"We are concerned about democracy itself," says Sérgio Rezende, a physicist at the Federal University of Pernambuco in Recife, and a member of the commission that wrote the SBPC analysis.

A draft of the SBPC report details a decline in science funding that began with a major recession in 2014. It draws a direct line between the unprecedented crisis in science and the future of Brazil. Without policies that are "grounded in rationality, science and the public interest", places such as the Amazon rainforest could soon pass the point of no return, according to the draft report.

The commission found that total spending by Brazil's three main science-funding agencies fell by nearly 47%, to 7 billion reais (US$1.8 billion), last year, compared with 2014. The situation has deteriorated further since Bolsonaro took office — in March, his administration announced a freeze on 42% of the budget for the ministry of science and communications, leaving it with just 2.9 billion reais for the rest of the year. The latest estimates suggest that the ministry could run out of scholarship money for undergraduate and graduate students and postdoctoral researchers by September if the government doesn't provide more cash.

The funding crisis is just one of the sore points between researchers and Bolsonaro. Concerns over his administration's policies regarding the environment and Indigenous tribes in the Amazon spiked last month, when Bolsonaro questioned his own government's data on deforestation in the rainforest.

In early July, Brazil's National Institute for Space Research (INPE) — which uses satellite observations of the Amazon to track the destruction of the rainforest — released data showing that deforestation rates from April to June had increased by 25% compared with the same period last year.

On 19 July, Bolsonaro accused INPE of lying about the numbers, then later suggested that his administration should have the right to approve the agency's data before they are released to the public. INPE director Ricardo Galvão accused the president of cowardice for publicly attacking his institute.

"We are concerned about democracy itself."

The data in question come from a monitoring system designed to provide rapid alerts to law-enforcement officers if it detects a new clearing in the Amazon as small as one hectare. The data aren't Brazil's official deforestation statistics — which come from a more detailed analysis of satellite observations — but often follow larger deforestation trends.

Scientists have defended INPE, saying that it has the most comprehensive deforestation monitoring system in the tropics. The agency's estimates provide a reliable gauge of deforestation trends and are based on publicly available data, says Ane Alencar, the science director at the Amazon Environmental Research Institute, an advocacy group based in Brasilia.

Galvão met with the minister of science, former astronaut Marcos Pontes, on 2 August to discuss the issue. But Galvão was told during the meeting that he was dismissed. He says that he had a constructive discussion with Pontes, and stressed that there was no indication that INPE's work on deforestation would be censored moving forward. But Galvão says that it was clear that he would have to leave because of the way he challenged the president.

"I don't have any regrets," says Galvão, a physicist formerly at the University of São Paulo who will now return to his academic post. "That was not a proper thing for a president to say."

The reported rise in deforestation comes as no surprise to many scientists and environmentalists. Bolsonaro's presidential campaign relied in part on promises to open up the Amazon to agriculture and mining interests.

Since taking office, he has scaled back enforcement of environmental laws and promoted development in Indigenous reserves. Now, his administration is pushing forward with proposals to shrink the size of protected areas in regions including the Amazon.

Bolsonaro has repeatedly derided environmental laws as being a barrier to progress and has criticized enforcement officials, says Maurício Voivodic, who heads the Brazilian branch of the environmental advocacy group WWF, which is in Brasilia.

"That's why we are seeing illegal miners invading Indigenous lands," he says. "That's why we are seeing more deforestation." ■

PHYSICS

'Supergravity' wins US$3-million prize

Three physicists honoured for theory that has been hugely influential — but might not be a good description of reality.

BY ZEEYA MERALI

Whether the theory of supergravity, an attempt to unify all the forces of nature, is a true description of the world still hangs in the balance more than 40 years after it was proposed. Nonetheless, it has now nabbed its founders one of the most lucrative awards in science: a US$3-million Special Breakthrough Prize in fundamental physics.

Supergravity was devised in 1976 by particle physicists Sergio Ferrara at CERN, Europe's particle-physics laboratory near Geneva, Switzerland; Daniel Freedman at the Massachusetts Institute of Technology in Cambridge; and Peter van Nieuwenhuizen at Stony Brook University in New York (D. Z. Freedman *et al. Phys. Rev. D* **13**, 3214–3218; 1976). The selection committee that awarded the prize did so, in part, for the theory's impact on the understanding of ordinary gravity. Supergravity also underpins one of physicists' favourite candidate 'theories of everything', string theory. This asserts that elementary particles are made of tiny threads of energy, but remains unproven.

"Supergravity has been transcendently important in the development of physics for the past 40 years and in our exploration of what might lie beyond what we know about nature," says string theorist Andrew Strominger at Harvard University in Cambridge, Massachusetts, who sat on the prize's selection committee.

