Climate change is intensifying droughts in Australia.

BROOK MITCHELL/GETTY

2018 in review

A turbulent year marked by raging wildfires and allegations of bullying in the sciences comes to a close. But researchers can celebrate some milestones, including the most accurate map yet of the Milky Way's stars, and the discovery of bones showing that a woman who lived 90,000 years ago had a Neanderthal mother and a Denisovan dad.

UP IN SMOKE

Evidence of a changing climate continued to mount in 2018. More than 50 fires raged across Sweden in July, fuelled by intense heat and the driest conditions the country had seen in more than a century. By August, British Columbia in Canada was in the middle of its worst fire season on record, and California was battling the largest wildfire in its history. In November, the state faced its deadliest wildfire when the Camp Fire killed at least 85 people.

The situation will probably get worse. The Intergovernmental Panel on Climate Change released a report in October stating that, in as little as a decade, global temperatures could pass 1.5 °C of warming since pre-industrial times. And there is scant evidence that governments are taking aggressive action to combat global warming.

Australia's new prime minister, Scott Morrison, abandoned a policy in September that would have limited emissions from the electricity sector, a move that scientists said amounted to abandoning the nation's commitment to the 2015 Paris climate accord.

The US Environmental Protection Agency (EPA) proposed rolling back regulations intended to curb emissions from vehicles and power plants. And in April, then-EPA administrator Scott Pruitt released a proposal that would prevent the agency from basing regulatory decisions on data that aren't publicly available — potentially eliminating epidemiological studies that don't report health data owing to patient-privacy concerns.

On a more positive note, US President Donald Trump, who had gone longer without a top science adviser than any first-term president since at least 1976, finally nominated one in July. But the nominee, meteorologist Kelvin Droegemeier, was still awaiting Senate confirmation as *Nature* went to press. In China, the government created a ministry of ecological environment to track pollution and enforce environmental rules, as well as an agency to protect endangered species.

There was also movement on two groundbreaking lawsuits that seek to hold governments accountable for their inaction on climate change.

NSF

An appeals court in The Hague upheld a 2015 ruling in response to a lawsuit filed by environmentalists that holds the Dutch government responsible for cutting the nation's emissions to 25% below 1990 levels by 2020. And the US Supreme Court ruled in November that a case brought in 2015 by 21 young people against the US government can proceed. The plaintiffs argue that the government violated their rights to life, liberty and property by failing to prevent dangerous climate change.

POPULIST UPHEAVAL

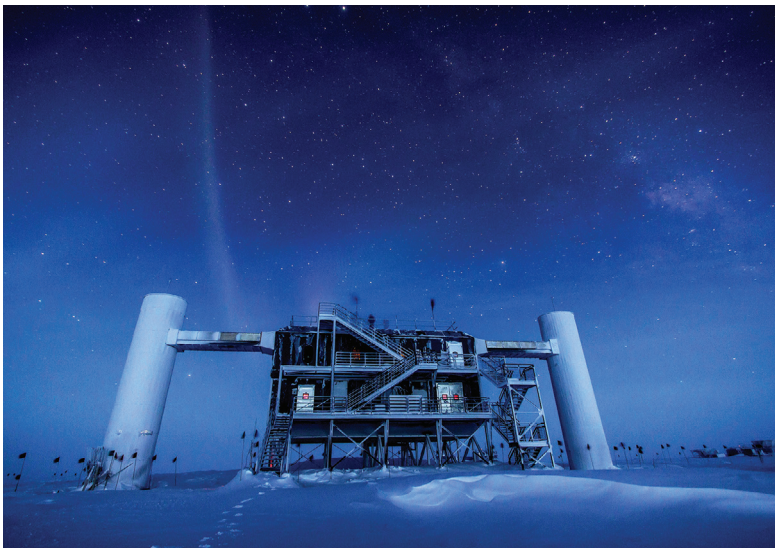
Brazilians elected right-wing candidate Jair Bolsonaro as their next president in October. He has promised to crack down on government corruption — but also to roll back environmental regulations. As a member of Brazil's lower house of Congress, Bolsonaro often voted with the conservative rural caucus, which sought to open up the Amazon rainforest to activities including farming. He takes office in January.

The political upheaval extended to Europe. In Italy, a coalition government comprised of two populist parties took over in June. The recently appointed health minister, physician Giulia Grillo, campaigned to roll back a 2017 decree making multiple vaccinations mandatory for schoolchildren. And in September, she announced that the government would probably continue to make only the measles vaccine compulsory.

