CALIFORNIA FIRE SCIENCE CONSORTIUM

JOINT FIRE SCIENCE PROGRAM

Management Considerations for Resource Managers

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Prescribed burning and the drought: go or no go?

One topic that is generating a great deal of interest among fire management professionals as California enters the fall prescribed fire season is whether we should be burning during this fourth year of drought. The concern is that with vegetation already stressed, prescribed fire could lead to more mortality than it might otherwise.

A few years ago, Phil van Mantgem, Eric Knapp, and others co-authored a paper that used National Park Service prescribed fire monitoring data, along with some data of post-fire effects on National Forest lands across the western US, to look at the interaction between drought and fire effects.

They found that tree mortality was higher at times of greater pre-fire climatic water deficits, meaning that fire-caused tree injury was more likely to result in tree mortality during a drought. It is important to note that climatic water deficit was a relatively minor factor, and many other factors such as firing pattern or flame length are likely much more important. (In a normal year, post-fire mortality averaged 3.2%, but it went up to 4.5% in a drought year.)

It is also important to recognize that in some parts of the West, the current drought is quite severe—probably beyond conditions captured by the data in this study.

So, should we burn?

Tree mortality is a function of the damage caused to a tree by fire. Damage is in turn a function of fuel loading and fuel consumption, plus conditions at the time of the burn, on top of whatever existing stresses a tree might be experiencing. So the question of whether or not to burn during drought is not black and white; there are a number of factors to consider, and there are a range of strategies to protect stressed trees while still accomplishing good work on the ground.

Factors to consider:

- **What is the burn objective?** Is the objective not to thin the stand but just to remove fuels (e.g., burning is following a thinning that already took tree density down to desired levels)? Or is the forest still denser than desired, and some added mortality might actually be a good thing?
- **How dry is the site compared to average conditions? Is significant tree mortality already occurring in the immediate area?** Drought impacts are not uniform across the state. Currently, the southern Sierra, where the drought has been most severe, is experiencing the highest levels of tree mortality in California. Even there, rates of mortality are much lower at higher elevations. If mortality is occurring, consider the size and species of dying trees and whether or

not existing and/or projected mortality supports management objectives.

- **What is the fuels situation in the stand?** If fuel loading (especially around the base of trees) is relatively low, and the trees have thick bark, fire might cause little if any added stress. On the other hand, if a site hasn't burned in a long time and the stand has large trees with deep basal duff mounds, fire-related stress could be considerable. (Stress is often reflected in tree growth and width of the annual rings. In the historical record, we see little evidence at many sites that mature trees were affected by fire much at all—ring widths are often similar in fire years and non-fire years. However, this was generally in light fuels, when burning was frequent. In areas with heavier fuels, fire-related stress is going to be more of a concern.)
- **Are the trees under other stresses?** Stress might be caused by various other factors, such as overly dense stands where trees are competing for water and nutrients, bark beetle activity, etc.
- **Can potential fire-related stresses be mitigated through altered burning prescriptions or firing patterns, or by burning units that are in normal years too wet to burn effectively?** For example, scorch could be minimized by using more backing fire, altering firing patterns (e.g., less distance between ignition strips), or burning during cooler and/or moister conditions. Evening and night burning are also a good (and currently underutilized) option for cooler burning.
- **Can some smaller trial burns be conducted to assess impacts and inform future management during drought conditions?**

Ultimately, if there is likely to be little or no added stress to trees, there is likely to be little or no change in fire effects from what might be expected under non-drought conditions.

Photo by Phil van Mantgem, USGS

Ideally, whether to burn should be evaluated on a case-by-case basis, because the degree of damage to trees, fuel loading, and pre-existing tree stressors all vary.

We hope these considerations help you navigate tough decisions in your burning program. However, they are just general guidelines; the interacting effects of drought and prescribed fire can't be predicted with absolute accuracy, and there is always a risk that outcomes will be different than expected. Remember to document and share what you learn in your burning!

Reference

van Mantgem PJ, Nesmith JCB, Keifer MB, Knapp EE, Flint A, Flint L. 2013. Climatic stress increases forest fire severity across the western United States. Ecology Letters 16: 1151-1156.