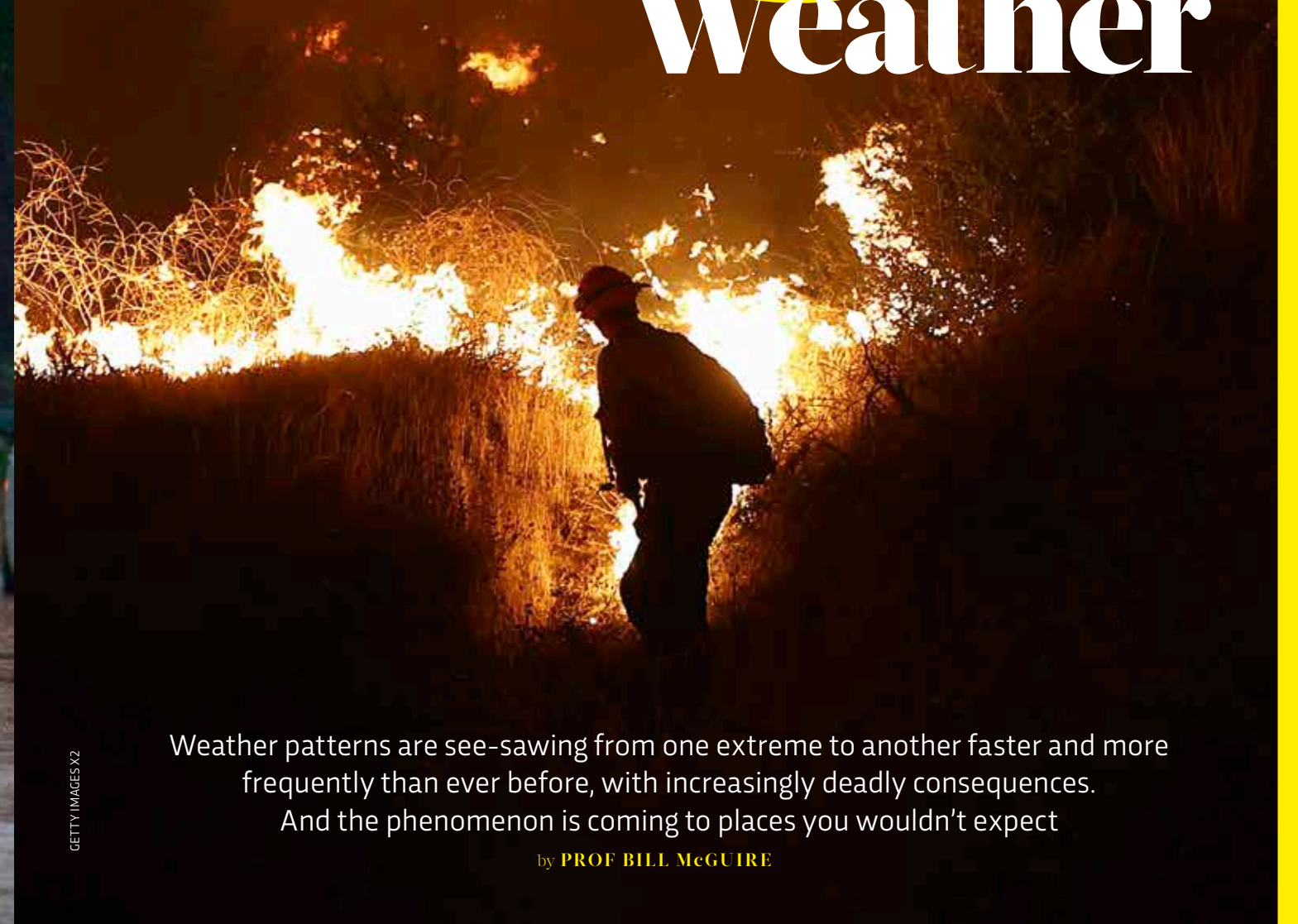


Welcome to

WHIP

LASH

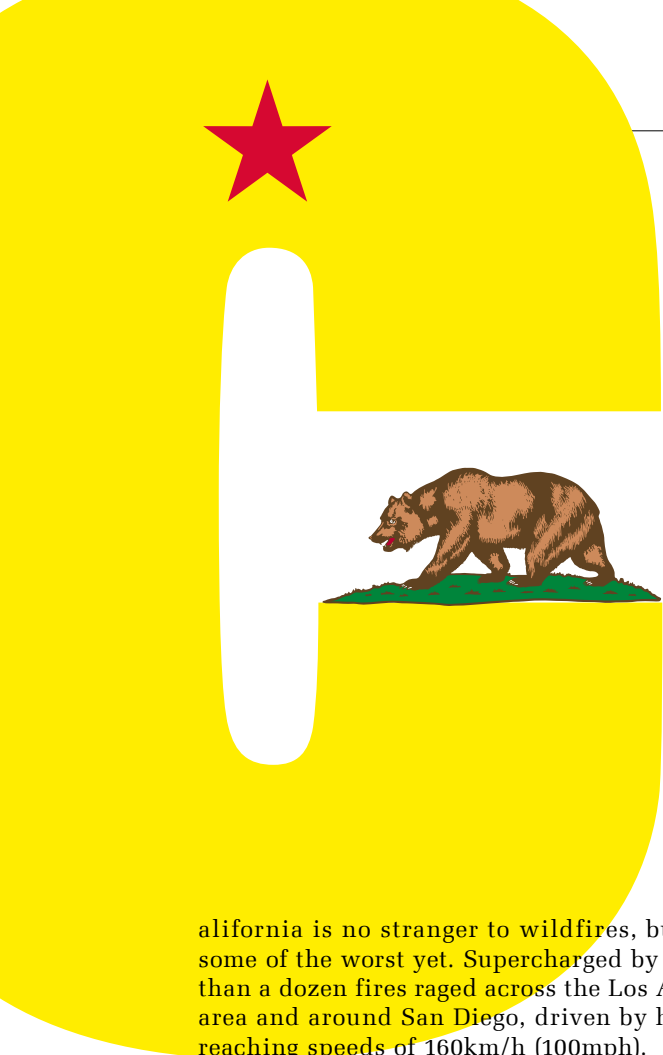
Weather



GETTY IMAGES X2

Weather patterns are see-sawing from one extreme to another faster and more frequently than ever before, with increasingly deadly consequences. And the phenomenon is coming to places you wouldn't expect

by **PROF BILL MCGUIRE**



California is no stranger to wildfires, but January 2025 saw some of the worst yet. Supercharged by global heating, more than a dozen fires raged across the Los Angeles metropolitan area and around San Diego, driven by hot Santa Ana winds reaching speeds of 160km/h (100mph).

Hundreds of thousands of people were evacuated and more than 16,000 homes and other buildings were destroyed – some owned by celebrities, including Billy Crystal, Jeff Bridges and Anthony Hopkins. The fires killed 31 people, but another 400 or so are thought to have died due to indirect effects of the fires, most notably the poor air quality.

While the fires took just a few weeks to do their worst, it had taken years to set the stage for their appearance. For the last decade or so, extreme drought was the order of the day across much of southern California. But then the weather flipped, bringing exceptionally heavy rainfall in 2022 and 2023, which resulted in an explosion of growth across forest, brush and grassland.