In Hungary, Viktor Orbán's populist government announced that it would take control of the Hungarian Academy of Sciences budget, starting in 2019. What that means for scientists working in the academy's 44 research institutes is still unclear. Meanwhile, the Central European University (CEU) in Budapest, an international university founded by billionaire George Soros, was at the centre of a struggle between liberals and the government. An agreement that would allow the CEU to continue to fully operate in the country after the end of the year remains unsigned by the government. The university has announced that it will transfer most of its degree programmes to its Vienna campus in 2019, although research would continue at the Budapest campus.

And as *Nature* went to press, British Prime Minister Theresa May had just won a 'confidence vote' in her leadership, securing her position as head of the Conservative Party for another year. That vote was triggered by her decision to delay a crucial parliamentary vote on the unpopular Brexit deal hammered out by UK and European Union negotiators. May now hopes to discuss contentious parts of the deal with EU officials, who have insisted that the agreement itself can't be changed. The UK government plans to step up its preparations for the possibility of the country leaving the EU without any deal — a situation that could lead to UK scientists losing access to more than £1 billion (US$1.3 billion) in annual EU research funding, and increased hurdles to the movement of staff, technologies and medicines in and out of the EU.

The political winds shifted in the United States after the country's November midterm elections. The Democrats regained control of the House of Representatives — but not the Senate — from the Republican Party. The newly elected representatives, including at least 12 with backgrounds in science, technology, engineering or medicine, take office in January. The change will give Democrats control of key committees and the power to subpoena documents and testimony from President Donald Trump's administration. The incoming chair of the House's science panel, Representative Eddie Bernice Johnson (Democrat, Texas), has pledged to investigate the Trump administration, defend science from "political and ideological attacks", and address climate change.



The IceCube observatory recorded data that could be used to track cosmic rays.

CARL DE SOUZA/AFP/GETTY

A man shows his support for Brazil's president-elect, Jair Bolsonaro.

THE RIGHT ANGLE

Back in the lab, a surprising property of graphene could help to solve a 30-year-old physics mystery. Two layers of the single-atom-thick form of carbon, when sandwiched together and offset by 1.1°, can mimic the superconducting behaviour of some copper-based materials called cuprates. The discovery gives physicists hope that they can use graphene to determine why cuprates conduct electricity without resistance at relatively warm temperatures (see page 325). Graphene is much better understood, and easier to manipulate, than cuprates. The finding, reported in March, could aid in the search for superconductors that don't need to be chilled close to absolute zero.

Superconductor researchers weren't the only physicists having a good year. In October, the European Commission unveiled the first round of winners in its 10-year, €1-billion (US$1.1-billion) funding spree for quantum technologies. The 20 projects cover topics such as atomic clocks and secure communications. Meanwhile, the United Kingdom renewed its domestic quantum-hubs programme with an extra £235 million, and Germany pledged €650 million for quantum research over 4 years.

