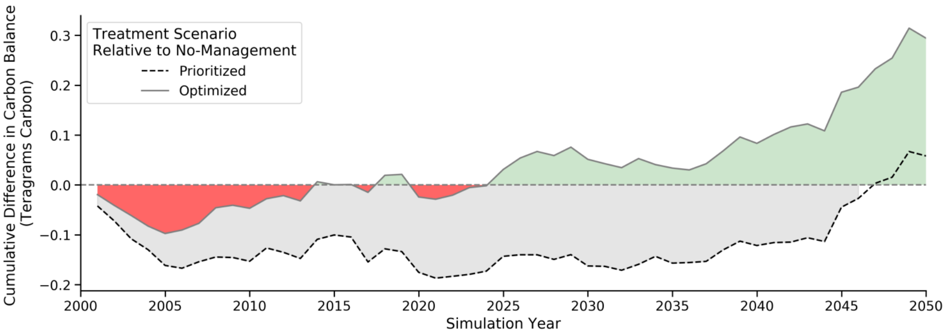
Earth Systems Ecology Lab



Cumulative net ecosystem carbon balance (NECB) of the prioritized (dashed black) and optimized (solid gray) scenarios, relative to the no-management scenario (0 line). Positive values indicate the landscape is taking-up more carbon than the no-management scenario. NECB accounts for carbon up-take by plants, losses from thinning, and emissions from prescribed fire and wildfire

Optimal Treatment Placement Reduces High-Severity Wildfire Risk with Less Area Thinned

Hotter, larger wildfires are becoming commonplace in the Western US and the area burned is likely to increase with additional climate warming. This is exacerbating the forest conditions that have resulted from a century of fire suppression. Restoring regular surface fires often requires first implementing expensive mechanical treatments. Given the size of the area in need of restoration treatments, optimally allocating treatments is a necessity. We ran simulations of the Santa Fe Fireshed to understand how optimizing mechanical treatment placement based on the risk of high-severity wildfire could reduce the frequency of high-severity wildfire and carbon losses under projected climate change and more severe fire weather.

We found that mechanically treating areas with the highest risk of high-severity wildfire and using prescribed fire to treat the unthinned areas (optimized scenario), we could reduce the area mechanically treated when all operable areas were thinned (prioritized scenario) by 54%. This outcome required a 27% increase in the area treated with prescribed burning. Both scenarios reduced high-severity wildfire when compared to the no-management scenario, as well as a significant reduction in wildfire carbon emissions. However, the optimized scenario did so at a considerable carbon savings in the short term, yielding a significant reduction in carbon lost from the system (see figure). Both of our scenarios achieved a reduction in high-severity fire and stabilized the remaining carbon. However, in both the management scenarios, maintaining carbon stability under changing climate and increasingly severe fire weather was contingent on the regular application of prescribed fire at return intervals that are consistent with historic fire regimes.

Management Implications

Prioritizing the allocation of thinning treatments to areas with the greatest chance of burning under high-severity wildfire and treating the rest of the landscape with prescribed burning, can substantially reduce the area requiring thinning.

Optimally locating thinning treatments can result in greater carbon storage across the landscape, with less risk of stand-replacing wildfire. The benefits of treatment optimization persist even as fire weather becomes more severe with changing climate.

Restoring high-frequency fire regimes is critical for reducing the risk of high-severity wildfire and stabilizing carbon.

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