Lassen National Forest. Here, Baker cypress occurs with montane chaparral and as a component of mixed conifer stands. We observed that many of the Baker cypress trees that were overtopped by other conifer species were dead or dying, and selected 21 Baker cypress trees within this population to monitor. In 2013 we tagged and cored each tree, measured tree diameter, assessed canopy health, and counted the number of growth rings in the outer inch of the tree core. In addition, we recorded the number and heights of all other conifers within a 50 foot radius of the tagged tree.

The Whittington Project included radial thin treatments around Baker cypress trees that reduced overtopping by removing all conifers within 50 feet of cypress. This treatment was completed in 2021 in a stand that contained 13 of our tagged trees. In 2023 we returned to these 13 trees, assessed whether they were still alive, and re-measured their diameters.

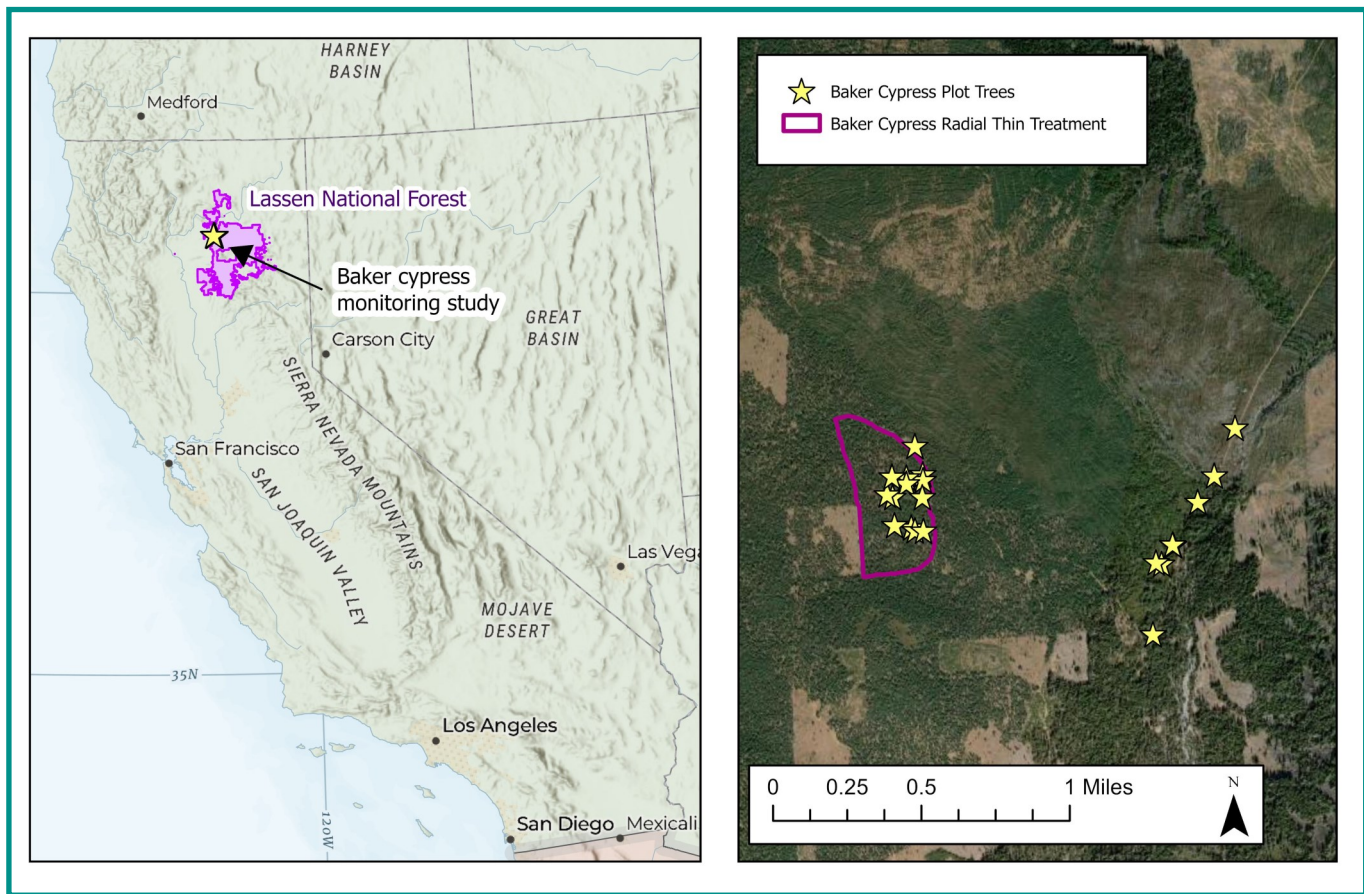


Fig. 3. Location of monitoring study (left), and arrangement of cypress plot trees and radial thin unit implemented under the Whittington Project. (right)