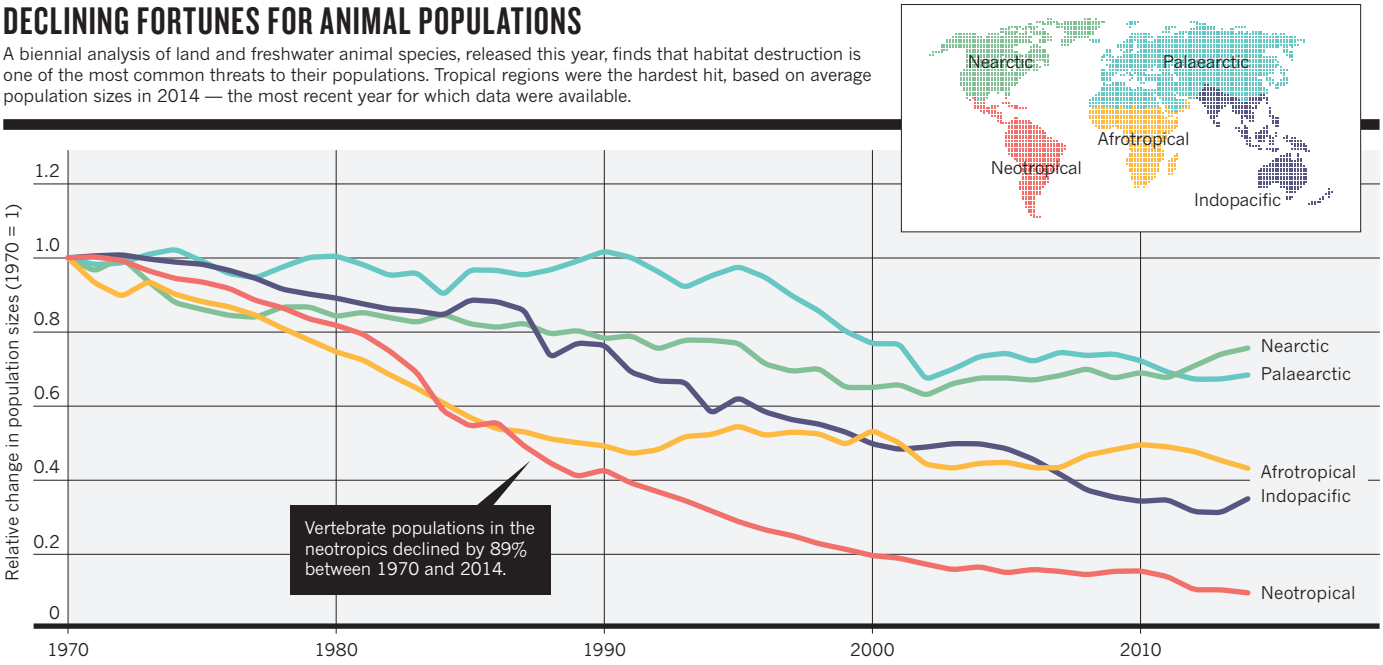
The end of the year saw the most significant overhaul of the standard units of measurement since 1875. In November, the General Conference on Weights and Measures in Versailles, France, approved a plan to define all units using fundamental constants of nature, rather than physical reference objects. For example, the kilogram is now rooted in the Planck constant of quantum mechanics rather than in 'Le Grand K', a platinum-alloy cylinder kept in a vault outside Paris.

CONTROVERSIAL EDITS

The year brought controversial news in the field of genetics. In November, Chinese scientist He Jiankui stunned the world by claiming the birth of the first gene-edited babies. His team used the CRISPR–Cas9 system to alter the *CCR5* gene, which encodes a protein that HIV uses to enter cells. The edited embryos produced twin girls, but it is unclear whether the changes will confer resistance ▶

DECLINING FORTUNES FOR ANIMAL POPULATIONS

A biennial analysis of land and freshwater animal species, released this year, finds that habitat destruction is one of the most common threats to their populations. Tropical regions were the hardest hit, based on average population sizes in 2014 — the most recent year for which data were available.



SOURCE: WWF/ZSL

▶ to HIV, especially because one of the babies seems to still have an intact copy of the gene.

Scientists the world over decried the work, warning that the technique is not ready for use in people. As *Nature* went to press, the Guangdong health commission was investigating He, and China's national science ministry had ordered him to stop doing research.

That announcement capped a year of genetic advances, including the first primates to be cloned using a method similar to the one used to produce Dolly the sheep. The breakthrough, announced in January, could eventually allow researchers to use gene editing to modify primate clones and create models of human disorders.

Another first centred on a young woman who lived some 90,000 years ago. She inherited half of her chromosomes from her Neanderthal mother, and the other half from a Denisovan dad, scientists revealed in August. Dubbed Denny, the hybrid woman is the only known first-generation offspring of two distinct hominin groups.

August also saw the approval of the first therapy that relies on a technique called RNA interference to silence a specific gene. It was the culmination of 20 years of dogged pursuit by researchers. The US Food and Drug Administration approved the drug to treat a rare disease called hereditary transthyretin amyloidosis, which can lead to organ damage.

On the legal front, a fierce patent battle entered its end game in September, when a US federal appeals court upheld patents on CRISPR–Cas9 editing from the Broad Institute of MIT and Harvard in Cambridge, Massachusetts. The fight had pitted the Broad against another team of researchers from institutions including the University of California, Berkeley.

A July ruling by Europe's highest court placed gene-edited crops under the same strict regulations as conventional genetically modified crops: a potential setback for researchers who work on such organisms.

And a surprising turn in a cold case put genetic sleuthing in the spotlight in April. A public genealogy site called GEDmatch enabled an arrest in California's Golden State Killer case. Joseph James DeAngelo is accused of committing a string of murders, sexual assaults and robberies in the 1970s and 1980s. Investigators identified him in part by matching crime-scene DNA to genetic profiles posted by some of his distant relatives on GEDmatch.

The suspect arrested in California's Golden State Killer case.