Then, in 2024, conditions flipped back again, bringing California's hottest summer on record. This was followed by extremely dry weather in the autumn and early winter, which saw next-to-no rain in downtown LA. By January 2025, there was a huge quantity of tinder-dry vegetation, just waiting for a spark to launch a conflagration and, inevitably, it came.

What made the fires even worse is the fact that, for every 1°C (1.8°F) the planet heats up, the atmosphere is able to absorb seven per cent more water. In 2024, the world was more than 1.5°C (2.7°F) hotter than pre-industrial times. Hotter air can

hold more water, so as the temperature climbs, the atmosphere acts like a sponge, sucking even more moisture out of vegetation and soils. This means that when the rain does eventually fall, it's much more intense, which in turn, encourages more plant growth that provides fuel for fires.

Living in the UK, I'm more than familiar with changeable weather, to the extent that it's one of the main topics of conversation here. It's not unusual to experience sunshine, snow, rain and hail on the same day, sometimes even within the hour. But the variability of the Great British weather can't hold a candle to the switches from drought to deluge and back to drought again that paved the way for the California wildfires – switches that are driven by ever-climbing global temperatures.

Call it global weirding or whiplash weather, it amounts to the same thing: the world's

weather is in turmoil. It means sudden flip-flopping is becoming more common, causing widespread damage and disruption, and playing havoc with people's lives and livelihoods.

