



CLOSING IN ON A CURE FOR MIGRAINES

Science Focus

The secrets of
YOUR SECOND BRAIN

Why we don't need
ROBOTS THAT LOOK LIKE US

**THE NEXT GENERATION OF SPACE TECH
IS HERE AND IT'S GOING TO TAKE US TO
PLACES WE'VE NEVER SEEN BEFORE**

INTO THE UNKNOWN



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Fingle Woods in Dartmoor, Devon

● Plantlife, the Woodland Trust, and the Atlantic Woodland Alliance.

Invasive species, especially the common rhododendron, *Rhododendron ponticum*, are among the largest threats. Temperate rainforest zones are the optimal habitat for this popular garden plant and exactly where it likes to grow, says Yahr. “Where it grows, it completely shades out the understory, and prevents anything else from coming in.” But removing it and keeping it out is extremely labour-intensive.

Grazing by deer also poses a huge issue in Scotland. Further south, conifers and other non-native tree species are an additional problem, says Rickwood. “In most of my sites [in Devon], we’re gradually removing the conifer and allowing the native species to regenerate.”

A rising effort in Britain aims to expand and connect existing patches of these rainforests together, while balancing people’s use of the land. Networks are needed so organisms have corridors to travel – especially in the face of a changing climate.

However, many of the species found in temperate rainforests are slow to move, raising the risk they may fail to keep up with the rate of change of habitats, adds Yahr. One way to overcome this is to experiment with translocations.

“We move them around and see how they do,” says Yahr. “They’re not too bad as experimental subjects to be moved, and they seem to survive in some places.”

As other areas of Britain are subject to climate change, temperate rainforests located in deep valley systems could become even more important as reservoirs of biodiversity, says Rickwood, as they are more protected than forests in exposed areas like moorlands.

These projects need to have long timeframes to regenerate naturally – including when it comes to funding, adds Rickwood. “A grant might exist for five years, but you can’t do it in five years. You’ve got to have a 20-to-30-year timeframe.”

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COMMENT

SPACE JUNK: AM I LIKELY TO BE HIT BY A PIECE OF OLD SPACESHIP?

The amount of debris in orbit around the Earth is a growing issue...

Back in July, a strange, black artefact appeared in a paddock nestled in Australia’s Snowy Mountains. It’s a place used to raging bushfires, so you could mistake it for a tree turned to cinder. Yet it came from outer space. Some reports suggest it is a stray piece of a SpaceX Dragon capsule that broke up in the Earth’s atmosphere upon re-entry. It stands upright after spiking into the Australian soil like a javelin. Clearly you wouldn’t want to have been standing there at the time.

More recently, a large chunk of spacecraft, thought to be part of China’s failed Long March 5B rocket launch, crash landed in Borneo.

This is not the first time pieces of space junk have returned to Earth with a bang, but what are chances of it damaging people or property? According to Prof Don Pollacco, director of the University of Warwick’s Centre for Space Domain Awareness, these events were rare.

“The surface of the Earth is mostly water, so the chances of this happening on land are really low,” he says. The chances of anyone being injured by it? “You’d have a better chance of winning the lottery,” Pollacco adds.

It has happened, though, albeit at sea. Five Japanese sailors were hurt when wreckage from a Soviet spacecraft hit a freighter off Siberia’s coast back in 1969.

Another hairy moment came in 1977 when a Soviet surveillance satellite crashed into northern Canada. It carried a nuclear reactor on board and only 0.1 per cent of the hazardous fuel was ever recovered. Some of the radioactive material made it into a lake and the Canadian government eventually received C\$3m (£2m) from the Soviets to pay for the clean-up operation.

Dangerous space junk falls may be rare, but that doesn’t mean space junk isn’t a threat.

“The danger isn’t deorbiting and landing on someone,” Pollacco says. “The danger is in damaging other satellites or stopping us launching into space.”

The region immediately around us in space is fast becoming a junkyard. There are tens of thousands of pieces larger than 10 centimetres across up there. For objects smaller than one centimetre across, the

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“The region immediately around us in space is fast becoming a junkyard. There are tens of thousands of pieces larger than 10 centimetres”

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tally runs into the hundreds of millions. These pieces include bits of old rocket, parts of defunct satellites and even flecks of paint and frozen fuel. Twelve accidental fragmentation events typically occur in space every year, as hardware breaks apart and adds to the growing problem. The tiniest objects can still wreak significant havoc.

“Objects in low Earth orbit are moving at 25,000mph [40,000km/h],” says Pollacco. “Even a pea-sized object packs a lot of energy – if it hit something, it would disable a satellite. It’s something we’re going to have to get used to.”

ABOVE
Scorched metal from a spacecraft pierced the soil of farmland in Australia

That’s because the number of satellites being hurled into space is skyrocketing. Companies like SpaceX and Amazon are launching mega-constellations into low Earth orbit to beam down the internet to remote places where traditional underground cables can’t reach.

One report estimates that we’ll launch 1,700 satellites a year between now and 2030. The rapid expansion of space capabilities comes on the back of the advent of reusable rockets. The cost of getting something into low Earth orbit has dropped from around \$60,000 (£50,000) per kilogram to just \$2,400 (£2,000).

So, what can we do about it? Bodies like the European Space Agency and NASA are advocating debris removal, and there are a number of companies working on this and running demo missions.

Pollacco sees big problems, though. “The reality is someone has to pay for this.” He points to a swarm of Russian satellites in a spacecraft graveyard some 800 kilometres (500 miles) above the surface of the Earth. “They weren’t decommissioned properly and they’re dangerous – they even still contain propellant,” he says. “Is Russia going to pay to remove them? No.”

Even then it’s a sticking plaster approach. Removing thousands of large, dead satellites does nothing about the hundreds of millions of pea-sized satellite killers.

“It’s not practical to deorbit those,” Pollacco says. “In the end you just have to know where it all is.”

So what’s the worst case scenario?

“You create a finer and finer cloud of satellite-killing debris that would take decades to deorbit,” Pollacco says.

Eventually, that could create such an obstacle that it affects our ability to put anything new into space. “If your risk of collision during launch is above a certain amount then you don’t launch – we won’t be able to get off the Earth,” he says.

We plan to go back to the Moon later this decade and to Mars in the decades ahead, but we could end up firmly rooted to *terra firma*. **SF**

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