Effects of overtopping on cypress growth and vigor

We found that as the number of conifers overtopping Baker cypress increased, so did the number of rings in the outer inch of the Baker cypress tree cores (Fig. 4). The high density of narrow rings indicated slower growth rates, suggesting that the growth of Baker cypress was suppressed when shaded by other trees. In addition, a greater proportion of Baker cypress canopies were dead or dying as the number of shade trees increased, further implying that overtopping had led to a decline in cypress vigor (Fig. 5). A range-wide study of Baker cypress found that as overtopping trees increased in height above the cypress, canopy seed storage declined (Fig. 6, Merriam and Rentz 2010).

These relationships suggested that increasing available sunlight to cypress trees through radial thinning, as proposed under the Whittington Project, might lead to an increase in cypress growth rates and vigor.

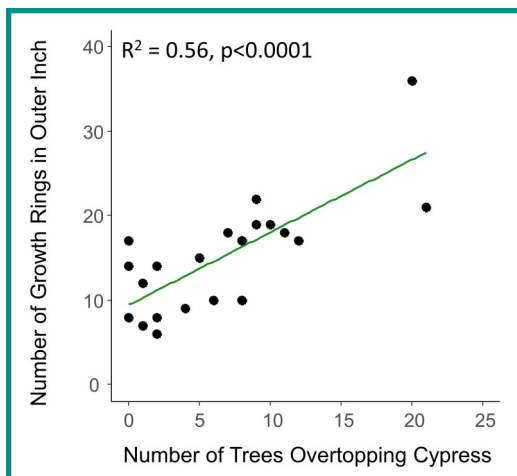


Fig. 4 (above) As the number of trees overtopping cypress increased, so did the number of growth rings in the outer inch of the tree core.

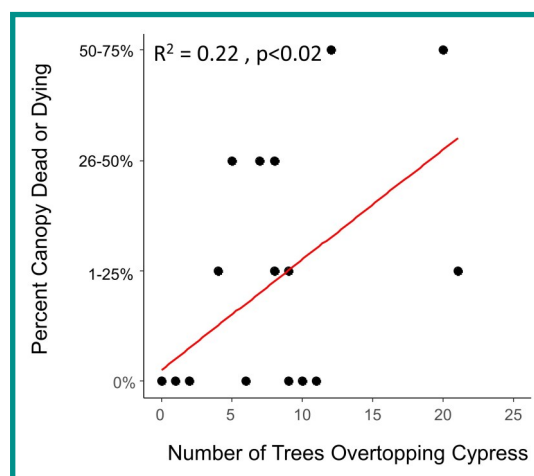


Fig. 5 (above) As the number of trees overtopping cypress increased, so did the percentage of the cypress canopy that was dead or dying.

Cypress trees that were overtopped by other conifers had significantly less annual growth and a greater percentage of dead or dying canopy than cypress trees that were unshaded.

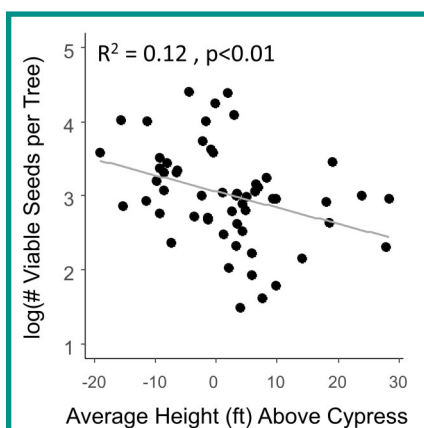
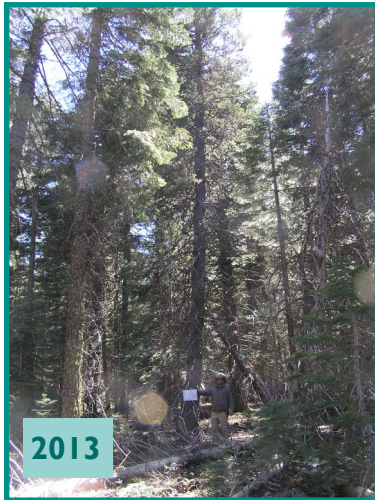