AN OLD THREAT, BUT NEWLY STRONG

In truth, there has always been whiplash weather. Rapid thaw and flood have brought to an end some of the coldest and snowiest UK winters, while intervals of extreme heat have long been broken by intense rainfall and floods fed by colossal thunderstorms.

But like pretty much every type of weather, this whiplash element has been supercharged by global heating. Nowadays, longer and hotter heatwaves are ended by even more extreme rainfall, and followed by bigger and more dangerous floods.

This is just one aspect of how, as Earth gets steadily hotter, our weather is becoming more extreme, more destructive and increasingly deadly. In 2024 alone, the cost of recovery and rebuilding due to climate-related disasters cost the US almost \$1 trillion. By mid-century, it's estimated that extreme weather will cost a mind-boggling \$38 trillion a year worldwide, almost one third of global GDP today. And much of this loss will be a result of whiplash weather,

which is already having an effect on the planet.

So, why is whiplash weather happening more often now? Ultimately, it all comes down to the 40-plus billion tonnes of carbon dioxide – approximately equivalent to the weight of 800,000 *Titanics* – that

RIGHT Multiple wildfires raged across California in January 2025

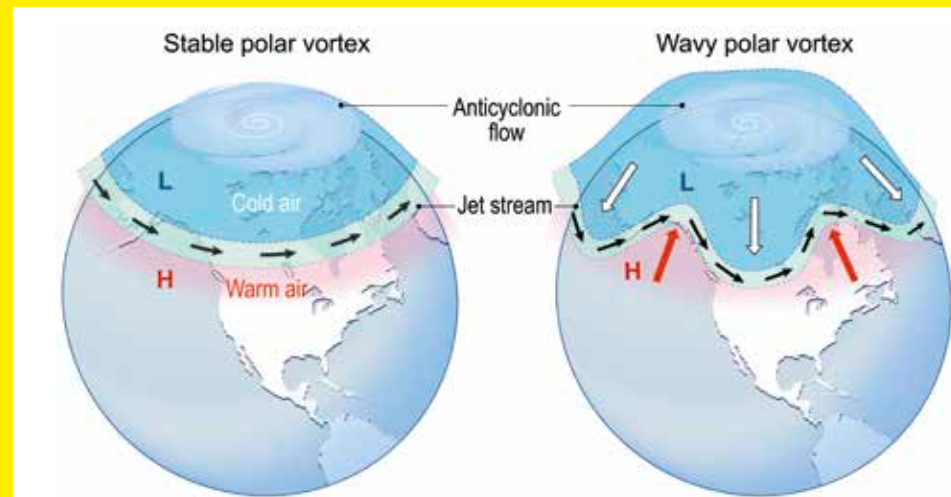
BELOW RIGHT The Palisades fire left a trail of devastation in its wake

BELOW LEFT Heavy rain after the January 2025 fires had cleared much of California's vegetation, left parts of the state prone to flooding



GETTY IMAGES X3

Wildfires blazed across parts of north-west Spain during August 2025. Though not unusual, this year's blazes were particularly hard to contain



And this isn't the end of the bad news. Crucially for California, extremely dry episodes are set to be ended more often by very wet conditions. These are brought to the area by long ribbons of exceptionally moist air, known as 'atmospheric rivers', including the infamous Pineapple Express, which starts off in the vicinity of Hawaii and can bring torrential rains to anywhere along the US west coast, and even further inland. In California, this plays a key role in feeding the growth of vegetation that can end up as fodder for fires to come.

An increase in whiplash conditions in many parts of the world is also expected to result from future changes in the frequency and strength of El Niño conditions, which involve abnormal warming of the tropical Pacific Ocean. All-in-all, the breakdown of our once stable climate as a consequence of global heating is pushing up the chances of whiplash weather pretty much everywhere.



ABOVE Swings in the polar jetstream are causing wilder temperature fluctuations in more northerly latitudes

BELOW The 'Pineapple Express' delivers heavy rain to much of California

we pump into the atmosphere every year, mostly from burning fossil fuels. As a consequence, the planet is heating at an accelerating rate, driving fundamental changes in the way our weather works.

