studies. "Our central role is in understanding how the Earth system is changing," says St. Germain.

Biden's predecessor, Donald Trump, whose policies favoured industry and downplayed climate change, repeatedly tried to cancel major NASA Earth-science missions, only to see them rescued by Congress. It was part of a broader pattern across the Trump administration of undercutting climate-change research and policy. NASA escaped the worst of those attacks by keeping most of its climate-change and Earth-science research below the radar of Trump officials. But it was a politically fraught time for the agency.

Now, NASA is literally reclaiming its seat at the table. Biden initially left the agency off the high-level climate task force he established a week after taking office in January. Following some pointed phone calls, NASA muscled its way into that group, and is now represented alongside administration heavyweights such as the secretaries of the treasury and defence as they discuss the nation's climate strategy.

"If you're going to make policy related to scientific questions, you need to have science at the table," says Gavin Schmidt, a climate modeller at NASA's Goddard Institute for Space Studies in New York City and the agency's new climate adviser.

NASA's new administrator, former senator Bill Nelson, has said that he supports the agency's Earth-science research. "You can't mitigate climate change unless you measure it, and that's NASA's expertise," he said at his Senate confirmation hearing on 21 April.

Budget struggles

Among NASA's epic observations of climate change are a 29-year programme recording global sea-level rise, measured precisely from space with French collaborators and others, and studies that began in 2002 to track ice loss from Greenland and Antarctica, done with German partners. Upcoming missions include a US-Indian radar satellite that will track planetary changes such as shifts in sea-ice cover, and a US-Canadian-French-UK spacecraft that will survey freshwater resources and ocean currents. Both are slated to launch next year.

But NASA has struggled to get some of its most anticipated climate missions under way. It intends to launch a series of spacecraft that would measure fundamental aspects of global warming, such as shifts in clouds and precipitation, and changes in Earth's mass as groundwater dries up. These missions were shaped by an influential 2018 report from the US National Academies of Sciences, Engineering, and Medicine, which named five 'designated observables' that NASA should track. Collectively, NASA calls them an Earth-system observatory; they would help scientists to continue to track global change, and give policymakers data they need to inform actions on climate change.

The report estimated that the necessary missions might cost between US$300 million and $800 million apiece, and suggested that they might be doable even with tight budgets. NASA's annual Earth-science budget has hovered around $2 billion for years, even as other agency programmes, such as planetary sciences, received huge funding increases.

"You can't mitigate climate change unless you measure it, and that's NASA's expertise."

In April, Biden proposed boosting NASA's Earth-sciences budget to nearly $2.3 billion, although Congress would need to approve it. "It's a big help and I'm supportive of it," says Abdalati, who previously served as NASA's chief scientist and also co-led the 2018 National Academies report. But "as a result of underinvestment for so many years, it looks better than it is". (NOAA also got a proposed boost of around $500 million for its own line of weather and climate satellites.)

Despite its budgetary struggles, NASA has managed to continue doing climate science in the past few years. It scraped together money to start work on a new instrument called Libera, which will launch in 2027 to measure solar radiation, so that the agency can maintain a crucial four-decade record of how much heat Earth's atmosphere absorbs. But it hasn't made the progress it would have liked on monitoring the designated observables. "Over the last year, we've been in an especially challenging environment with COVID," says St. Germain.

If Congress approves a significant boost for NASA's Earth-science division, the agency might finally be able to accelerate progress on satellites to track climate change. The funding decision is expected in the coming months.

"The switch in administration now means that we can actually start to implement some of these missions," says Helen Fricker, a glaciologist at the Scripps Institution of Oceanography in La Jolla, California, who studies Antarctic ice loss. "We can make up for lost time and get on with it."

PFIZER COVID VACCINE PROTECTS AGAINST WORRYING VARIANTS

Data from Qatar provide strongest evidence yet that vaccines can stop strains thought to pose a threat.

By Ewen Callaway

Qatar's second wave of COVID-19 was a double whammy. In January, after months of relatively few cases and deaths, the Gulf nation saw a surge driven by the fast-spreading B.1.1.7 variant, which was first identified in the United Kingdom. Weeks later, the B.1.351 strain, which is linked to reinfections and dampened vaccine effectiveness, took hold.

Amid this storm, researchers in Qatar have found some of the strongest evidence yet that current vaccines can quell variants such as B.1.351. People in Qatar who received two doses of the Pfizer–BioNTech vaccine were 75% less likely to develop COVID-19 caused by B.1.351 than were unvaccinated people, and had near-total protection from severe disease caused by that strain. The findings — published on 5 May in *The New England Journal of Medicine* — suggest that current messenger RNA vaccines are a potent weapon against the most worrisome immune-evading variants (L. J. Abu-Raddad *et al. N. Engl. J. Med.* https://doi.org/gjzcxb; 2021). Pfizer, based in New York City, and BioNTech, in Mainz, Germany, are developing an updated mRNA vaccine targeting B.1.351, as is Moderna, based in Cambridge, Massachusetts. Early results from Moderna's efforts suggest that a booster shot of the updated vaccine triggers a strong response against B.1.351.