RANDY PENCH/SACRAMENTO BEE/TNS/GETTY

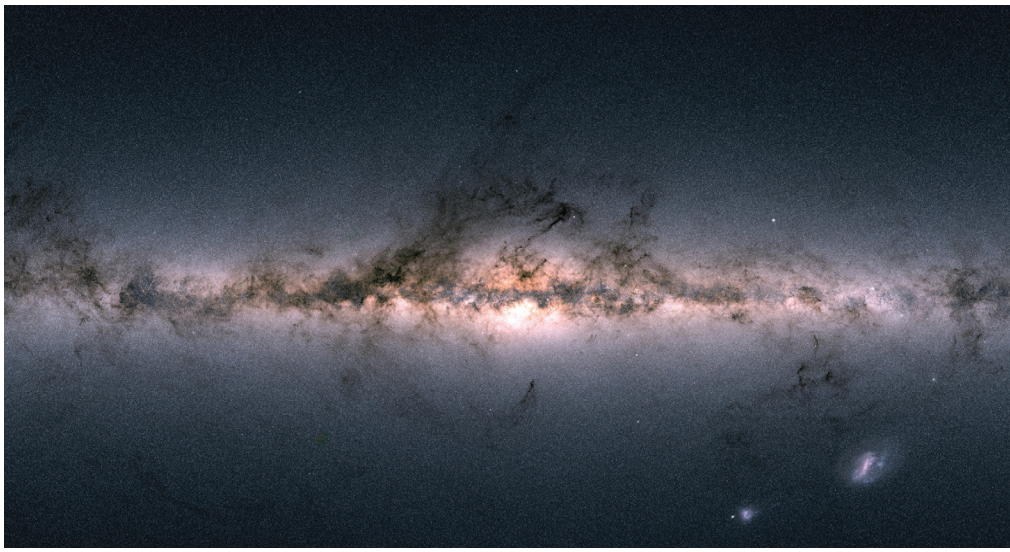
BAD BEHAVIOUR

In the United Kingdom, researchers at several prominent institutes spoke out about bullying, while major science funders cracked down on workplace harassment. In May, the Wellcome Trust in London, a biomedical research funder, introduced a pioneering anti-bullying policy. Three months later, it revoked £3.5 million from cancer geneticist Nazneen Rahman, who had resigned from the Institute of Cancer Research in London following an investigation into bullying allegations. Rahman said at the time that she and her team would complete their Wellcome-funded research before she left the institute in October.

Later in August, complaints surfaced about the management of the Wellcome Sanger Institute in Hinxton, UK, which is funded by the Wellcome Trust. They included allegations that the institute's director, geneticist Michael Stratton, bullied staff, discriminated against them and misused funds. In October, an investigation reported failings in how people were managed, but cleared senior leaders, including Stratton, of wrongdoing. Stratton apologized for "failures in people management" and the resulting "unintended detrimental effects on individuals". The whistle-blower and some of those who made complaints disputed the investigation's findings.

Bullying was also an issue at the University of Bath, UK, which upheld a complaint against vertebrate palaeontologist Nicholas Longrich, who was part of the team that first discovered a fossilized four-legged snake. After the university's investigation, the Leverhulme Trust in

ESA/GAIA/DPAC



Data from the Gaia mission helped to create a star map for the Milky Way.

London revoked a nearly £1-million grant it had awarded to Longrich in 2016. He did not respond to *Nature*'s requests for comment.

In the United States, sexual harassment continued to make headlines. A comprehensive analysis released by the US National Academies of Sciences, Engineering, and Medicine found that sexual harassment is pervasive in the country's academic sciences. The June report also concluded that a 1972 law prohibiting gender-based discrimination on US campuses that receive government funding, known as Title IX, had not reduced incidences of sexual harassment.

Accusations of harassment continued to rock several institutes. The president of the University of Rochester in New York resigned in January following campus protests over the university's handling of sexual-misconduct allegations against one of its professors, cognitive scientist Florian Jaeger. Jaeger has denied the accusations. Cancer researcher Inder Verma resigned from the Salk Institute for Biological Studies in La Jolla, California, in June after allegations of harassment, which he has denied. And three senior female faculty members who had sued the Salk over alleged gender discrimination — which they say harmed their careers — settled their cases with the institute.

