the Amazon, says Carlos Rittl, executive secretary of the Climate Observatory in São Paulo, a network of 37 groups focused on climate policy. If Bolsonaro won, it "would be a nightmare".

Bolsonaro — whose vice-presidential running mate has raised the spectre of military intervention to address political dysfunction — was once considered a long-shot candidate. The latest poll analysing run-off scenarios, however, shows Bolsonaro with a slight lead over Haddad.

"People say Bolsonaro stands no chance, but who knows," says Carlos Nobre, a climate scientist and former secretary for research and development policy at Brazil's Ministry of Science, Technology and Innovation.

BOOSTING SCIENCE

Haddad, by contrast, has a more mainstream vision for Brazil that emphasizes science, innovation and action on climate and environmental policies. He has promised to promote renewable energies, such as wind and solar, while fighting deforestation and maintaining protections for Indigenous territories in the Amazon.

And unlike Bolsonaro, who has called for more private-sector research and development, Haddad has committed to boosting federal spending on science. He has proposed raising the national investment in research and development to 2% of Brazil's gross domestic product, using government and private funding. That would bring the country's science spending in line with many industrialized nations.

It's unclear how feasible those spending goals are. One wrinkle is that in late 2016, Brazil adopted a constitutional amendment that caps government investments for 20 years, aside from adjustments for inflation.

Any policies that recognize and invest in science and technology are welcome, says theoretical physicist Luiz Davidovich, president of the Brazilian Academy of Sciences. He notes that, after adjusting for inflation, the science ministry's budget has decreased by roughly two-thirds since 2010, to around 3.4 billion reais (US$860 million).

Budget shortfalls have meant less money for equipment, federal grants, travel and postdoctoral fellowships for public-university researchers in Brazil. Despite this, Davidovich says, scientists are pressing on wherever possible.

Although science and technology factor in the campaigns of Bolsonaro and Haddad, it's too soon to tell what might happen after the election.

"The fact that they have science and technology in their programme does not mean it's going to be important when they become president," Davidovich says. "There is a big difference between what is written, and what is practised." ■

Glaciers and sea ice won't be safe in a world that warms to 2 °C above pre-industrial levels.

NASA/EYEVINE

GLOBAL WARMING

Clock ticking on climate action

IPCC sees small window to avoid worst effects of warming.

BY JEFF TOLLEFSON

Limiting global warming to 1.5 °C above pre-industrial levels would be a Herculean task, involving rapid, dramatic changes in how governments, industries and societies function, says the Intergovernmental Panel on Climate Change (IPCC). But even though the world has already warmed by 1 °C, humanity has 10–30 more years than scientists previously thought in which to kick its carbon habit.

To meet this target, the world would have to curb its carbon emissions by at least 49% of 2017 levels by 2030 and then achieve carbon neutrality by 2050, according to a summary of the latest IPCC report, released on 8 October. The report draws on research conducted since nations unveiled the 2015 Paris climate agreement, which seeks to curb greenhouse-gas emissions and limit global temperature increase to between 1.5 and 2 °C.

The world is on track for around 3 degrees of warming by the end of the century if it doesn't significantly reduce greenhouse-gas emissions. It could breach 1.5 °C between 2030 and 2052 if global warming continues at its current rate.

Scientists have "high confidence" that 1.5 °C of warming would result in a greater number of severe heat waves on land, especially in the tropics, the report says. They have "medium confidence" that there will be more extreme storms in areas such as high-elevation regions, eastern Asia and eastern North America. The risk of such severe weather would be even greater in a 2 °C world. Temperatures on extreme hot days in mid-latitudes could increase by 3 °C with 1.5 °C of global warming, or by 4 °C in a 2 °C world.

Two degrees of warming could destroy ecosystems on around 13% of the world's land area, increasing the risk of extinction for many insects, plants and animals. Holding warming to 1.5 °C would reduce that risk by half.

The Arctic could experience ice-free summers once every decade or two in a 2 °C world, versus once in a century at 1.5 °C. Coral reefs would almost entirely disappear with

2 degrees of warming, with just 10–30% of existing reefs surviving at 1.5 °C.

Without aggressive action, the world could become an almost impossible place for most people to live in, says Ove Hoegh-Guldberg, director of the Global Change Institute at the University of Queensland in St Lucia, Australia. "As we go toward the end of the century, we have to get this right."

IMPOSSIBLE DREAM

Given that current national commitments on greenhouse-gas emissions fall well short of the goals laid out in the Paris climate agreement, many scientists have argued that meeting even the 2 °C goal is almost impossible. But the IPCC report sidestepped questions of feasibility and focused instead on determining what governments, businesses and individuals would need to do to meet the 1.5 °C goal.

