USDA Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Rocky Mountain Research Station

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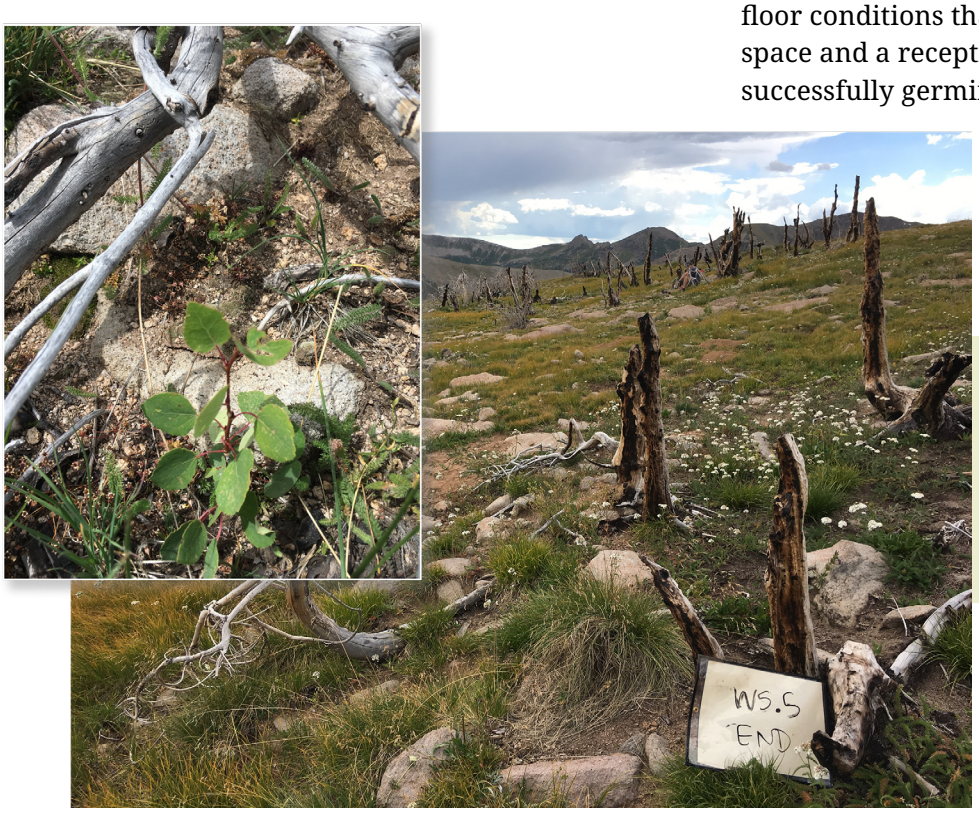
Wildfire: Helping Aspen Get One Step Ahead of a Warming Climate

High severity fires of unprecedented size have become regular occurrences and land managers are now facing the challenge of how to manage the increasing expanse of postburn landscapes. As the climate warms, tree species distributions are shifting, and managers are considering whether to promote the same tree species that previously existed at a site or more climate-adapted trees. Will long-lived tree species migrate on their own as fast as the climate is changing? Recently published work by Rocky Mountain Research Station research forester Mike Battaglia, Colorado State University's Katie Nigro, Miranda Redmond, and Monique Rocca, and Western Colorado University's Jonathan Coop addressed this question.

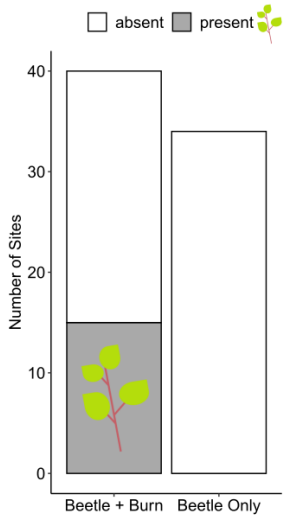
This story starts in the postburn landscape of the West Fork Fire Complex, a large and severe wildfire that burned more than 100,000 acres of the Rio Grande National Forest (Colorado) in 2013. This landscape was already severely impacted by prior bark beetle mortality. Using aerial imagery and field surveys, the researchers determined that the upper elevational limit for adult aspen before the fire was approximately 11,500 ft. After the fire, seedlings were found to be established at elevations up to 12,066 ft. In contrast, the research team did not find any aspen seedlings in the beetle-killed but unburned forests surveyed in the same area. The combination of beetle-killed forest and wildfire created forest floor conditions that provided more growing space and a receptive seedbed for aspen seeds to successfully germinate.



