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Science You Can Use *(in 5 minutes)*
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The Story in the Understory: Mechanical treatments stimulate expansion of native understory plants in dry conifer forests

More than 100 years of fire exclusion, logging, grazing, and other human activities have contributed to uncharacteristically high tree densities in the dry conifer forests of the western United States. Mechanical forest treatments using heavy machinery or chainsaws to remove trees are being used widely to create a more open and diverse overstory, especially in situations where prescribed fire is not feasible. It has not been clear how these treatments affect the understory, particularly over longer time frames. To help managers better assess what is happening in the understory, Rocky Mountain Research Station (RMRS) researchers Arièl Demarest and Paula Fornwalt recently published a study that looked at responses shortly after mechanical treatment (1–2 years) and over a longer time frame (4–6 years), across a wide environmental gradient in dry conifer forests of the Colorado Front Range.

The overall finding was that the native understory thrives with mechanical tree removal in these sites, even without being the focus of the treatment. The mechanical treatments removed cover of roughly half of the overstory basal area. Over the course of the study, native understory species richness increased only modestly, while the cover of native understory species responded more dramatically; by the 4–6 year mark, native understory cover was 1.7 times higher in treated areas than in the areas that had not undergone mechanical tree removal. Higher post-treatment understory richness and cover values were associated with lower basal areas, especially basal areas close to the range of historical mean basal area for the Front Range.

Native grasses and sedges were particularly stimulated by mechanical restoration treatments. This photo depicts the exuberant 4-6 year post-treatment response of Parry's oatgrass (Danthonia parryi) at the Payne Gulch site near Bailey, Colorado. USDA photo by Arièl Demarest.

The richness and cover of native grasses and sedges expanded the most after mechanical forest thinning, with cover doubling in treated compared to untreated areas by 4–6 years posttreatment. The long-lived natives was about 1.6 times higher after treatment, while the cover of short-lived natives increased slightly but remained at less than 1 percent of the total cover both before and after treatment. The only native species group to not clearly benefit from the treatments were shrubs.

One surprising finding of the study was that the native understory responded positively after mechanical

treatments across a wide climatic gradient. Demarest explains, “We thought that understories in harsher, hot-dry areas might struggle after treatment compared to those in cool-wet areas, but it turns out that understories responded well across a broad range of climates.” Also, posttreatment invasion of non-native species was not a factor, as they were generally present at very low levels (less than 0.5 percent of cover) both before and after the treatments.

Overall, the findings of this research support the importance and value of ongoing restoration treatments in these dry conifer forests for both the over- and understory plant communities.

MANAGEMENT IMPLICATIONS

- Recent RMRS research on the impacts of mechanical tree removal showed a positive effect on the native understory plant community following forest treatments.
- Relative to untreated areas, there was only a modest increase in understory species richness by 4–6 years posttreatment, but the cover of these species expanded 1.7-fold on average. Surprisingly, positive impacts were consistent across varied environmental conditions and expansion of nonnative species was minimal.
- The study findings support the importance of ongoing restoration treatments in these dry conifer forests to support multiple objectives including reinvigoration of native plant understories.

Native understory plants benefited from mechanical restoration treatments, as demonstrated by this pair of photos taken (top) before treatment and (bottom) 4-6 years after treatment at a plot in the Phantom Creek 1 site near Woodland Park, Colorado. USDA photos by Paula Fornwalt.

FURTHER READING

Briggs, Jennifer S.; Fornwalt, Paula J.; Feinstein, Jonas A. 2017. Short-term ecological consequences of collaborative restoration treatments in ponderosa pine forests of Colorado. Forest Ecology and Management. 395: 69–80.

Cannon, Jeffery B.; Barrett, Kevin J.; Gannon, Benjamin M.; Addington, Robert N.; Battaglia, Mike A.; Fornwalt, Paula J.; Aplet, Gregory H.; Cheng, Antony S.; Underhill, Jeffrey L.; Briggs, Jennifer S.; Brown, Peter M. 2018. Collaborative restoration effects on forest structure in ponderosa pine-dominated forests of Colorado. Forest Ecology and Management. 424: 191–204.

Demarest, Arièl B.; Fornwalt, Paula J.; Wolk, Brett H.; Rodman, Kyle C.; Redmond, Miranda D. 2023. Mechanical forest restoration treatments stimulate understory plants in the Colorado Front Range. Forest Ecology and Management. 548: 121322.

CONTRIBUTORS AND WRITER

Arièl Demarest was an ecologist with the RMRS. While at RMRS, she contributed to a variety of research projects that examined how forest management affects understory plants. She is now with the Pacific Northwest Research Station.

Paula Fornwalt is a research ecologist with RMRS. Her research focuses on how forest vegetation in the interior mountain west is structured by a wide array of disturbances, including forest management.

Brett Wolk of the Colorado Forest Restoration Institute at Colorado State University; **Miranda Redmond** of the University of California, Berkeley; and **Kyle Rodman** of the Ecological Restoration Institute at Northern Arizona University all made major contributions to the research.

Sue Miller is the author of this Science You Can Use.