CALIFORNIA FIRE SCIENCE CONSORTIUM

Research Brief for Resource Managers

Release: June 13, 2024

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Trends in prescribed fire weather windows from 2000 to 2022 in California

Fossum, CA, BM Collins, CW Stephens, JM Lydersen, J Restaino, T Katuna, SL Stephens. 2024. "Trends in prescribed fire weather windows from 2000 to 2022 in California" Forest Ecology and Management. 562: 121966. https://doi.org/10.1016/j.foreco.2024.121966.

Management Implications

- This study documents changes in prescribed fire weather windows over 23 years, with the Sierra Nevada landscape seeing a decline in burn windows over time, and the coastal landscape experiencing more burn windows
- Increased operational capacity and regulatory flexibility around prescribed fire treatments could allow practitioners to take advantage of non-traditional or infrequent burn windows.

Background

Total area burned across California is significantly below historical averages, yet the amount of land burning at high severity has increased. Increases in fuel accumulation and reduction in forest resilience due to climate change and fire suppression are likely to continue influencing the frequency and severity of wildfires across the state. Prescribed fire is effective at moderating the severity and extent of subsequent wildfire and reduces the amount of suppression resources needed. While many acknowledge the need and call for expanding the use of prescribed fire, there are barriers to increasing the implementation of this tool.

Barriers to prescribed fire include regulatory constraints around endangered species and effects on air quality. Additionally, resources to conduct burns can be insufficient due to mismatches between appropriate weather windows and timing of resource availability. Burn windows in California have potential to shift under climate change as a reduced snowpack could increase the availability of spring and winter burn windows. Yet information on the influence of altered climate on seasonality and regional patterns of prescribed fire windows in California is limited. It will be key to understand how these are changing in space and time to properly prioritize resources and further the extent of prescribed fire in California.

This study analyzed a 2-km hourly gridded weather dataset over a 23-year period to investigate the influence of climatological trends on prescribed fire weather windows. The authors explored how prescribed fire windows changed over this period for two California counties: Sonoma County near the coast and Plumas County in the Sierra Nevada, which contrast in land ownership types, vegetation, and climate. These counties represent diverse prescribed fire considerations in regions where recent

catastrophic wildfire has drawn interest from land managers. Using burn prescriptions written by experienced local fire practitioners, the authors identified the degree of weather-driven change in prescribed fire opportunities for these two distinct areas within California.

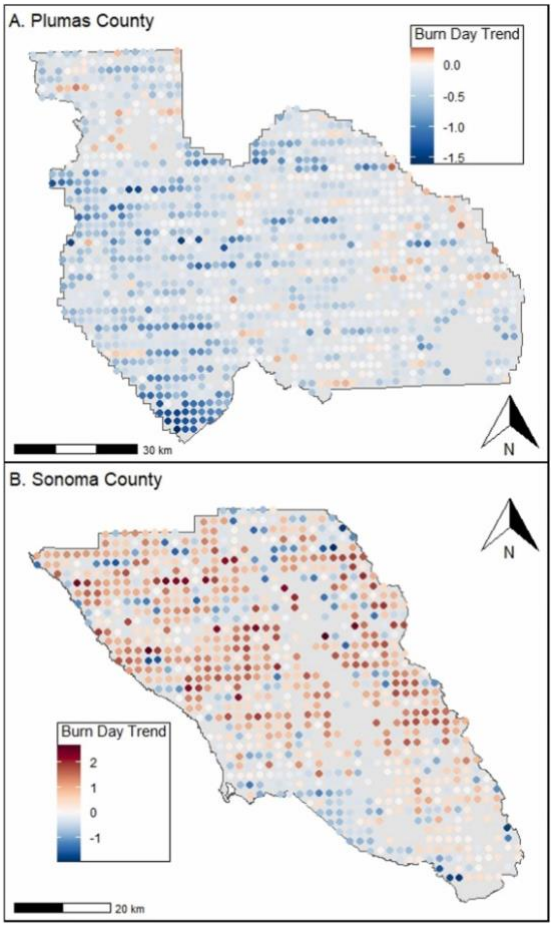

Figure 1. *Adapted from Fossum et al. 2024. Trends in annual burn days across Plumas (A) and Sonoma (B) counties.*

Findings

Over the 23-year period, the authors found a decline in prescribed burn days in the montane Plumas County and an increase in burn days in the mesic, coastal Sonoma County (Fig. 1). The yearly average of burn days in Plumas County was only 28 days a year and decreased by 8.5 days during the period, while Sonoma had an annual average of 125 days that increased by 8.6 days. These burn windows shifted seasonally with increases in winter burn opportunities for both counties, including an increase of 6.6 days for Sonoma in the winter. Plumas, which had the greatest number of burn days in the spring and fall compared to other seasons, decreased in all non-winter seasons, with the largest decline in the spring by 5.6 days.

Spring has generally had the greatest likelihood of longer windows, providing more opportunity for larger scale burns that are implemented over multiple days. Yet, the reduction of spring burn days combined with practitioners' concern for the need to patrol spring burns into the wildfire summer season to prevent escape is likely to reduce the viability of spring weather windows. There are also constraints to employing winter burning, including restrictions by air quality regulations as winter inversions trap prescribed fire emissions at lower altitudes. Winter prescribed fire opportunities do, however, have the benefit of bypassing the challenges of fall and spring burning in their proximity to wildfire season.

Prescribed fire windows in Sonoma lengthened for all seasons except fall, which maintained the same duration. While this might indicate the potential for more burning in this area, Sonoma was more constrained by non-weather barriers. Both air quality regulations and fire management resource availability had a greater effect on Sonoma than Plumas County, in part due to the longer summer and fall burn windows that overlap with wildfire season. Sonoma is also limited by the complexity of land ownership and related risk, economics, and cooperation. Based on this mismatch of summer and fall burn days with the threat of wildfire, this region could leverage the under-utilized burn windows within winter and spring, however, local practitioners would likely need increased operational capacity during these seasons. Expanding prescribed fire infrastructure would enable practitioners to take advantage of infrequent or non-traditional windows to increase prescribed fire extent and achieve land management goals.