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# Research Brief for Resource Managers


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# Analysis of past burn windows can help land managers plan and prioritize future burns


*Striplin, R., McAfee, S. A., Safford, H. D. and Papa, M. J. 2020. Retrospective analysis of burn windows for fire and fuels management: an example from the Lake Tahoe Basin, California, USA. Fire Ecology 16:13. DOI: https://doi.org/10.1186/s42408-020-00071-3*


In low-severity, frequent-interval fire regime forests, prescribed fires are widely considered to be effective tools for reducing future fire severity. Despite their known effectiveness, the use of prescribed fire has decreased since the late 1990s. As wildfire seasons expand into what previously were prescribed burn seasons, there may be even fewer opportunities for prescribed burns. This makes the identification of burn windows of critical importance.

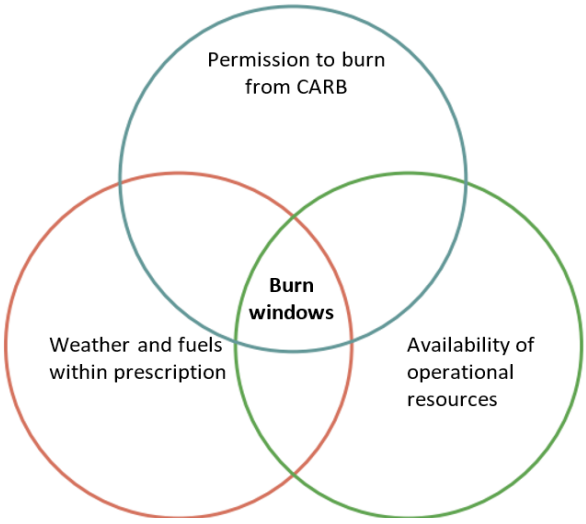


**Fig 1.** Venn Diagram showing the three conditions that must be satisfied for a burn window

## Management Implications

- Comparing available and utilized burn windows can help identify missed opportunities to conduct prescribed fire.
- In areas similar to the study, spring followed by fall and winter had the most burn window opportunities.
- Knowing seasonal patterns in weather conditions can inform decisions to burn depending on the objective. For example, spring burns opportunities may be more frequent, but also may result in patchier fuel consumption.
- Given short burn windows, nimbleness to respond quickly to burn opportunities will likely result in more prescribed fires.

Barriers to prescribed burning include multiple physical, logistical, and cultural factors. In order for a prescribed burn to occur, there needs to be adequate fuel and weather conditions, sufficient resources, and permissible air district burn days. There is currently no standard quantitative method for assessing how frequently a burn window (when all the above conditions are met) occurs. This study uses historical patterns of burn windows to predict burn window likelihood to inform prescribed burning planning and budgeting.

The study area was the Lake Tahoe Basin (LTB), where site-specific factors may not reflect those that occur across the broader region. 75% of the LTB is designated as WUI. With 50,000 permanent

residents and 7.7. million recreation visitors per year, ensuring fire safety and minimizing air quality impacts is a priority. To find patterns of potential prescribed fire feasibility, the study looked back on 20 years' worth of data on (Fig. 2):
1. Permission to burn from air quality regulators (California Air Resources Board (CARB))
2. Weather and fuels within prescription
3. Availability of operational resources

Permission to burn from an air quality perspective is authorized by each air district (roughly the county scale). Burn plan prescriptions include a set of weather and fuel parameters with thresholds based on desired fire behavior and effects. The third factor was assessed using Preparedness Level (PL), a daily index that ranks the commitment level of fire suppression and incident management resources committed to wildfires for a geographic area. This was used as a proxy for the availability of operation resources. The use of PL makes this study most applicable to federal agency burning, which applies to roughly half of the forestland in California.

Burn windows (Fig. 2) where all three constraints are lifted are most frequent in the spring (April-June: average 39% of days). This is followed by the fall (October-November: 29%) and closely by winter (December-March: 27%). They are least frequent during mid-summer (July-Sept: 11%). *Note: these seasons were delineated by the authors of this brief and not by Striplin et al.*

Burn windows lasting multiple days (Fig. 3) were infrequent and two-to-three day burn windows rarely occurred more than twice per month over the twenty years. Still, there is a familiar pattern of two-to-three day burn windows being most common in the spring, followed by the fall, then winter. Multi-day burn windows are great opportunities for large-scale burns but require more resources to implement. Managers with a nimble fire crew that can quickly mobilize are better positioned to take advantage of these fleeting burn windows.

The authors found that burn plan prescription was consistently the most limiting factor, except in January, and occasionally July-October, when CARB burn days were more limiting.

On average there were 96 burn windows each year in the LTB, reflecting only 26% of days with a burn window. Yet between 2010-2018, the Forest Service only utilized 51 burn windows on average each year, suggesting that other constraints may be preventing prescribed burning. These could include risk tolerance, prioritization and utilization of current resources, or other structural barriers in the USFS.

There are limitations to this study. The authors used a "typical" burn plan prescription criteria that included 10-hour fuel moisture between 7 and 20% and minimum relative humidity between 20 and 50%. These parameters are arguably too wide for broadcast burns. It is unlikely that effective fuel consumption from a broadcast burn could occur on a significant portion of the wet end of this prescription. Further, the prescription factors do not take into account that overall fuel moisture (including duff and large diameter fuels) in the spring and winter are likely higher within burn sites, compared to weather station readings. In the spring and winter, fuel moisture may need to be lower than it is in the fall and summer because of differences in live fuel moisture and soil moisture. Actual prescriptions are likely to be adjusted depending on the season, as opposed to one prescription for all times of year. These factors would suggest that the number of actual burn days are overestimated by this study.