Measures include ramping up the installation of renewable-energy systems, such as wind and solar power, to provide 70–85% of the world's electricity by 2050, and expanding forests to increase their capacity to pull carbon dioxide from the atmosphere.

Most scenarios in the report suggest that the world would still need to extract massive amounts of carbon from the atmosphere and pump it underground in the latter half of this century. The technology to do this is in the early stages of development, and many researchers say that it could be difficult to develop it for use on a global scale.

Other proposed options involve changing lifestyles: eating less meat, riding bicycles more and flying less. The report also waded into murky questions about ethics and values, stressing that governments must address climate change and sustainable development in parallel, or risk exacerbating poverty and inequality.

Without aggressive action, the world could become an almost impossible place for most people to live in.

The IPCC report includes recent research suggesting that the amount of carbon that humanity can emit while limiting warming to 1.5 °C might be larger than was thought. The previous IPCC assessment, released in 2014, estimated that the world would breach 1.5 °C by the early 2020s at the current rate of emissions. The latest report extends that timeline to 2030 or 2040, on the basis of studies that revised the estimate of warming that has already occurred (R. J. Millar *et al*. *Nature Geosci.* **10**, 741–747; 2017).

"Every extra tonne of carbon that we dump into the atmosphere today is a tonne that will have to be scrubbed out at the end of the century," says Myles Allen, a climate scientist at the University of Oxford, UK, and one of the lead authors of the report.

"I think we need to start a debate about who is going to pay for it, and whether it's right for the fossil-fuel industry and its customers to be enjoying the benefits today and expecting the next generation to pay for cleaning it up," Allen says.

But scientists have only "medium confidence" in the revised carbon budgets, says Thomas Stocker, a climate scientist at the University of Bern. He says that researchers will provide a more comprehensive look at the numbers in the next full climate assessment, which is scheduled to be released in 2021.

In the meantime, the newer and larger carbon budget could send the wrong message to policymakers, says Oliver Geden, a social scientist and visiting fellow at the Max Planck Institute for Meteorology in Hamburg, Germany. He fears that the IPCC report undersells the difficulty of achieving the 1.5 °C goal. "It's always five minutes to midnight, and that is highly problematic," he says. "Policymakers get used to it, and they think there's always a way out." ■

BIOLOGY

Peer-reviewed homeopathy study sparks uproar in Italy

Homeopathy advocates have championed the paper, but scientists doubt its claims.

BY GIORGIA GUGLIELMI

A study[1] that claims to show that a homeopathic treatment can ease pain in rats has caused uproar after it was published in a peer-reviewed journal. Groups that promote homeopathy in Italy, where there is currently a debate about how to label homeopathic remedies, have held the study up as evidence that the practice works. But several researchers have cast doubt on its claims.

The authors acknowledge some errors flagged in an analysis of the paper by a separate researcher, but stand by their overall conclusions. One of the authors, pharmacologist Chandragouda Patil of the R. C. Patel Institute of Pharmaceutical Education and Research in Dhule, India, also says that the results are preliminary and cannot yet be applied to people, and that he hopes that the team's findings will encourage other researchers to conduct clinical studies.

Researchers have presented evidence in support of homeopathy before — famously, in a 1988 *Nature* paper[2] by French immunologist Jacques Benveniste that was later discredited. This latest claim has attracted attention, in part, because it passed peer review at the journal *Scientific Reports*. (*Nature*'s news team is editorially independent of its publisher Springer Nature, which also publishes *Scientific Reports*.)

"It's worrying that a major journal like *Scientific Reports* didn't pay close attention to a study that claims to show that homeopathy works," says Enrico Bucci, the researcher who carried out the analysis of the paper. Bucci is co-founder of the company Resis in Turin, Italy, which provides tools to uncover potential problems with scholarly articles, and a researcher in systems biology at Temple University in Philadelphia, Pennsylvania.

A paper that claims something as exceptional as the corroboration of homeopathy but also contains errors "raises questions on whether the review process was adequate", adds Michelangelo Cordenonsi, a cancer researcher at the University of Padova in Italy.

A spokesperson for *Scientific Reports*, which published the paper on 10 September, says that the editors are looking into the criticisms, and will correct or retract the paper if necessary. On 1 October, the journal added an editors' note to the homeopathy paper alerting readers to criticisms regarding the study.

HEALING RESPONSE

Homeopathy is based on the idea that illnesses can be treated using substances that produce similar symptoms. Mostly, the substances have been heavily diluted in water or alcohol so that none or only a few molecules of the active ingredient are present. Some supporters of the practice say that the water or alcohol 'remembers' the substance, which triggers a healing response. But these claims aren't backed up by scientific evidence, and the European Academies' Science Advisory Council notes that homeopathic products are no more effective than placebos in treating health problems. ▶