
Babbage
Science and technology

Forest management

Difference engine: Fire on the mountain

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CAN even be seen from space and smelt 240 miles (390km) downwind on the ground. The wildfire raging in New Mexico's historic Gila National Forest has already scorched some 230,000 acres (93,000 hectares) of woodland, making it the biggest in the state's history, and the largest by far of the two dozen uncontained blazes that firefighters are currently battling across the country. The good news is that, as the fire season in the American west gets under way in earnest, the tally of burned acreage to date is running 40% below last year's rate—despite the region's relatively dry winter.

In many ways, the New Mexico blaze is a test case. It represents the first large-scale opportunity that firefighters have had to test a new approach to forest management. This relies on pruning

the undergrowth and thinning out the stands, and then letting nature take its course when lightning strikes and triggers a blaze.

That is not to say firefighters in New Mexico have stood idly by. They have doused flames, removed fuel in the fire's path and carved containment lines around parts of the wildfire's perimeter where communities could be threatened. Other than that, the object has been to steer the blaze so it can do its job safely and effectively. As planned, the fire is burning more slowly and less ferociously than might otherwise have been the case. Vindication, then, for the Forest Service's new policy of reducing the fuel-load on mountain sides on a regular basis using chainsaws and prescribed burns.

The restoration work the Forest Service has undertaken of late in places like Gila has had other benefits. Thinning and clearing out the “trash trees” not only influences how quickly and intensely wildfires burn, but also reduces the amount of soil erosion and the impact loosened debris has on the watershed. In turn, that makes forests more resilient to torrential downpours, epidemics of insect-borne diseases and even climate change.

Actually, there is nothing new about the latest approach to forest management. Native Americans were practising similar forms of forestry long before settlers arrived from Europe. Where lightning had not done the job for them, they set fires to thin the forests—so grasslands and edible plants could flourish between the trees and attract grazing animals for hunting. Records indicate the land in pre-settlement times had no more than a dozen trees per acre. Today's forests, whether natural or man-made, tend to be packed with well over 100 trees per acre.

Until recently, the official approach was to leave the forests to their own devices, and then suppress wildfires aggressively whenever they break out. The aim (not always successful) has been to extinguish the blaze by 10am the following morning—before the daytime temperature climbs, the humidity drops, and the winds pick up and fan the flames.

No question that the Forest Service's policy of total suppression, instigated after the Great Fire of 1910 burned 3m acres in Montana and Idaho and killed 86 people, has been extremely effective in preserving valuable timber. On average, wildfires were laying waste to 30m acres of woodland a year in the 1930s. Thanks to aggressive firefighting, the toll had dropped to between 2m and 5m acres a year by the 1960s. Over the past decade, wildfires have blackened on average no more than 1m acres annually.

Even so, as the unkempt forests have thickened, wildfires that do occur have grown alarmingly

in intensity, burning hotter, faster and more destructively. That has made suppression all the more difficult and dangerous, and added hugely to the cost of containment.

Apart from creating vast tinderboxes throughout the American west, allowing forests to become so packed with trees has had another unintended consequence: a shortage of water in an already arid region. The denser growth within the forests has resulted in thicker canopies which, in turn, intercept more rain and snow. In doing so, a high proportion of the moisture, which would normally have soaked the forest floor and fed local streams and tributaries, is returned to the sky as vapour.

In her classic account of why the rain-soaked British Isles are perpetually caught between deluge and drought (“Water in Great Britain”), Celia Kirby, formerly of the country's Institute of Hydrology, reckoned that the man-made forests of densely packed conifers had much to answer for. Water captured and returned to the atmosphere by their canopies—with their large surface areas of branches, twigs, needles or leaves—could amount to as much as 40% of the incoming rainfall. By contrast, grasslands and crops in open fields transpire no more than 10% of the precipitation they receive.

That tallies with studies done on American forests. In a recent [essay](http://articles.latimes.com/2012/may/08/opinion/la-oe-workman-kill-trees-save-rivers-20120508) (<http://articles.latimes.com/2012/may/08/opinion/la-oe-workman-kill-trees-save-rivers-20120508>) on America's over-abundance of trees, two fire ecologists at Wesleyan University in Connecticut, Helen Poulos and James Workman, estimate that a typical over-forested acre today transpires an extra 2.3 acre-feet of water annually—enough to meet the needs of four families. Considering just the 7.5m acres of conifers in the Sierra Nevada mountains, the additional transpiration caused by over-stocked forests deprives the rivers feeding the parched communities of California of some 17m acre-feet of direly needed water every year.

As Ms Poulos and Mr Workman note, a century's accumulation of dry fuel on public lands makes it too expensive and risky—for people, property, habitats and carbon emissions—to unleash prescribed fires on a scale needed to manage America's national forests more efficiently. (Including private land, national parks and other government property, forests cover nearly 750m acres in America—a third of the country's land surface.) On the other hand, letting the lumber companies loose to go logging in the national forests on such a scale would engender a massive public outcry. So, what is to be done to release the water that over-stocked forests squander?

One practical solution, known as “forest to faucet”, is being undertaken in Colorado by Denver Water, a utility serving 1.3m Denver residents. After severe wildfires stripped the local landscape

and left the soil exposed, subsequent storms drove so much sediment down the hillsides that the utility is now having to spend \$30m to dredge the streams and reservoirs that supply its water.

The lesson the utility has learned is that, even though it is not its responsibility, it is far better to pay to have the upstream forests thinned and cleared—so future wildfires in the watershed are nowhere near as fierce, river flows improve, storms do less damage and droughts become less frequent. Under a five-year agreement, the Forest Service will share the cost with the utility to ensure the watershed is properly managed. Denver Water's enlightened customers will each stump up \$27 over the period.

This public-private approach is the kind the Wesleyan researchers favour. They note that water rights in western parts of America are valued at \$450 to \$650 per acre-foot and rising. It therefore pays thirsty downstream communities to spend \$1,000 per acre (the average cost to the Forest Service) to remove the fire-prone trash trees in upstream forests that affect their water supply. In return for their investment, they get the 2.3 acre-feet of water (worth \$1,000 to \$1,500), which would have otherwise transpired into the sky, for every acre of forest that has been properly thinned.

What is stopping other communities in America's arid west from following suit? Nothing, other than a mind-set among many who think that if a dozen trees are good, 100 are better. Meanwhile, to replenish the streams before they dry up, others have to accept that chopping down trash trees to prevent conflagrations, and thereby preserve the forests, is no bad thing. As the Wesleyan ecologists admit, “We lifelong tree-huggers must learn when and where to let go.”