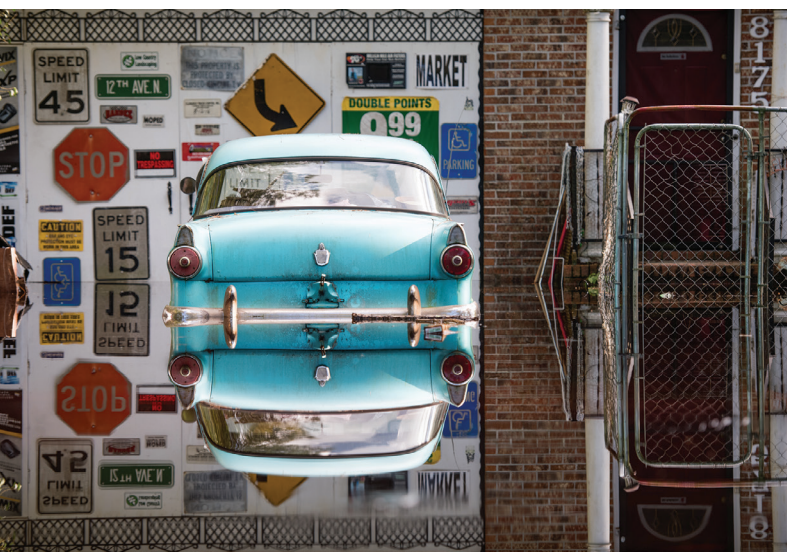
TEAR DOWN THAT PAYWALL

The launch of Plan S, a radical strategy to flip scholarly publications to a fully open-access model, rocked the world of publishing. Spearheaded by Robert-Jan Smits, the European Commission's open-access envoy, the programme started with the backing of 11 national research funders, including heavyweights from the United Kingdom, France and the Netherlands.

Beginning in 2020, the results of any research funded by Plan S backers — such as the Research Council of Norway and the Austrian Science Fund — must be freely available on publication, under a liberal publishing licence that allows others to reuse the work. Under certain conditions, the bold bid will allow work to appear in hybrid journals, which collect subscriptions while publishing some papers openly for a fee.

Finland joined Plan S shortly after the September launch, and major biomedical charities the Wellcome Trust, and the Bill & Melinda Gates Foundation in Seattle, Washington, signed up in November. China backed the plan in December.

SEAN RAYFORD/GETTY



Climate change could exacerbate flooding from storms.

FLY ME TO THE MOON

It was a year of beginnings and endings for the world's space agencies. NASA started developing concepts for a space station near the Moon this year, following a 2017 presidential order to return astronauts to the lunar surface. The agency is also working with companies to develop small lunar landers. And in December, China launched its Chang'e-4 rover, which will attempt the first-ever soft landing on the Moon's far side.

The European Space Agency's (ESA's) BepiColombo mission launched in October on a journey to Mercury, and in August, NASA's Parker Solar Probe headed for the Sun. Meanwhile, two probes travelled into interplanetary space to gather cosmic dirt from near-Earth asteroids. The Japan Aerospace Exploration Agency's Hayabusa2 spacecraft dropped two small robots onto the asteroid Ryugu. And in December, NASA's OSIRIS-REx arrived at its own rock, named Bennu.

But the US space agency also said its share of farewells. Its Dawn spacecraft ran out of fuel in October after visiting the large asteroids Vesta and Ceres; in the same month, NASA ended science operations for its long-running exoplanet-hunter, the Kepler space telescope.

On Mars, a planet-wide dust storm in June cut off communications with NASA's 15-year-old Opportunity rover, which is now feared lost. But a discovery reported in July revealed a potential target for future exploration. Researchers announced that ESA's Mars Express orbiter had spotted a possible lake beneath the ice near the planet's south pole.

Back on Earth, two radio antennas in the Australian outback found indirect hints of the Universe's very first stars as they began to shine around 180 million years after the Big Bang. If scientists can confirm these signals of the 'cosmic dawn', announced in February, they'll have their first glimmers of an epoch that has so far been impossible to observe.

Data from ESA's Gaia probe yielded a 3D map of the Milky Way of unprecedented accuracy. It records the positions, distances, colours and speed and directions of motion of 1.3 billion stars, and has already led to more than 400 papers since its April release. The map has also demolished the image of the Milky Way as a steadily rotating spiral, showing instead that the Galaxy is still sloshing back and forth from interactions with smaller galaxies in the past one billion years.

And for the first time, astrophysicists traced the origins of a high-energy neutrino to a supermassive black hole at the centre of a distant galaxy. The finding, announced in July, could help researchers to pin down the source of cosmic rays — the most energetic particles in nature — because scientists think that some cosmic rays and high-energy neutrinos are produced in the same way. ■

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