Fig. 6 (left) A study across the range of Baker cypress found that canopy seed storage declined as the height of other conifers increased above Baker cypress



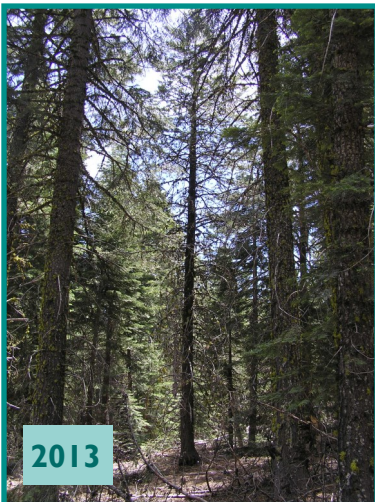
What were the effects of radial thinning treatments to Baker cypress?

Thinning treatments were implemented in a mixed conifer stand as part of the Whittington Project in 2021. Due to the small sample size, we can describe treatment effects to tagged Baker cypress trees only anecdotally. These photos illustrate the range of conditions encountered in the radially thinned stand prior to (2013) and after (2023) treatment.



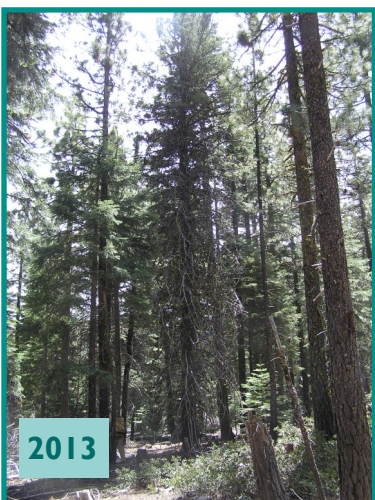
Radial thinning occurred, cypress alive and no longer overtopped

The largest gains in Baker cypress diameter occurred in two trees where radial thinning occurred. A third tree where radial thinning occurred was barely alive after its top snapped off.



Some thinning occurred, but live cypress still overtopped

Shading was reduced but not eliminated around four of the seven live Baker cypress trees. These four trees experienced less diameter growth than the fully released trees described above.



Cypress mortality

Six tagged Baker cypress trees were either dead or could not be relocated in 2023. It is unknown whether these trees died prior to, during, or following thinning treatments.



Management Recommendations

Although the Whittington Project radial thinning treatments were designed to release suppressed Baker cypress trees and promote their growth and vigor, there was no evidence that treatments were able to consistently accomplish this goal. Nearly half of the 13 tagged trees that were monitored in 2013 within the thinned stand were dead ten years later.

Apart from the tagged trees, we found extensive mortality of Baker cypress throughout the thinned stand. Although cones had opened on many of the fallen cypress, there was no cypress regeneration observed. This is consistent with the research finding that Baker cypress requires high severity fire to successfully promote regeneration (Merriam and Rentz 2010). It is likely that radial thinning treatments constituted “too little, too late” for cypress within the mixed conifer stand. Trees weakened by decades of suppression may have been rendered more vulnerable to windthrow, insects and disease, and other stressors after the removal of surrounding trees. In addition, other factors such as drought occurring between 2012-2016 and again in 2020-2022 may have contributed to cypress mortality within the stand.

While several trees that were in good condition prior to the treatment appeared to benefit from radial thinning, half of our tagged trees died. The following management recommendations apply to cypress in mixed conifer stands:

- Reduce conifer encroachment before Baker cypress becomes overtopped in order to maintain Baker cypress health, prevent Baker cypress mortality, and maintain these important populations.
- Approach radial thinning around suppressed trees with caution, due to the potential vulnerabilities of trees in poor condition.



This project addressed the following monitoring question from the Burney Hat Creek CFLRP Ecological Monitoring Strategy:

BOT 1.3. Can management activities such as thinning and prescribed fire be used to promote cypress reproduction and vigor?

Fig. 7. Baker cypress tree.

Literature Cited

Merriam, K., and E. Rentz. 2010. [Restoring fire to endemic cypress populations in northern California](#). Final Report to the Joint Fire Science Program: 06-2-1-17.