Chaparral Fuel Modification: What Do We Know—and Need To Know?

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Following the fires of 2003 in southern California, the San Diego Fire Recovery Network was formed to help local communities and landscapes recover from fire effects. At one of the Network's meetings, a poster was presented showing the perimeters of fires that did not overlap. The conclusion was drawn that fuel modification through prescription burning is a valuable management technique capable of preventing catastrophic wildfire losses. Similar analyses and conclusions have been published before for chaparral landscapes (Philpot 1974; Minnich 1998).

Counterexamples

However, interpreting the meaning of such static stand age maps raises many problems, including changes in weather not accounted for in interpreting the pattern and the fact that younger fuels are strategic sites for fire suppression forces to make a stand. Moreover, a careful evaluation of the literature shows that for every fire burning out at the perimeters of young fuel classes, there is a fire that didn't. For example:

- The 1971 Romero Fire near Santa Barbara, CA, burned about 14,600 acres (5,900 ha), nearly half which were in 7-year old fuels that regenerated following the 1964 Coyote Fire (Gomes and others 1993).

> Evidence shows that for every fire burning out at the perimeters of young fuel classes, there is a fire that didn't.

- The 2003 Otay Fire southwest of San Diego burned about 44,000 acres (18,000 ha), nearly a quarter of which were in 7-year old fuels. The 2003 Cedar Fire showed similar patterns (Keeley and others 2004).

Such conflicting examples have divided observers into different "camps," with people tending to choose sides. Unfortunately, science is left behind as each side's "experts" battle it out. It is worth understanding the basis for such differing observations. In particular, fire is not driven by a single factor such as fuels, but rather by multiple factors, the most critical of which are fuels in conjunction with weather and topography.

Differing Fire Behavior

Chaparral fires that ignite under moderate weather conditions behave differently from fires driven by severe Santa Ana winds. Under moderate conditions, a chaparral fire might well lay down upon reaching young fuels. However, the massive 2003 Cedar Fire clearly

A fuelbreak in southern California doubles as a hiking trail. Such treated areas can help firefighters stop chaparral fires ignited under moderate weather conditions, but they do nothing to stop fires driven by fierce Santa Ana winds, such as the fires of October 2003. Photo: Kyle MerriamU.S. Geological Survey.

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showed that a even a landscape-scale mosaic of stand age classes, including many young stands—some from recent fuel manipulations—cannot stop a chaparral fire under severe weather conditions, at least not until the weather changes (Keeley and others 2004).

Recognizing these differences does not, in and of itself, dictate fuels management strategy in southern California. Even under severe weather conditions, younger chaparral fuels do reduce a fire's intensity, thereby increasing defensible space for firefighters. Strategic application of fuel treatments does have value, particularly in the wildland/urban interface (WUI). As the WUI expands and increases in complexity, the value of strategically placed fuel treatments will only grow as firefighters are forced to defend lives and property.

What about the fires that start under moderate weather conditions? Are landscape-scale fuel manipulations advisable to help control these fires? There is little doubt that some strategically placed fuel modifications in chaparral have reduced the ultimate size of some fires. For example, fuel breaks are anchor points for backfires that can stop wildfires from reaching urban areas. However, under the severe wind conditions characteristic of the most damaging fires in southern California, windows of opportunity for such a strategy are rapidly closed as firefighters are forced into defensive action near the WUI.

In most instances, fuel modifications in the WUI would seem to be more cost-effective than backcountry fuel breaks designed to help fight the region's least threatening fires.

Cost / Benefit Analysis Needed

Ultimately, a decision to conduct landscape-scale fuel manipulations in chaparral should be based on rigorous cost/benefit analysis (see, for example, Donovan and Rideout 2003). In most instances, fuel modifications in the WUI would seem to be more cost-effective than backcountry fuel breaks designed to help fight the region's least threatening fires.

Any such cost/benefit analysis should not be limited to fire-related considerations. It should also take nonfire resource management concerns into account. For example, landscape-scale fuel manipulations in chaparral can damage native plant communities and open the way for invasive plants (Keeley 2005). Such potential costs must go into the balance.

Additionally, the potential benefits of any landscape-scale fuel manipulation should be fairly weighed. Fires burning under moderate weather conditions are seldom lethal to people. The damage they do is less, by several orders of magnitude, than the damage done by a typical fire driven by Santa Ana winds.

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Deciding the Debate

The debate over how to stop wildfire-related catastrophes in southern California is understandably emotional, but science can help. Evidence shows that fuels alone do not account for the region's most damaging fires, so fuel manipulations per se are not the solution. Although strategically placed fuel treatments can help firefighters protect lives and property, they must be in the right location. The region's land managers owe it to the people they serve to base their decisions on where to locate fuel manipulations—whether in the WUI or in the backcountry—on a full and fair cost/benefit analysis.

References

Donovan, G.H.; Rideout, D.B. 2003. A reformulation of the cost plus net value change (*C* + *NVC*) model of wildfire economics. Forest Science. 49: 318–323.

Gomes, D.; Graham, Jr., O.L.; Marshall, E.H.; Schmidt, A.J. 1993. Sifting through the ashes: Lessons learned from the Painted Cave Fire. Santa Barbara, CA: University of California, Graduate Program for Public Historical Studies.

Keeley, J.E. 2005. Fire management impacts on invasive plant species in the Western United States. Conservation Biology. In press.

Keeley, J.E.; Fotheringham, C.J.; Moritz, M.A. 2004. Lessons from the 2003 wildfires in southern California. Journal of Forestry. 102(7): 26–31.

Minnich, R.A. 1998. Landscapes, land-use and fire policy: Where do large fires come from? In: Moreno, J.M., ed., Large forest fires. Leiden, The Netherlands: Backhuys Publishers: 133–158.

Philpot, C.W. 1974. The changing role of fire on chaparral lands. In: Rosenthal, ed., Proceedings of the symposium on living with the chaparral. San Francisco, CA: Sierra Club: 131–150. ■