



Forest Service
U.S. DEPARTMENT OF AGRICULTURE



Rocky Mountain Research Station Science You Can Use *(in 5 minutes)*

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Anything to Conserve Moisture: Seedlings Planted after Wildfire Benefit from Shade, North Aspects, and Depressions

The REPLANT Act, part of the 2021 Bipartisan Infrastructure Law, directs the Forest Service to plant more than a billion trees on 4 million acres of deforested national forest lands over the next decade. Most of these lands were burned by severe wildfire, and are not reforesting naturally due to a lack of seed sources and unfavorable climatic conditions. Currently, there are several bottlenecks in the planting pipeline, so maximizing the survival and growth of seedlings is critical.

A team of forest ecologists from the Rocky Mountain Research Station (RMRS), Colorado State University (CSU), Northern Arizona University, and The Nature Conservancy (TNC) recently collaborated with land managers with the Arapaho Roosevelt National Forest ([ARP](#)) to identify some of the conditions that contribute to the survival and growth of seedlings planted after the Cold Springs Fire, a high-severity wildfire that burned in 2016 near Nederland, Colorado. The study results were recently published in the journal *Fire Ecology*.

ARP land managers chose to replant in the Cold Springs Fire footprint to help re-establish a mixed conifer forest similar to the forest that was present prior to the burn. The site lies in the wildland urban interface and is heavily used for recreation. ARP land managers planted the approximately 90-acre site with ponderosa pine, limber pine, and Douglas-fir seedlings, and monitored the survival of 100 individuals of each species for the first three growing seasons.

Laura Marshall, postdoctoral researcher at CSU, Paula Fornwalt, an RMRS Research Ecologist, and their team took over for the fourth growing season of monitoring and data analysis. Along with seedling survival, the team measured seedling height, height growth, aspect, the presence of objects that provide afternoon shade, and the presence of ground depressions even as small as a footprint.



Conifer seedlings growing on a north aspect, in shade, or in a slight depression had a survival and growth advantage. Ponderosa pine shown. USDA Forest Service photo by Paula Fornwalt.



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The team found that the growing environment has a strong effect on seedling survival, height, and height growth, with increased values on north aspects and in the presence of a shade object or a depression. For example, survival was nearly twice as high on north aspects as south.

“Everything that likely contributed to a cooler, moister microclimate also contributed to increased survival and growth,” says Marshall.

Team member Catherine Schloegel, watershed forest manager with TNC in Colorado, says, “As we seek to collectively scale up reforestation in burn scars, applied research findings such as these will be an important guide.”

Asked to interpret the findings for south aspects, Marshall says that managers should expect more seedlings to die. She recommends planting in the shade of an object, if possible, on south aspects in particular—even moving objects—and targeting depressions.

Marshall and Fornwalt have since contacted national forest managers across Colorado, Arizona, and New Mexico seeking data about tree planting efforts. They are analyzing variables from elevation to climate to where seed was collected. “With data from across the Southwest,” says Marshall, “we can draw broader conclusions as to what’s driving seedling performance.”

Key Findings/Management Implications

- The growing environment has a strong effect on whether seedlings survive and how they grow.
- The team generally found greater seedling survival, height, and height growth on northerly aspects, in shade, and in depressions.
- These findings are important in supporting REPLANT Act mandates and post-fire replanting everywhere.

Further Reading

Marshall, L. A. E.; Fornwalt, P. J.; Stevens-Rumann, C. S.; Rodman, K. C.; Rhoades, C. C.; Zimlinghaus, K.; Chapman, T. B.; Schloegel, C. A. 2023. [North-facing aspects, shade objects, and microtopographic depressions promote the survival and growth of tree seedlings planted after wildfire](#). *Fire Ecology* 19:26.

Stevens, J. T.; Haffey, C. M.; Coop, J. D.; Fornwalt, P. J.; Yocom, L.; Allen, C. D.; Bradley, A.; Burney, O. T.; Carril, D.; Chambers, M. E.; Chapman, T. B.; Haire, S. L.; Hurteau, M. D.; Iniguez, J. M.; Margolis, E. Q.; Marks, C.; Marshall, L. A. E.; Rodman, K. C.; Stevens-Rumann, C. S.; Thode, A. E.; Walker, J. J. 2021. [Tamm Review: Postfire landscape management in frequent-fire conifer forests of the southwestern United States](#). *Forest Ecology and Management* 502: 119678.

Rodman, K.; Fornwalt, P.; Chapman, T.; Coop, J.; Edwards, G.; Stevens, J.; and Veblen, T. 2022. [SRRT: A decision support tool to inform postfire reforestation of ponderosa pine and Douglas-fir in the southern Rocky Mountains](#). Research note RMRS-RN-95. 12 p. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station.

Lead Scientist

Paula Fornwalt is a Research Ecologist with the Forest and Woodland Ecosystems program at Rocky Mountain research Station. Her research examines how forest vegetation in the interior mountain west is shaped by disturbances including fire, climate change, and land management.

Laura Marshall is a postdoctoral researcher with the Forest and Rangeland Stewardship Department at Colorado State University and works on tree and plant community responses to fire and climate.

Joy Drohan is the author of this Science You Can Use.

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/>.

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