World view

By Crystal Kolden

Wildfires: count lives and homes, not hectares burnt

Smarter ways to assess fires will bring better methods of preventing damage.

Fires in California will probably ravage more than 1.5 million hectares over 2020. That statistic is widely trumpeted as evidence of the state's worst fire season ever. A better marker of why 2020 is a tragic year (and one for the record books) is the thousands of homes destroyed and scores of lives lost.

Most of our data sets record only one metric: area burnt. That is too simplistic for us to learn to manage wildfires and the forests that fuel them in our changing climate. We need to focus instead on what is burning.

As a firefighter two decades ago, I remember wondering why we were battling a fire in a remote California wilderness that could have burnt safely in an ecosystem that had evolved with fire. After all, this is a landscape in which an estimated 1.8 million hectares once burnt annually, owing to lightning and Indigenous practices. I became a fire scientist to try to solve this riddle. What I have learnt is that our fire-resilience strategies are suboptimal, and that we need better data to answer essential questions. A detailed national database that specifically tracks prescribed fires – those set for human benefit – would help. So would mapping and documenting fires' more nuanced effects, good and bad.

Fires can be detrimental, ecologically or economically beneficial, or a combination. Detrimental fires are perhaps the easiest to track. Measures include human fatalities; homes and livelihoods destroyed; volume of timber consumed; days of air rated unhealthy in the Air Quality Index, and numbers of people exposed; nesting sites lost for an endangered bird; dollars wasted on ineffective fire suppression; thousand-year-old giant trees killed.

Ecologically beneficial fires are tougher to quantify. I count how many species of wildflower bloom under partially burnt trees. I measure the reduction in the mass or volume of small trees and shrubs. (These steal water and nutrients from larger trees, and result in less carbon sequestration overall.) I count fire refugia – islands of unburnt trees that will restock the burnt landscape. In Yosemite National Park, near my home, I see benefits in the mixed-age forests and open meadows supporting diverse species, and in the blackened 'catfaces' of the stately giant sequoia trees that need fire to be able to reproduce.

Economically beneficial fires are set intentionally to clear land for planting. They have tangible, quantifiable fiscal outcomes. I saw the Nature Conservancy, based in Arlington, Virginia, use such fires on the Zumwalt Prairie in northeastern Oregon to induce new grass growth for grazing herds (with a side benefit of increasing biodiversity). This category accounts for the bulk of burnt areas each year, particularly in the tropics. Right now, these fires and wildfires are treated identically in many data sets, which makes it difficult to disaggregate increasing effects of climate change from generally shrinking rates of slash-and-burn agriculture.

> **"Even for a single fire, effects can be detrimental and ecologically and economically beneficial."**

Even for a single fire, effects can be both detrimental and beneficial. The behemoth Biscuit Fire burned 18 years ago across the California–Oregon border. The 200,000-hectare conflagration grew from several smaller, lightning-ignited blazes that eventually burnt together in remote terrain, making suppression expensive (more than US$200 million in today's terms) and inefficient, at best. The effects were a complex tangle. The burnt wilderness area is recovering, much as it had for millennia. Four homes were lost, but no lives. Salvage logging reaped several million dollars, but hindered forest regeneration.

There is a broad scientific consensus that ecosystems in western North America need more fires, not fewer. Smarter options include building homes that can resist embers, conducting controlled burns, improving evacuations and planning communities with homes enclosed by natural fire buffers such as parks, golf courses and vineyards. In the southeastern United States, acceptance of prescribed burns is higher, and there are few fire disasters.

My most humble moment as a fire scientist was standing amid the ashes of someone's home, forlorn that our efforts hadn't been able to save it. Such tragedies have led to fire suppression being prioritized to the exclusion of other strategies. This approach increases other liabilities (particularly the build-up of flammable biomass), which ultimately devastate ecosystems and make forest fires more destructive. To counter this, prescribed fires' beneficial impacts on ecosystems, and their reduction of wildfire fuels, need to be better documented.

One advance in using better metrics is the 1999–2014 aggregation of US fire-management records, which pull many of the detrimental effects into a single database in the US National Incident Management System. Scientists should improve remote-sensing tools to distinguish the three types of fire effect using ancillary data (for example, areas that burn at the same time, and in the same sequence, each year are probably used for slash-and-burn agriculture). Thermal data can help to quantify how hot a fire is burning, for example, and how fast it is spreading. My colleagues and I have reported on whether 'extreme wildfires' were also disasters, and why, by matching the hottest large fires in satellite data with archived Internet news stories (D. M. J. S. Bowman *et al. Nature Ecol. Evol.* **1**, 0058; 2017). This type of added information can help us to predict disasters.

Fire suppression at all costs ultimately harms lives, landscapes and property. If we stop simply focusing on area burnt, we can start asking how much fire is too much and how much fire burning, at what intensity, is actually good.

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