In the northern hemisphere, the polar jetstream – a narrow band of 320km/h (200mph) high-altitude winds that keeps the freezing Arctic air in place – is beginning to experience wild swings. At temperate latitudes, in places such as southern Canada and the northern US, alongside the UK and western Europe, this can bring sub-tropical air and heat one week, followed by a plunge of polar air and snow the next. Increased meandering of the north polar jetstream is attributed to an evening out of temperatures between the equator and the poles as the planet gets hotter.

A WORLD OF PROBLEMS

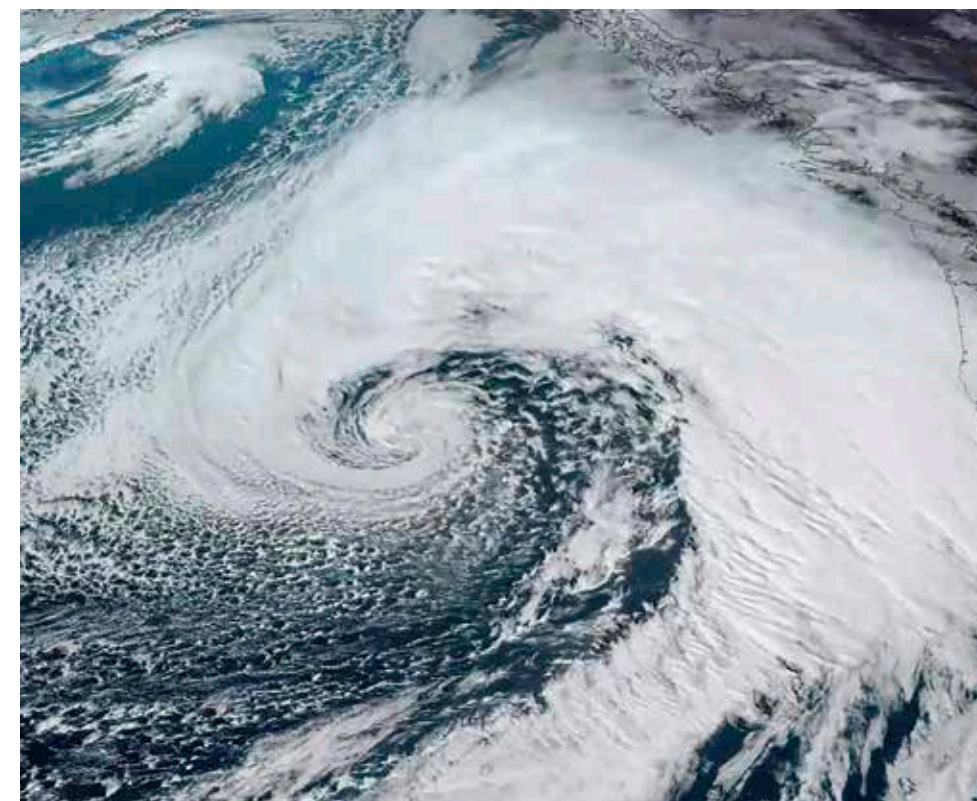
California is one of the world's hotspots for wildfires and it's clear that this is set to continue as whiplash weather becomes the normal state of affairs in the decades ahead. As well as exacerbating wildfire activity in other places already severely affected, such as Australia and southern Europe, the concern is that whiplash weather will mean that wildfires will also become a growing problem in cooler parts of the world, like the UK.

This year has already seen a record number of fires in the UK, which, together, have burned an area of 460km² (177 sq miles) – an area more than twice the size of the city of Glasgow.

A particular worry is that the effects of whiplash weather on parkland, recreation space and gardens will make cities in the UK, and other countries with a temperate climate, vulnerable to what are becoming known as 'firewaves' – multiple separate fires triggered across major urban centres once the conditions are right.

But the problems that whiplash weather is causing aren't just limited to aggravating wildfires. It's also set to have an impact on societies and economies in every corner of the world.

In a landmark scientific paper published in the journal *Nature* earlier this year, Dr Daniel Swain, of the University of California, and co-authors showed that what they refer to as 'hydroclimate whiplash' (flip-flopping between wet and





LEFT Heatwaves in Kenya ruined many subsistence farmers' crops in 2023, before heavy rainfall in 2024 devastated farmland

ABOVE Droughts are already threatening agriculture in places like Eritrea. The effects of climate change will only worsen the situation

will undoubtedly be a major contributor to plunging global crop yields, which, according to a 2021 report by the UK thinktank Chatham House, could be down 30 per cent by mid-century. A chilling statistic, if ever there was one.

