How Aboriginal knowledge can help the world combat wildfires

By Kate Douglas, *New Scientist* #3133, 8 July 2017

Wildfires are on the increase across the globe as the climate changes. To gain control, we should learn how people in Australia have traditionally tamed them.

Fight fire the Aboriginal way?

“I LIVE in a city that can be completely destroyed by fire,” says David Bowman. Fifty years ago, the Tasmanian capital, Hobart, came within a whisker of being burned to the ground as flames raked in from the surrounding hills. Some 3000 buildings and 80 bridges were destroyed; more than 60 people died.

When wildfires hit the news, they tend to be in tinderbox lands in south-eastern Australia and the western US, or perhaps in southern Europe, as with last month’s catastrophic fires in Portugal. But wildfires are a truly global concern. They consume an area the size of India each year, and their economic and social impacts are felt far beyond their scorched boundaries. They release huge amounts of carbon dioxide into the atmosphere – and as Earth warms, they are on the increase.

Yet we know surprisingly little about them. For many, fire is just about oxygen, fuel and heat for ignition. For Bowman, an ecologist at the University of Tasmania who has been researching wildfires for 40 years, those bald chemical facts aren’t enough. “I’m not a guru,” he says. “Gurus tempt people with simple solutions, and fire is complicated.”

Specifically, we tend to ignore some crucial elements that determine how wildfires play out: landscape, people and the interaction between the two. And for effective solutions to the problem of wildfire, says Bowman, we should look to those people who have lived alongside fire the longest.

Fires have raged on Earth ever since there was vegetation to burn. Long before our species existed, natural wildfires caused by lightning or lava were shaping the planet. Fire has shaped us, too: our ancestors were manipulating it as much as 790,000 years ago, and domesticated it between 100,000 and 50,000 years ago. Food cooked over fire may have given our forebears the energy needed to

feed their expanding brains. Later, burning facilitated our shift from a hunter-gatherer to settled lifestyle, as fire converted forests to agricultural land. “Humans learned to use and live with fire over long generations, with knowledge encoded in rituals, myths and tradition,” says Stephen Pyne, a fire historian at Arizona State University.

Yet modern approaches to wildfire have tended to ignore that history. They emerged from the science of forestry, and were largely developed in the damp forests of central Europe – not a natural breeding ground for wildfires. “Foresters condemned fire, and considered fire control the first task of any effort to rationalise landscapes,” says Pyne.

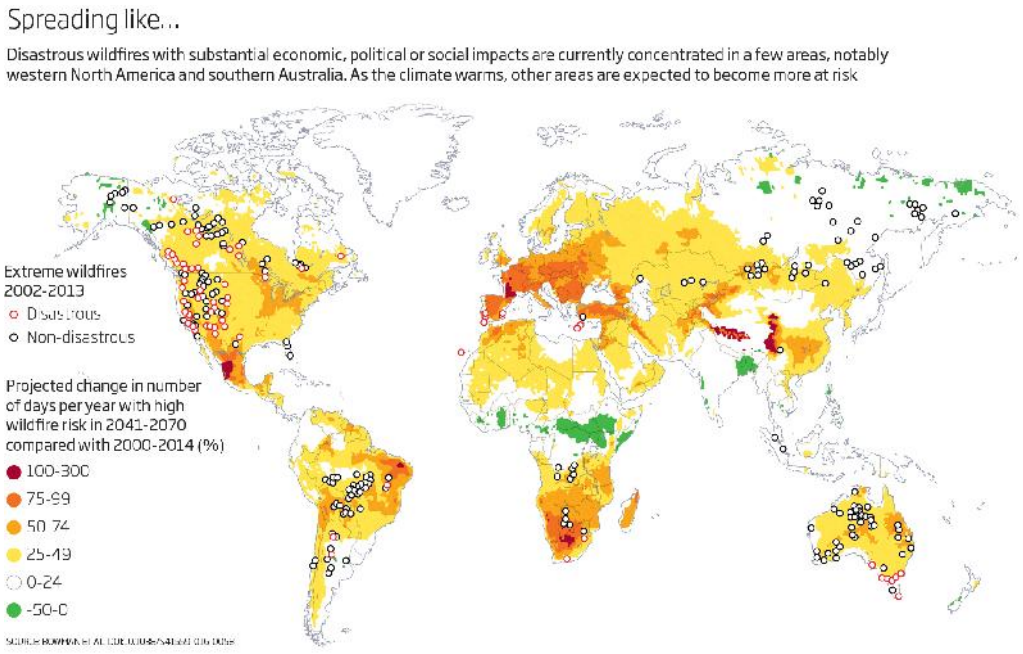
“Australia is Earth’s most fire-prone continent – a land shaped by fire”

