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Rocky Mountain Research Station

Science You Can Use *(in 5 minutes)*

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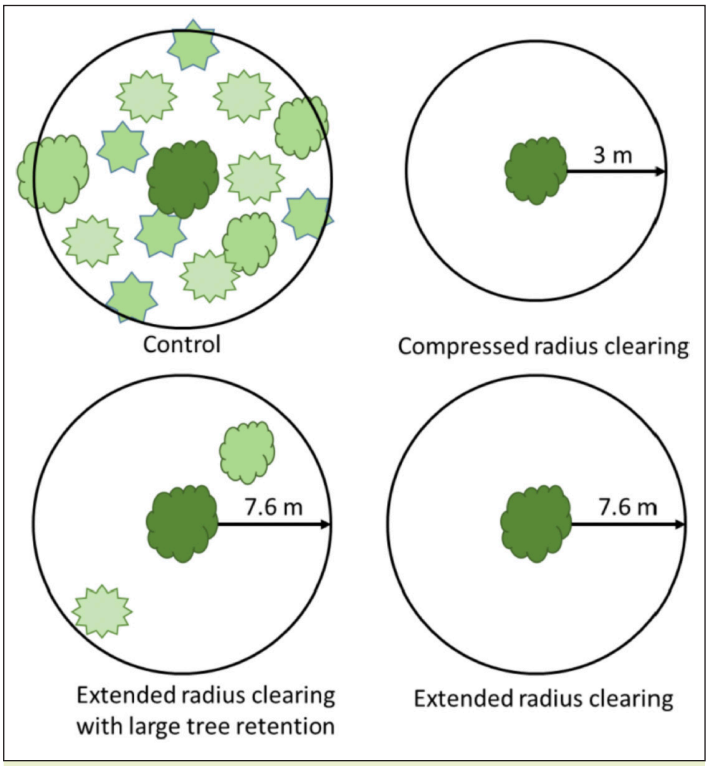
Radial Thinning: It may not be as beneficial as hoped

White pines in North America face threats including the nonnative blister rust pathogen, mountain pine beetle, wildfires, and other consequences of rapid climate change. These grand trees need protection to restore and maintain a diverse forest ecosystem. Radial thinning— clearing a prescribed radius around each tree—is one treatment that researchers and managers are testing to possibly increase vigor and decrease mortality, while still maintaining high forest cover. This type of treatment is sometimes used when heavier, stand-level thinning is not a viable option due to social or regulatory constraints.



Schematic of the control and three radial thinning treatments applied in an attempt to decrease mortality and increase growth of sugar pine in a southwest Oregon study. Though there was some increased growth, sugar pines did not show increased survival (as compared to the control) after 16 years even in the extended radius treatment, where all trees and shrubs were removed.

In a 16-year study, Rocky Mountain Research Station Research Ecologist Sharon Hood and her colleagues assessed three types of radial thinning to determine whether they would improve the growth and survival of sugar pines, a species of white pine, in southwest Oregon on sites located in the Umpqua National Forest and Bureau of Land Management Roseburg District. In addition to evaluating a control group, the researchers examined three kinds of treatments in which trees and shrubs were removed around sugar pines to 3 m (10 ft); 7.6 m (25 ft), while retaining large trees with diameters greater than 64 cm (2 ft); or 7.6 m (25 ft). Though some of the radial thinning strategies seemed promising at the 9-year mark, the radial thinning did not improve sugar pine survival at the end of the study (year 16), as compared to the control group. The extended (7.6 m) radial thinning with complete tree removal treatment did increase tree growth for sugar pine that survived, but the level of tree mortality was similar regardless of whether trees had radial thinning or not. Most tree mortality was due to the native mountain pine beetle.

Hood understands that these results may be frustrating for researchers and managers looking for solutions and might even "feel like a failure." Instead, Hood sees the results as demonstrating the importance of monitoring and learning from our treatment attempts. This outcome shows the importance of long-term monitoring of treatment. Hood adds, "This study offers the opportunity to highlight the value of monitoring and adaptive management, even when there are negative results."

In a study of legacy ponderosa and Jeffrey pines on the Lassen National Forest in northeastern California, Hood and colleagues came to similar conclusions about the value of radial thinning. The authors looked at annual growth patterns to see if treatments could improve the growth of trees 300 years or older. However, there was a key difference between this study and the sugar pine work: this research compared radial thinning to stand-level thinning. While radial thinning at 9.1 m (30 ft) did slow tree growth decline, as compared to the control, only stand-level thinning increased tree growth immediately after the treatment and was sustained throughout the 15-year study period. Stand-level thinning, however, is not always an option for forest managers.

Reflecting on both studies, Hood points out that efforts to maintain forest vigor and reduce tree loss will require multipronged silvicultural practices, in tandem with the support of long-term studies of a variety of treatments.

Left: Control (no radial thinning) for sugar pine study (southwest Oregon) at 18 years after initiation. Right: Results of radial thinning that cleared a 7.6-m radius around a sugar pine (southwest Oregon), 18 years after initiation. USDA Forest Service photos by Sharon Hood.

FEATURED SCIENTIST

Sharon Hood is a Research Ecologist with the Fire, Fuel, and Smoke Science Program of the Rocky Mountain Research Station in Missoula Montana. Her primary research focuses on the causes and mechanisms of postfire tree mortality, understanding the effects of reduced fire frequency in fire-dependent ecosystems, and how fire affects a tree's susceptibility to bark beetle attack.

FURTHER READING

Hood, Sharon M.; Schaupp, Willis C., Jr.; Goheen, Donald J. 2022. Radial thinning ineffective in increasing large sugar pine survival. Forest Ecology and Management. 520: 120351.

Hood, Sharon M.; Cluck, Daniel R.; Jones, Bobette E.; Pinnell, Sean. 2017. Radial and stand-level thinning treatments: 15-year growth response of legacy ponderosa and Jeffrey pine trees. Restoration Ecology. 25(5): 813–819.

KEY MANAGEMENT CONSIDERATIONS

- Long-term monitoring is necessary to ensure that a treatment is effective. In the sugar pine study in southwest Oregon, the first 9 years seemed to show decreased mortality from the mountain pine beetle in the radial thinning treatments. The pattern was the opposite in the second half of the study; mortality was lowest in the control group.
- As a single treatment, radial thinning did not meet the goal of decreasing sugar pine mortality in the 16-year study.
- The sugar pine that survived in the 7.6 m (25 ft) treatment, with all trees and shrubs removed in the radius, showed increased growth, as compared to the control, in addition to more sugar pine seedlings in the openings. Mortality was caused primarily by the mountain pine beetle in all treatments and the control.
- Radial thinning did decrease tree decline in the study of old, legacy ponderosa and Jeffrey pines in northeastern California, but only stand thinning increased tree growth.

The Rocky Mountain Research Station is one of seven units within USDA Forest Service Research & Development. RMRS maintains 14 field laboratories throughout a 12-state geography encompassing parts of the Great Basin, Southwest, Rocky Mountains, and the Great Plains. While anchored in the geography of the West, our research is global in scale. RMRS also administers and conducts research on 14 experimental forests, ranges and watersheds and maintains long-term research databases for these areas. Our science improves lives and landscapes. More information about Forest Service research in the Rocky Mountain Region can be found here: https://www.fs.usda.gov/rmrs/.