Overstory retention limits cheatgrass invasion after wildfire

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Wildfires may catalyze ecosystem invasion by non-native plant species through opening preivously occupied habitat and freeing growth-limiting resourcs. The invasive annual grass, Bromus tectorum (cheatgrass) is particularly problematic in the western US, where its continous fine cover and early-season senescence have increased fire frequency. In recent years, cheatgrass has invaded mixed-conifer forests across the western US, altering fuel structure and species composition.

MANAGEMENT IMPLICATIONS

- Cheatgrass loadings increased 22 – 68 fold in mixed-conifer forests after wildfire
- Overstory tree cover strongly limited cheatgrass cover and loadings
- Mastication + prescribed fire minimized overstory fire effects 13 y after treatment
- Fuel treatments that minimize fire effects on the overstory may limit cheatgrass invasion in mixed-conifer forests

In 2021 the French wildfire burned across a long-term fuel treatment study site in a California mixed-conifer forest that originated from a 35-yr old ponderosa plantation that had previously been treated by a combination of mastication, prescribed fire, and a 'pull-back' of surface fuels away from live tree stems to minimize fine root mortality from prescribed fire, as well as a control treatment. In 2024, researchers from University of Idaho and the USDA Forest Service measured post-fire changes in forest and fuel structure and cheatgrass loadings, by treatment, to assess post-fire outcomes.

Post-fire cheatgrass loadings increased in all treatments, but were strongly limited by surviving overstory tree cover (**Fig. 1**). The elevated post-fire cheatgrass loadings were primarily driven by increases to cheatgrass cover where overstory canopy cover was least, though the average post-fire cheatgrass height was nearly double pre-fire values. These changes in fuel structure were likely caused by increases in understory light levels from the mortality of overstory trees. As well, several very large post-fire precipitation events likely benefited cheatgrass, relative to native species.

Despite the dramatic increase in cheatgrass loadings (**Fig. 2**), the current fuel structure likely poses minimal risks to surviving mature conifers which have elevated crowns and thick bark. Cheatgrass invasion into mixed-conifer forests has been documented following wildfire and other disturbances (e.g., grazing, fuelbreaks) where, if it burns, could increase the likelihood of ladder fuel ignition and further suppress the native understory. However, it is still unclear if

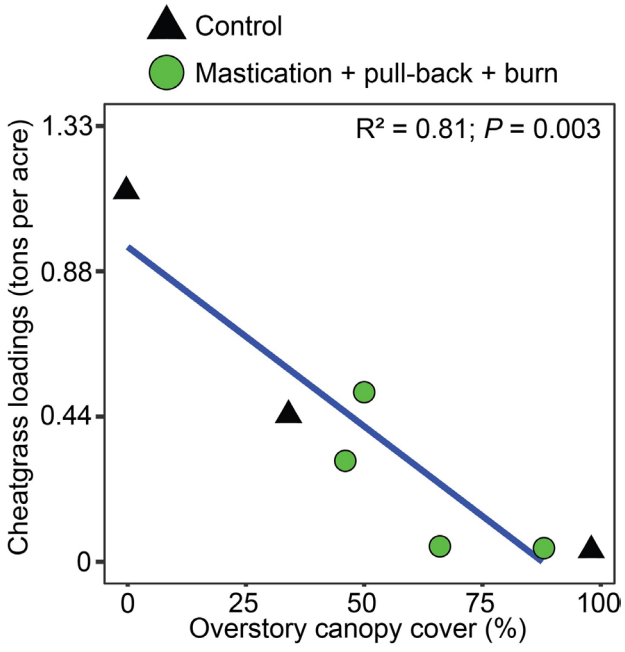

Figure 1 *Relationship between post-fire cheatgrass loadings (tons per acre) and overstory*

increased cheatgrass cover and loadings will shorten the fire return intervals of invaded forests. Invaded rangelands in the Great Basin have experienced dramatic shortening of fire return intervals and undesirable changes in ecosystem function and species composition. Therefore, continued monitoring of cheatgrass invaded mixed-conifer forests is critical to understand the long-term consequences of invasion and to develop treatments to mitigate undesirable effects.

In mixed-conifer forests, reducing impacts of invasive annual grasses may require land management to strike a balance between maintaining wildfire-resistant forests and fuel structures and minimizing opening canopy gaps which may be exploited by invasive species already present in the forest. Restoring tree canopy cover may be a long-term approach to reducing the biomass of invasive grasses where fire or other disturbances have caused substantial overstory tree mortality. Additional treatments including herbicide applications and annual monitoring may be needed to eradicate cheatgrass or reduce its abundance in mixed-conifer forests.

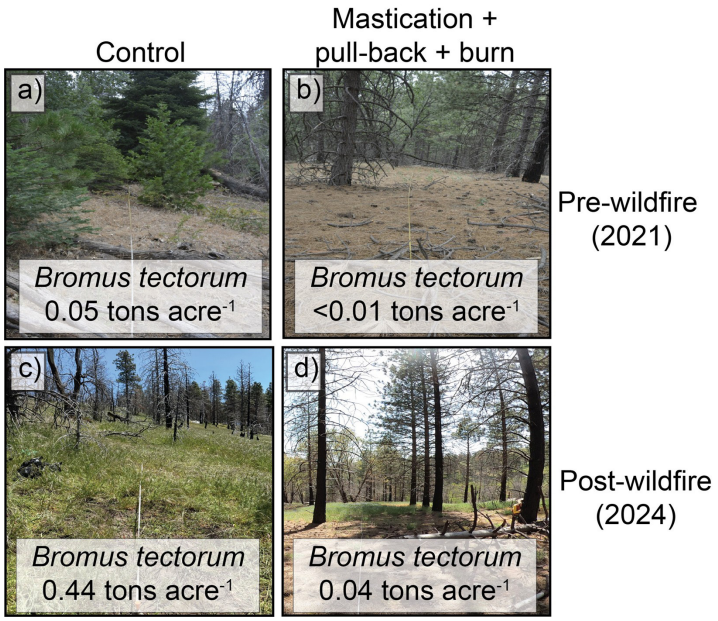

Figure 2 *Changes in fuel structure from pre-fire (a; b) to post-fire (c; d) in control (a; c) and mastication + pull-back + burn (b; d) treatments. Cheatgrass cover increased in both treatments, catalyzed by the wildfire and consumption of overstory foliage.*

Additional Information

This brief is based on the following article:
Birch, Joseph .D., Miesel, Jessica .R., Batista, Eugenia K., and Matthew B. Dickinson. 2026. Overstory retention in a managed mixed-conifer stand limits cheatgrass invasion after wildfire. Fire Ecology. https://doi.org/10.1186/s42408-025-00445-5

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Suggestions for further information:
Reiner, A.L., Vaillant, N.M., Fites-Kaufman, J. and Scott M. Dailey. 2009. Mastication and prescribed fire impacts on fuels in a 25-year old ponderosa pine plantation, southern Sierra Nevada. Forest Ecology and Management, 258(11), pp.2365-2372. https://doi.org/10.1016/j.foreco.2009.07.050

Birch, J.D., Reiner, A., Dickinson, M.B. and Jessica R. Miesel. 2023. Prescribed fire lessens bark beetle impacts despite varied effects on fuels 13 years after mastication and fire in a Sierra Nevada mixed-conifer forest. Forest Ecology and Management, 550, p.121510. https://doi.org/10.1016/j.foreco.2023.121510