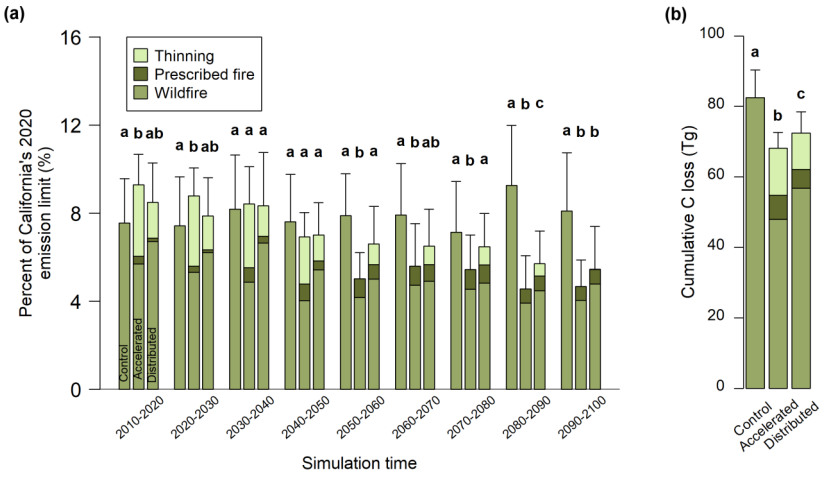
Earth Systems Ecology Lab



Temporal changes in C loss from the system by treatment and source (a), and total cumulative C loss over the 90-year simulation by treatment and source (b). Error bars represent standard deviation.

Large-scale restoration increases forest carbon stability under projected climate and wildfire

Changing climate is compounding the higher fire hazard resulting from long-term fire suppression and poses a challenge to forest carbon (C) stability. In fire-prone forests, restoration treatments that reduce tree density and restore surface fire regimes can reduce severe fire effects. However, treatment implementation has been slow and spatially limited. Given the increasing size of wildfires, there is recognition that increasing the pace and scale of restoration is necessary to reduce the risk of high-severity wildfire. We ran simulations for the Sierra Nevada mountain range to quantify how the implementation timing of large-scale restoration treatments would influence C storage and emissions under projected climate and area burned.

We found that when treatments were implemented during the first half-century (accelerated), the proportion of the mountain range that experience high severity wildfire was lower than when the same amount of treatment was distributed throughout the century (distributed).

The influence of treatment on fire severity led to an immediate reduction in wildfire emissions and reduced cumulative emissions by up to 42% (accelerated) over the simulation period (see figure). Although C losses from thinning and prescribed burning were larger in the accelerated scenario than in the distributed scenario, total cumulative losses were significantly lower. By 2100, the accelerated scenario stored 6 Tg more C across the Sierra Nevada, with the cumulative amount of avoided C emissions equaling 24% of California's 2020 emission limit. Both the accelerated and distributed scenarios stored more C and retained more forest cover than the no-management scenario.

Management Implications

Large-scale restoration treatments reduce fire severity, wildfire emissions and cumulative carbon loss.

Large-scale restoration treatments initially have larger carbon loss, but reduce fire severity leads to lower carbon loss from wildfire.

The accelerated treatment pace allowed more forest to be treated before it burned by wildfire resulting in lower total carbon losses, larger total carbon stocks, and a larger proportion of the Sierra Nevada being forested.

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USDA United States Department of Agriculture National Institute of Food and Agriculture

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