Russian entrepreneur Yuri Milner launched the prize in 2012, and funders now include Google co-founder Sergey Brin and Facebook's Mark Zuckerberg. Awards are given out towards the end of each year, across a range of fields in science and mathematics. But the selection committee — picked from the pool of previous prizewinners — can make special awards to recognize exceptional work.

By the early 1970s, physicists had constructed the standard model of particle physics, in which three of the four fundamental forces of nature are associated with their own particle: the electromagnetic force is carried by the particle of light, the photon; the strong force that binds atomic nuclei is mediated by the 'gluon'; and the weak force that governs radioactive decay is associated with 'W' and 'Z' particles. All these have been observed experimentally. But the fourth fundamental force, gravity, resisted efforts to include it in the model. Supergravity was an early attempt to do so, combining particle physics with Albert Einstein's theory of gravity, general relativity.

Ferrara, Freedman and van Nieuwenhuizen drew inspiration from supersymmetry, an extension of the standard model first proposed in 1973. It asserts that each known particle has a heavier, and as yet undiscovered, twin. Models that try to bring the final fundamental

force, gravity, into the mix assign it a hypothetical 'graviton' particle. The team proposed a super-twin for the graviton called the gravitino. Van Nieuwenhuizen remembers the night he watched their computer program crunch through the supergravity calculations, fearful it would prematurely grind to a halt, indicating that the theory was wrong. "I sat there with mounting tension," he says. But when the program reached its conclusion successfully, he was convinced supergravity was real.

Some 40 years later, van Nieuwenhuizen was left speechless by the news of the award. "I'd given up hope it would happen," he says.

David Tong, a string theorist at the University of Cambridge, UK, says that the innovation behind supergravity was "astonishing", given that at the time particle physicists and gravity researchers rarely interacted. "Here, the team was applying particle-physics techniques to gravity and then testing them computationally, when nobody was using computers to do this sort of thing," says Tong.

Today, supergravity is a cornerstone of string theory, a popular candidate for the ultimate description of reality. But for decades, particle accelerators, including CERN's Large Hadron Collider (LHC), have failed to spot any signs of the gravitino, or any evidence for string theory — although this does not rule it out completely. "These ideas may just not be testable in our lifetime," says Tong.

A lack of evidence should also not detract from supergravity's achievements, argues Strominger, because the theory has already been used to solve mysteries about gravity. For instance, general relativity apparently allows particles to have negative masses and energies, in theory. "If that was true, some things wouldn't fall to Earth when dropped, but fall into space," says Strominger. That does not happen, but no one could explain why not. Turning supergravity's machinery to general relativity enabled physicists to prove that particles cannot have negative masses and energies.

But Sabine Hossenfelder, a theoretical physicist at the Frankfurt Institute for Advanced Studies in Germany, warns that the lack of evidence from the LHC deals a near fatal blow to supergravity's chances of being true. She says that the winners have "done great mathematical work that deserves recognition", adding, "but perhaps the award should be for pure mathematics, because this is not physics." ■

GEOLOGY

India's geologists seek law to protect fossil treasures

Among those at risk of vandalism or development is the site of a major extinction event.

BY PRIYANKA PULLA

India's scientists are lobbying lawmakers to protect the country's myriad geological sites and fossils from looting and development. Among the country's geological gems are a large, scientifically significant dinosaur nest and a formal marker for a geological age.

On 6 August, the Indian National Science Academy (INSA) in New Delhi and the Society of Earth Scientists in Lucknow presented a draft bill to politicians. If enacted into law, the bill will create a national agency that has the power to designate geological and palaeontological sites, and to restrict access to them.

India currently has no national laws that conserve these resources, says Delhi-based geologist Satish Tripathi, a member of the Society of Earth Scientists and an adviser on the bill. A few important sites are protected under local laws, but many are not protected at all. As a result, there is little to prevent the theft of fossils and geological relics, or to stop developers and mining companies from destroying sites, a document accompanying the draft bill states.

Conservationists have struggled for years to guard important geological locations. But India's rapid development over the past decade has increased the urgency, says Tripathi. "The law has to be created, or such sites will vanish," he says.

At least a couple of hundred sites could need safeguarding, estimates sedimentologist Rajasekhara Reddy Dhanireddy, an adviser to the Indian National Trust for Art and Cultural Heritage, a non-profit organization in New Delhi.

AMIT DAVE/REUTERS

Dinosaur eggs have been pilfered from unprotecte fossil sites in India.

TREASURE TROVE

Among the artefacts in need of safeguarding is a 6-centimetre-thick layer of soil in the state of Himachal Pradesh's Spiti Valley. Scientists have tied the layer to an extinction event that took place around 252 million years ago. An exposed section of this layer, which separates shale from the Permian period from Triassic limestone above it, is in danger from a road ▶