INSIGHTS

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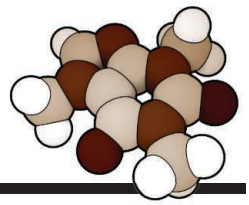

PERSPECTIVES

ENVIRONMENTAL SCIENCE

Reform forest fire management

Agency incentives undermine policy effectiveness

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Globally, wildfire size, severity, and frequency have been increasing, as have related fatalities and taxpayer-funded firefighting costs (*1*). In most accessible forests, wildfire response prioritizes suppression because fires are easier and cheaper to contain when small (*2*). In the United States, for example, 98% of wildfires are suppressed before reaching 120 ha in size (*3*). But the 2% of wildfires that escape containment often burn under extreme weather conditions in fuel-loaded forests and account for 97% of fire-fighting costs and total area burned (*3*). Changing climate and decades of fuel accumulation make efforts to suppress every fire dangerous, expensive, and ill advised (*4*). These trends are attracting congressional scrutiny for a new approach to wildfire management (*5*). The recent release of the National Cohesive Wildland Fire Management Strategy (NCWFMS) (*6*) and the U.S. Forest Service's (USFS's) current effort to revise national forest (NF) plans provide openings to incentivize change. Although we largely focus on the USFS, which incurs 70% of national firefighting costs (*7*), similar wildfire policies and needed management reforms are relevant throughout the United States and fire-prone areas worldwide.

POLICY

Accumulated fuels in dry forests need to be reduced so that when fire occurs, rather than "crowning out" and killing most trees, it is more likely to burn along the surface at low-moderate intensity, consuming many small trees and restoring forest resilience to future drought and fire. Mechanical thinning can reduce tree density and some fuels but is often limited by legal (wilderness and park areas), operational (steep or remote ground), and cost constraints (*8*). Fire can also be used to reduce fuels either intentionally (prescribed burning) or opportunistically (letting a natural ignition burn as "managed wildfire") under moderate weather conditions. Although these burns are much less precise than mechanical thinning, in remote locations, fire is usually more efficient, cost-effective, and ecologically beneficial than mechanical treatments (*9*).

Many severe wildfires are due to past fire suppression. Firefighters during the Rim Fire near Yosemite National Park, California, 25 August 2013.

ENTRENCHED DISINCENTIVES. Management reform in the United States has failed, not because of policy, but owing to lack of coordinated pressure sufficient to overcome entrenched agency disincentives to working with fire. Responding to established research, official agency policy now supports a more flexible response to fire than ever before (*6*). Actual wildfire response, however, has changed little because of substantial management impediments. Suppression generally begets larger, more intense wildfires, which in turn intensifies agencies' suppression response (*10*). The alternative, working with fire, is rarely used because of liability and casualty risks and little tolerance for management errors.

For example, during the most recent decade when data were collected (ending in 2008), only 0.4% of ignitions were allowed to burn as managed wildfires (*7*). For individual NFs, there is little economic incentive to change because fire suppression is steadfastly financed through dedicated congressional appropriations, which are augmented with emergency funding, whereas fuels reduction and prescribed burning costs come out of a limited budget allotted to each NF and is often borrowed to cover wildfire suppression costs. With these deterrents, "battling" fire and "only you can prevent wildfire" campaigns have more traction than recognizing that many severe fires result from accrued management decisions. This skewing of agency motivation also distorts economic, insurance, and local regulatory incentives that influence development in fire-prone regions (*11*).

Although agencies are slow to reform internally, they may more rapidly respond to local stakeholder pressure. The core problem has been the lack of a public constituency that advocates for reform of fire-use practices (*11*). The benefits of greater fire use have been a difficult sell because of public objections to smoke and a negative perception of forest fires. This has begun to change as communities increasingly threatened by large fires are urging land-management agencies to accelerate fuel reduction efforts, including the use of managed fire (e.g., yosemitestanislaussolutions.com and 4FRI.org). Timber companies would also benefit from more fire-resilient landscapes in which their private lands are embedded. There is growing awareness that large, severe fires are inevitable in many dry forests, especially in a warming climate. Smoke, safety threats, fire intensity, and human health risks can be better managed for public benefit with proactive fire use under favorable weather and wind dispersal conditions (*12*).