That ignored the crucial role fire can play in adapted ecosystems. In the 1960s, for example, it was found that strategies of fire suppression were damaging the health of California’s iconic giant sequoias. The trees relied on natural fires that swept through the forests every decade or so to release their seeds, restore nutrients to the soil, and open up gaps in the canopy that would allow sunlight to fall on germinating seedlings.

Big wildfires cannot be stopped in their tracks, anyway. All firefighters can do is guide their path until they are eventually extinguished by rain. So Western practice has settled on rigid schemes of pre-emptive burning, almost always involving big fires set at the start of the dry season to reduce the amount of combustible material.

This strategy has significant problems. Large-scale, pre-emptive burning can itself get out of control: in 2012, a fire set by the Colorado State Forest Service in Lower North Fork, south-west of Denver, destroyed more than 20 homes and killed three people. Annual burning also favours the growth of flammable grasses adapted to the environment. This is an expanding problem as more people move into highly combustible areas and the risk of arson and accidental wildfires increases (see “Spreading like …”).

A one-size-fits-all approach also fails to take account of local ecological differences, says Clay Trauernicht, a fire ecologist at the University of Hawaii. “Wildfire risk assessment tools in places like the continental US often don’t work here due to the novel fuel types and different fire-climate relationships we have observed on the ground,” he says.



Nowhere is the need for better answers more acute than in Australia, the most fire-prone continent on Earth. “It’s a land shaped by fire,” says Bowman. Fires set by the first human colonisers at least 40,000 years ago may have precipitated the extinction of Australia’s megafauna; there seems little doubt that it killed off some fire-sensitive plants and animals. And burning must have contributed to the wide-open savannah grasslands and the prevalence of fire-adapted species, such as eucalyptus.

Today, Aboriginal Australians burn land for a range of practical reasons, from clearing land for habitation to hunting fires used to catch small mammals, large lizards or to drive turtles from a swamp. Fires are also used to generate new grass shoots to attract game. The Kunei people of Arnhem Land in Australia's Northern Territory burn patches on drainage lines to promote habitat for kangaroos.

Land is also burned pre-emptively to reduce the risk of large wildfires – but not in the way it is in the US, say. Strategies vary in between different Aboriginal groups, but have several features in common: the fires are relatively frequent, small-scale and low-intensity. This reduces the amount of flammable grass while sparing the tree canopy, and produces a fine mosaic of burned and unburned patches.

Patch burning seems to have two major benefits. It reduces the risk of uncontrolled fires; wildfires ignited by lightning are much smaller in areas where patch burning has occurred. And it promotes biodiversity, by creating a range of different habitats suitable for a wide range of animals and plants.

Feel the burn

Aboriginal burning practices are also adaptable. Around Kakadu National Park in the Northern Territory – a UNESCO world heritage site thanks to its many endemic species and vast tracts of tropical savannah – the Gundjeihmi burn early in the dry season when vegetation is still moist, using low, creeping fires to protect the canopies of fruit trees. Their neighbours the Kunei, by contrast, tend to hold off burning until the middle of the dry season when the winds keep flames below 3 metres.

