

Life on a knife-edge



The delicate, 3 cm long fronds of *Anogramma ascensionis* resemble tiny sprigs of parsley

As part of Kew's work to help conserve biodiversity around the world, Kew scientists have teamed up with colleagues on Ascension Island in a bid to rescue a rare endemic fern, as Stephanie Pain explains

First there were none – at least none that anyone had seen for half a century. Then there was one. Then four. And now there are thousands. In a remarkably rapid reversal of fortune, the Ascension Island parsley fern has gone from being classed as extinct to a fern with a future, all in the space of a year.

Ascension Island is one of the smallest of the UK Overseas Territories (UKOTs), a tiny volcanic dot in the South Atlantic. Its youth and remoteness mean it has only 25 native plants, ten of them unique to the island. Three of those are already extinct. Much of Ascension's native flora, as on so many other islands, has been devastated by goats, rabbits and sheep, or pushed out by more vigorous introduced plants, including many sent by Kew to help 'green' the island in the 1870s.

Back in 1843, however, when Kew's future director Joseph Hooker visited, he found plenty of parsley ferns on Green Mountain – the island's highest peak and

today a National Park. He described the tiny fern and named it *Anogramma ascensionis*. Parsley ferns were recorded several times in the 19th century, and were last seen in 1958. In 2003, the species was declared extinct, ousted, it is thought, by introduced maidenhair ferns.

On 27 July 2009, conservation officer Stedson Stroud and Kew botanist Phil Lambdon were surveying Green Mountain during an annual plant census. That day, they were exploring a dramatic, knife-edge ridge on the volcano's southern slopes when they spotted a tiny frond sticking out of a crevice in near-naked rock. They realised instantly it was the 'extinct' parsley fern and searched for more. They found another three.

The excitement of the discovery was tinged with the knowledge that these could be the last of the species. They had to be rescued. Stedson judged it too risky to move them and decided to try to keep them alive until they produced spores. His plan was to try propagating spores himself and to send

some to Kew, where Viswambharan Sarasan and his colleagues in the Conservation Biotechnology Unit (CBU) have experience in growing endangered ferns in culture.

Twice a week for the next two months, Stedson and his colleague Olivia Renshaw returned to the ridge to water the ferns and clear weeds from their crevices. 'Finding the fern was difficult. Carrying water and hanging on to the safety rope was even harder,' says Stedson. If climbing down to the crevices was nerve-racking, so was the waiting. 'We weren't sure how long it would take for the plants to produce spores. We just had to be patient and check them every week,' recalls Olivia.

They also faced a dilemma. The CBU needed spores before they were shed. 'It's normally better to have ripe spores, but we need clean material, so we want them before they're released,' explains Sarasan. Clipping a piece from such a rare plant could damage it and that was a worry. There was a logistical problem



Olivia Renshaw examines the fronds to see if the spores are at the required stage



On Ascension, Stedson Stroud (left) and Ross Denny keep a close eye on their gametophytes



Stedson and Olivia climbed down the ridge twice a week to tend the newly found ferns

too – to stop the spores drying out, they'd have to reach Kew within 24 hours.

Stedson decided to go for it. On 22 September, when he judged the spores were almost ripe, he and the island's administrator, Ross Denny, climbed down the ridge, clipped tiny pieces of frond from two ferns and put them in a sterile container for dispatch to Kew. The sample was flown to RAF Brize Norton, where Marcella Corcoran of Kew's UKOTs team was waiting.

As soon as Marcella got back to Kew with the fronds, Sarasan and student Katie Baker set to work. 'Spores were already flying around,' says Sarasan. 'If we'd got them

any later it would have been too late.' The samples were unusually small too – hardly enough to cover a penny – and some of the spore-bearing organs were empty. 'Only a small percentage of the spores were viable,' he says, 'but that's not a problem for us – once we have them in culture we can guarantee all viable spores will germinate.'

The first step was to sterilise the surface of the samples to kill any microbes brought from Ascension, then sow spores on to a culture medium. Compared with a rocky crevice, sterile culture medium provides ideal conditions for a germinating fern spore.

Soon, Sarasan and Katie had thousands of little leafy gametophytes. Ferns have a two-part life cycle: fern plants, which we're all familiar with, are known as sporophytes, and produce spores. The spores grow into gametophytes, which develop male and female sex organs. When sperm meets egg, the result is a new fern plant, or sporophyte.

'We grew several thousand gametophytes,' says Sarasan. 'The next stage was to get them to grow up into sporophytes. That can be quite tricky – we had to experiment to get conditions right, but after a few months we grew good quality sporophytes.'

Back on Ascension, Stedson had also successfully germinated spores and he had more good news too. Searches had turned up another 15 ferns at sites nearby.

This September, after visiting Kew, Olivia Renshaw will return to Ascension with some of the ferns grown in the CBU. With plenty to work with, she and Stedson can experiment to find the best conditions for the ferns and identify suitable places to return them to the wild.

Chances are they'll do well. But if they don't, the CBU will also be working on a cryopreservation technique for the fern to ensure it never disappears completely. 'We can conserve gametophytes in liquid nitrogen,' says Sarasan. 'That way, if they can't keep them going on the island, we have them safely stored here and can try again.'

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Under sterile conditions in Kew's Conservation Biotechnology Unit, the spores germinated readily