EFFECTING CHANGE. Public support for expanded fire use could thus be directed toward revision of each NF plan, which provides standards and guidelines for daily management decisions. Plans can divide the landscape into zones for different fire management strategies, an approach used by Parks Canada. U.S. forest plans could zone areas close to homes (wildland-urban interface) as an area where most fuels reduction relies on mechanical thinning and fires are suppressed. Beyond this could be an intermediate area where prescribed fire and mechanical treatment are used to optimize fuels reduction. More remote forests could be intentionally burned with prescribed fire, or lightning ignitions allowed to burn as managed wildfires under moderate weather conditions.

Three of the first eight NFs to develop new plans have proposed that more than half of their area in the southern Sierra Nevada be zoned for prescribed and managed fire use. Over the next decade, most of the 155 NFs will begin writing new plans and holding public forums. Engaged local stakeholders will need to look beyond short-term impacts of fire use (e.g., smoke, limited access, and risk of escape) to support managers working with fire and challenge suppression in remote forest zones.

Public support of NCWFMS may help overcome reform disincentives by stressing national interagency collaboration. In response to decades of problem wildfires, the U.S. Congress passed the FLAME Act in 2009 requesting development of NCWFMS, a coordinated strategy to support landscape restoration and fire-adapted communities. Coordination is essential as large, intense wildfires often cross ownership boundaries. For example, in California's 2013 Rim Fire, large patches of old-growth trees in Yosemite National Park were killed when fuel-loaded forests on nearby NF land generated extreme fire behavior that crossed into the park (*13*). NCWFMS can exert peer pressure between agencies and provide support for tough decisions. To accomplish these changes, some policy and resource-deployment decisions supporting fire use could be made at the national level. In the United States, federal land agencies each fund their own fire crews but the National Interagency Fire Center (NIFC) coordinates resource deployment between agencies and nationally across geographic areas. Dedicated crews could be hired and trained for managed fire use, and NIFC could be charged with deploying them for beneficial burning (*14*). Some local and regional agencies have briefly created such crews, but they were often pulled into fire suppression when wildfire activity increased. By giving NIFC deployment authority, it could ensure that these crews are only used for working with fire and are available to burn when weather conditions are favorable. Optimal weather and smoke dispersal conditions occur even in heavily populated and regulated areas such as California, but many burn windows are missed because crews are at or being held for wildfire deployment (*9*). Air-quality regulations limit prescribed fires, although they have much lower emissions than the inevitable wildfire. The Environmental Protection Agency could consider treating prescribed fire smoke like wildfire, as an unregulated "exceptional event."

National government also has an incentive to reduce wildfire expenses and forest agencies' emergency fire borrowing. In many years, suppression costs consume 50% of agency annual budgets, which, after operating expenses, leaves little money for proactive fuels treatment or forest restoration (*11*). Costs and injuries, however, are much lower on managed fires than on escaped wildfires (*7*, *15*). The estimated cost savings for using managed fire compared with wildfire suppression over the same area (*15*) could be reported to Congress to highlight the economy of using proactive restoration rather than reactive triage.

Increased fire use will necessitate management changes (*16*). Mechanical fuels reduction could also be used not only for fire containment but also to establish safe-zone anchors to facilitate greater fire reintroduction (*8*). Large prescribed burns commonly used in Western Australia are possible because a network of these anchors allows 6 to 8% of the forest to be burned annually (*16*). Australian foresters make substantial efforts to educate the public about the inevitability of fire and its ecological benefits and to build support for fire use and smoke tolerance.

We will not eliminate wildfire, but public support for proactive use of managed fires can help restore millions of hectares of forest ecosystems. ■

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