"I think this variant is probably the worst of all the variants we know," says Laith Jamal Abu-Raddad, an infectious-disease epidemiologist at Weill Cornell Medicine–Qatar in Doha, who led the Qatari study. "We have the tools, despite these variants, to control at least the severe forms of infection — and this should work quite well on transmission."

Researchers in South Africa identified B.1.351 in late 2020, and it's now the predominant strain there. Laboratory studies show that the variant harbours mutations that blunt the effects of virus-blocking antibodies, and trials suggest that some COVID-19 vaccines are

significantly less effective against the strain than against others.

Early lab research suggested that mRNA vaccines, including the Pfizer–BioNTech jab, would be weakened by B.1.351, but probably not fully compromised. Abu-Raddad's team analysed tens of thousands of COVID-19 cases that occurred between the start of Qatar's vaccination campaign in late December and the end of March. Genome sequencing showed that B.1.1.7 and B.1.351 were the predominant coronavirus lineages during this period and, from mid-February, each accounted for about half of the country's cases.

The researchers compared rates of infection with the coronavirus SARS-CoV-2 in vaccinated people with those in unvaccinated controls. People who received two vaccine doses were about 90% less likely to develop an infection caused by B.1.1.7, echoing findings from Israel, the United Kingdom and elsewhere. There were around 1,500 'breakthrough' infections caused by the B.1.351 variant in vaccinated individuals, but only 179 of these occurred more than 2 weeks after the second dose. There were hardly any severe cases of COVID-19 caused by either B.1.1.7 or B.1.351 among fully vaccinated individuals.

Promising data

Shabir Madhi, a vaccinologist at the University of the Witwatersrand in Johannesburg, South Africa, says the Qatari results are promising. The comparatively high levels of virus-blocking antibodies triggered by two doses of an mRNA vaccine probably explain why it confers better protection against B.1.351 than do other vaccines, such as the one developed by the University of Oxford, UK, and pharmaceutical company AstraZeneca in Cambridge, UK.

But Madhi expects that other vaccines will also prevent severe disease caused by that variant. In another 5 May *New England Journal of Medicine* study, his team reported that the jab produced by biotechnology company Novavax in Gaithersburg, Maryland, lowered the risk of getting COVID-19 by 60% in participants without HIV in a South African trial involving more than 6,000 people (V. Shinde *et al. N. Engl. J. Med.* https://doi.org/gjzcxc; 2021). As-yet unpublished data show that the vaccine was highly effective against severe cases of COVID-19 caused by B.1.351, with no cases in vaccinated individuals and five in the placebo arm.

Qatar, where more than one-third of the population has received at least one dose of the vaccine, might provide an early glimpse at how the worst coronavirus variants can be controlled. Abu-Raddad says there is evidence that the Pfizer–BioNTech vaccine might also be highly effective at blocking transmission of B.1.351. And after cases of the variant peaked in mid-April, he says, "things have been going extremely well; the numbers are going down very, very rapidly".

TOLGA AKMEN/AFP/GETTY

HOW MANY DEATHS ARE ACCEPTABLE POST-PANDEMIC?

Nations are weighing up the COVID-19 burden they will tolerate to open economies after vaccinations.

By Smriti Mallapaty

On 24 April, Perth in Western Australia entered a snap three-day lockdown when two people tested positive for the coronavirus SARS-CoV-2 — the first community infections recorded outside hotel quarantine in the state in more than a year. Pubs, gyms and playgrounds shut, remembrance-day services were cancelled and people were confined to their homes.

Australia is part of a group of countries — including Bhutan, China and New Zealand — that has applied a zero-tolerance approach. When outbreaks are detected, the response is swift and severe: mass testing, sudden lockdowns and closed borders.

But this cannot be sustained indefinitely. "We have to accept that people will get infected, will go to hospital and will die from COVID-19 in the future," says James McCaw, an infectious-diseases epidemiologist at the University of Melbourne, who advises the Australian government.

As more people get vaccinated, scientists and health officials are pondering how societies can live with the virus, and what level of risk they are willing to absorb. In some countries, such as Australia, the threshold is low. But in some nations worn down by a year of restrictions, such as India and the United States, communities remain open even in the face of high transmission.

Different nations, different answers

Researchers say there is no universally agreed number of hospitalizations and deaths that societies will find acceptable. But there are