Because it is site- and agency-specific, this study does not broadly tell fire practitioners when their particular burn windows will likely occur. But the process and analysis used in this study can be adapted for use by other land management units for planning fuel management activities. Understanding when fire suppression resources are limited for particular landowners and agencies can provide an incentive to develop innovative staffing solutions such as staggering seasonal crew start and end dates to allow for more staffing that can be nimble in conducting burns when short windows open. For private landowners who do their own prescribed burns, they can eventually identify their most likely burn windows by monitoring weather and permitting trends that tend to occur at their location.

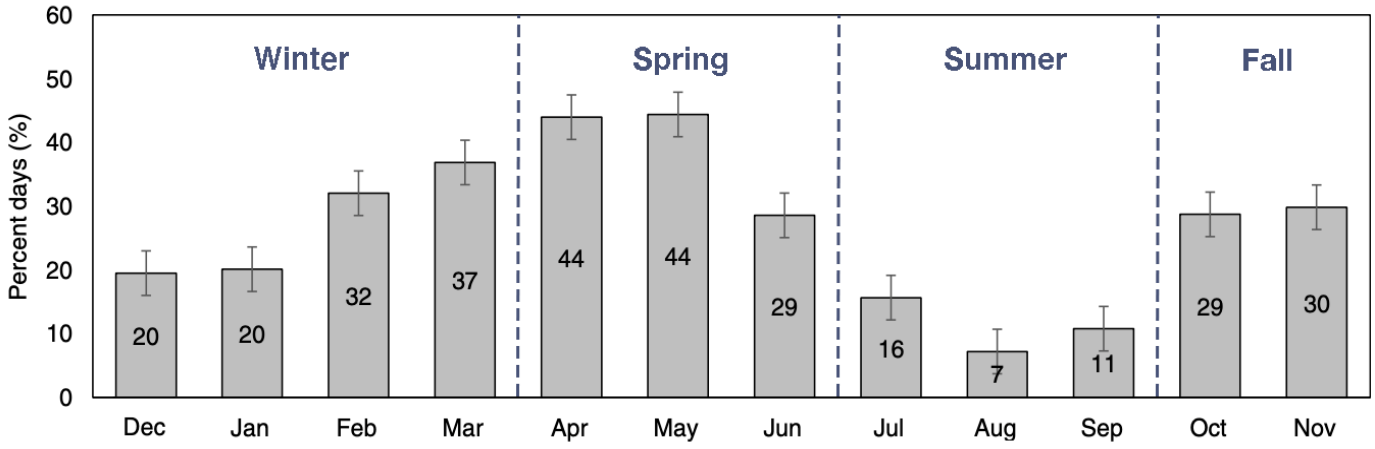


**Fig 2**. Percentage of all days in each month that were burn windows in the Lake Tahoe Basin, USA, from 1999 to 2019. Days with simultaneous occurrence of permission to burn by the air quality regulators, sufficient resources needed for implementation, and weather within burn plan prescription criteria were designated as burn windows. Error bars show the standard error of the mean.

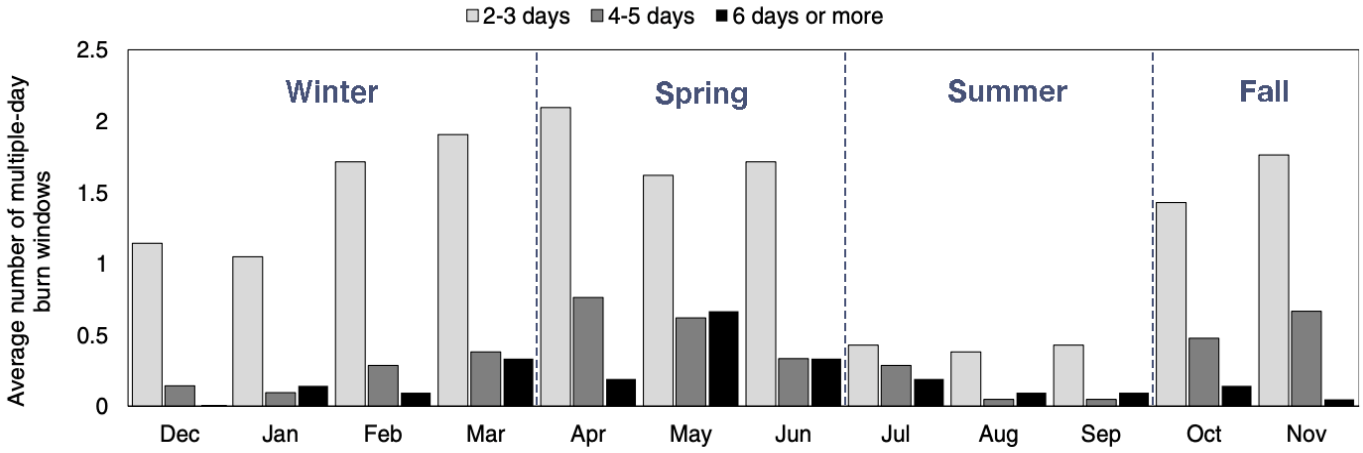


**Fig 3**. Average multiple-day burn windows per month in the Lake Tahoe Basin, USA, for the analysis period 1999 to 2019 based on observed and estimated Baron remote automated weather station data. Multiple-day burn windows were consecutive days meeting burn-window criteria. Relative monthly frequency of multiple-day burn-window occurrences is depicted. These classes do not include single-day occurrences. Each class of consecutive-day periods excludes the lower classes (i.e., 2- to 3-day periods are not counted in the 4- to 5-day periods, etc.)