Aboriginal burning practices (above) may help reduce wildfire threat to surrounding cities (below)

But when that happens varies from year to year. Dividing the year into wet and dry seasons is a Western convention. Aboriginal Australians recognise six seasons marked by cues such as thunderstorm activity, the summer monsoon, temperature, humidity and changes in wind direction, plants and animals. These seasons form a reliable sequence whose timing varies, meaning burning is adapted to suit local conditions.

Until recently, Aboriginal burning practices were largely charted through proxies such as charcoal particles in lake sediments, or "eloquent narratives" recorded by 19th century ethnographers. The core of Bowman's "pyrogeographic" work over four decades has been to observe Aboriginal practices and translate them into a Western scientific vocabulary of distinct "fire regimes". These are characterised by measurable factors, such as what type of vegetation burns, whether the fire flames or smoulders, how fast a fire spreads, when and how regularly fires are lit, how big they are, patchiness, and impact on vegetation and soils.

Bowman is now working in Tasmania's Bass Strait islands, where Aboriginal communities have lost much of the ancient know-how and are keen to adopt practices used in the Northern Territory. "There's a great interest in rekindling their traditions," he says. But it's a case of hasten slowly, he adds. The patch-burning approach must be modified to account for climate change and suburban sprawl into bushland, for example. "Tasmania has a very fire-sensitive ecology and we don't want it to go up in flames," he says.

That caution is echoed by Pyne. "There is no single driver, there is no universal algorithm", for wildfires, he says. Nevertheless, Bowman's approach of looking back at long-established interactions between peoples and their landscapes can be useful, he says.

Trauernicht agrees. "It's important to keep in mind that we have a deep, collective heritage of proactively managing fire," he says. He is developing a wildfire model for Hawaii grounded in the principles of pyrogeography to help landscape managers take effective steps to protect fire-prone areas.

For Bowman, it's not just an academic project, but also a personal and political one. Back when he started, the Aboriginal Land Rights Act, passed in the Northern Territory in 1976, had recently given Aboriginal groups a claim to their traditional lands for the first time, and there was friction with incomers. "People were saying, 'Aboriginal culture is irrelevant'," says Bowman.

He thought otherwise – and 40 years on, feels the wind is finally changing. Traditional knowledge could be one of the most effective weapons to beat back wildfire – as long as we learn to use the methods the right way. "The likelihood of major fires is increasing and the consequences are horrendous," he says. "It's exciting. But I'm conflicted about it. We mustn't set them up to fail."

A global problem

About 400 million hectares of Earth's surface are burned every year through human activity and natural factors. The cost can be huge in destroyed infrastructure, degraded ecosystems, smoke-related disease and loss of life. Fires in South-East Asia's tropical forest sparked by conditions related to the 1997/98 El Niño–Southern Oscillation event are estimated to have cost the region $9 billion.Globally, carbon dioxide emissions from wildfires equal half those from burning fossil fuel, a warming effect compounded by heat-absorbing black-carbon aerosols. As Earth warms and weather extremes become more extreme, wet periods that promote vegetation growth are followed by heat waves and droughts that turn landscapes into tinderboxes. An increasing wildfire frequency in Canada also risks releasing carbon stored in permafrost.

Earlier this year, David Bowman at the University of Tasmania and his colleagues revealed the first global picture of human exposure to wildfires, present and future. The greatest risk occurs where human habitation encroaches into flammable landscapes in south-eastern Australia and the western US. Despite its similar climate and vegetation, southern Europe historically has had fewer extreme fires. But as people migrate from the countryside into cities, creating urban sprawl and leaving fallow land that was once intensively worked, that picture is changing.

The study suggests that susceptible landscapes could see an increase of between 20 and 50 per cent in the number of fire weather days, with the worst-affected areas being on the Australian east coast, including Brisbane, and across the Mediterranean.

"Our results suggest that extreme wildfires impacting southern European communities may simply be a matter of time," says Bowman – a point underscored by the deadly wildfires that engulfed central Portugal last month.

This article appeared in print under the headline "Flame resistance"