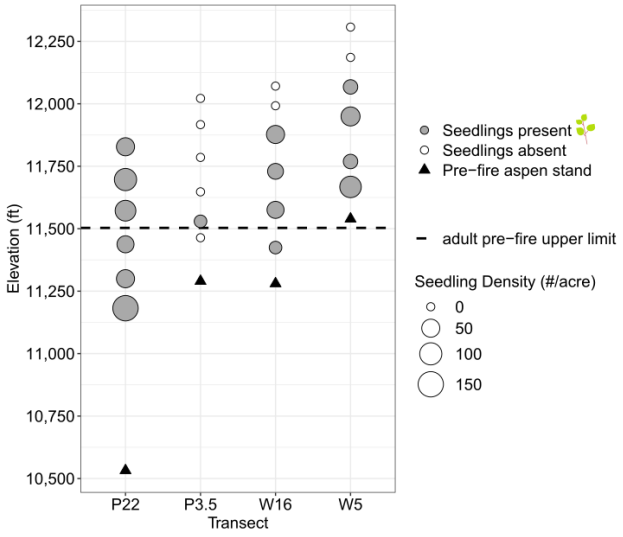
The aftermath of the West Fork Fire in Colorado, with the inset showing the highest-elevation aspen seedling post-burn, was found at 12,066 ft. The highest elevation where adult aspen was found before the fire was approximately 11,500 ft. USDA Forest Service photos by Katie Nigro.

Distance to seed source was not a factor for aspen seedling establishment in this study, reflecting aspen's long-distance seed dispersal capabilities. Both wildfire and prescribed fire are likely to be important processes for promoting the migration of aspen and other shade-intolerant wind-dispersed species in response to climate warming. Though this is a promising sign for aspen persistence, more than one-third of the burned sites investigated had no aspen seedlings and 76 percent of the seedlings that the researchers did find had browse damage from elk, deer, or other ungulates. Browse pressure and other factors are likely to limit where aspens establish.

"We found that fire is the key ingredient for aspen's success in its migration upslope," says Battaglia and Nigro. "We may therefore be able to use fire as a tool to promote more aspen expansion in this era of rapid climate warming."



Number of sites with and without aspen seedlings in burned + beetle-killed vs. beetle-killed only areas.



The four elevational transects where seedlings were found with the elevation of the pre-fire adult aspen stand (triangle) and each site surveyed (circles). Circle color indicates seedling presence and size indicates density. The adult pre-fire upper elevational limit is represented by the dashed horizontal line.

Further Reading

Nigro, Katherine M.; Rocca, Monique E.; Battaglia, Mike A.; Coop, Jonathan D.; Redmond, Miranda D. 2022. Wildfire catalyzes upward range expansion of trembling aspen in southern Rocky Mountain beetle-killed forests. Journal of Biogeography. 49: 201-214.

Kreider, M.R.; Yocom, L.L. 2021. Low-density aspen seedling establishment is widespread following recent wildfires in the western United States. Ecology. 102(10): e03436. doi: 10.1002/ecy.3436

Landhäusser, S.M.; Pinno, B.D.; Mock, K.E. 2019. Tamm Review: Seedling-based ecology, management, and restoration in aspen (Populus tremuloides). Forest Ecology and Management. 432: 231–245.

Scientist Bios

Mike Battaglia is a research forester in silviculture with the Rocky Mountain Research Station in Fort Collins, CO. His research focuses on developing and implementing innovative management strategies to enhance forest resilience to disturbances and evaluating the subsequent ecological impacts of these activities.

Katie Nigro's research centers on tree species' distributional shifts under changing climate and disturbance conditions. This study is part of her Ph.D. work at Colorado State University investigating the potential for future range expansions under different disturbance scenarios in the western United States.

Key Findings/Management Implications

- Fire can be a useful tool for promoting migrations of shade-intolerant wind-dispersed species such as aspen.
- Aspen successfully established in burned areas far from seed sources, so managers may choose to focus attention on other species in postburn reforestation.
- Beetle-killed forests were not found to promote aspen seedling establishment, so tree planting could be used in these sites to facilitate aspen migration.
- Reducing browse pressure may be necessary for aspen's continued success in post-disturbance situations.