LASTING CONSEQUENCES

While agriculture will bear the brunt of flip-flopping weather, urban centres will be far from immune. A 2025 study by the charity WaterAid, revealed that around one in five of the world's most populated cities – including Dallas, Shanghai and Nairobi – is now experiencing whiplash weather, in the form of rapid switches between drought and torrential rainfall. Water is the lifeblood of big urban centres, but too much of it, or too little, can bring all sorts of problems, especially where often ageing or inadequate infrastructure is unable to handle the new conditions. Inadequate drainage can lead to serious flooding, sewage into the streets and the spread of disease, while also impacting power and drinking water supplies. In the worst cases, it can lead to a breakdown of law and order.

The bottom line is that whiplash weather is not only here to stay, but it's getting worse. It won't stop even when, or if, emissions are brought to heel, because whatever temperature Earth has reached by then will be maintained for thousands of years, so we have no choice but to live with it. Is there, then, anything we can do to manage its impact and mitigate its worst effects? Well, yes – quite a bit in fact, provided we're prepared to make the effort and spend the cash. The problem is that we need to be able to handle two weather extremes – too much rain and too little – which is never going to be easy, especially for agriculture. Finding new ways of saving water for use during drought is a no-brainer, for example, by harvesting and storing rainwater. But preventing flooding caused by torrential rains is harder.

The best way, as is often the case, is to let nature take its course, by allowing rivers to flood naturally across their floodplains during wet periods. Not only

will this provide a source of water that may be accessed for use during droughts, but it'll also reduce the flood risk to communities and infrastructure downstream. Towns and cities need to become sponges, so permeable surfaces should be the order of the day, allowing water to infiltrate rather than run off. Not only would this reduce flood risk, but it could also help recharge groundwater aquifers.

30%
THE DROP IN
GLOBAL CROP
YIELDS BY 2050
DUE TO WHIPLASH
WEATHER

dry conditions) has already increased across the world by between a third and two-thirds compared to the middle of the last century. Furthermore, they warned that this trend is set to continue.

For a 3°C (5.4°F) hike in global temperature, compared to pre-industrial times – which is possible, even likely, by 2100 – land areas are predicted to see within-season whiplash rise by up to 130 per cent, with year-to-year flips happening 50 per cent more often than at present.

This will bring all sorts of problems, especially for food production, and particularly in north and central Africa, the Middle East and South Asia, which support big and often vulnerable populations.

More than 800 million people already go to bed hungry every night and whiplash weather is certain to increase this number. East Africa is already struggling, as severe drought in 2022 and 2023, followed by torrential rain and serious flooding, devastated harvests, leaving up to 20 million people without enough to eat, and more than two million homeless.

Such a pattern, of too little rain followed by too much, makes it all but impossible to farm and is set to make growing food increasingly difficult in the decades to come – particularly in nations that are home to the majority of the world's populations, which are already struggling to grow enough food. Whiplash weather



ABOVE Firefighters monitor a controlled burn in California's Pacific Union College Forest

RIGHT Controlled burns of the dry foliage that could fuel a wildfire help prevent a blaze from spreading



FIRE PREVENTION

But what of California and its fires? There's actually much that can be done there, and technology could help. This includes the use of lightning detectors designed to pinpoint the location of strikes within 40 seconds, and unmanned fire-detection drones.

Better prediction of fire behaviour would also make a huge difference to the chances of controlling the flames. Artificial intelligence is being used to improve this by bringing together weather information like wind speed and direction, temperature and air pressure, with fire data gleaned from drones, aircraft and satellite-based sensors.

It's hoped all this will help stamp wildfires out early, before they have a chance to develop into monsters. This is all well and good, but it would be better if fires never started at all. Improving prevention requires better management of forest, brush and grassland, and the use of controlled burns where appropriate. Introducing fire-resistant tree species and making sure that fire-breaks are in good shape can help to slow the spread of fires, while using more fire-resistant materials in buildings and maintaining open spaces around them could limit damage.

On an ever-hotter planet, however, battling wildfires, alongside the floods and drought that whiplash weather is set to bring more of, is only going to get harder. Assuming we're serious about tackling the problem, we know exactly what we have to do: stop pumping out the carbon and pumping up the heat. **SF**



by **PROF BILL MCGUIRE**

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