Small is beautiful

PLANTS UNDER PRESSURE

With around 380,000 species worldwide, the question of quite how threatened plants are is difficult to answer. The Plants Under Pressure project aims to quantify threats to plants across the world. Museum botanists **Ana Claudia Araujo** and **Neil Brummitt** explain more, with particular focus on a rare and mysterious orchid from Brazil.

Despite more than 300 years of scientific discovery, thousands of new plant species are still described every year, and many remote regions of the world remain poorly known. Plants are facing greater risks from habitat loss, invasive species and other factors, and we lack a detailed picture of their overall conservation needs.

The International Union for the Conservation of Nature (IUCN) Sampled Red List Index for Plants – which we helped to produce – aims to fill this gap by providing a baseline assessment of the global conservation status of plants.

A CRITICALLY- OR ENDANGERED ORCHID

Florianópolis – or Floripa – is the capital of the state of Santa Catarina in south Brazil and Ana Claudia's home city – it was her connections that made this project possible. The large city shares its island – Santa Catarina Island – with many popular tourist resorts around a series of low hills covered in Atlantic Forest.

As part of the Plants Under Pressure project – a partnership between the Museum, IUCN and the Royal Botanic Gardens, Kew – we travelled to Floripa to try and locate a Critically Endangered orchid, known only from a single location in the south of the island.

THE COLLECTION LOCALITY

Anathallis kleinii is a micro-orchid – the whole plant reaching not much more than two or three centimetres in diameter – with yellow flowers that have a purple labellum (central lobe) on a short stem above a rosette of small, slightly succulent, sessile leaves.

It was first spotted and collected in the hills above Pantâno do Sul village in 1970 by two local botanists, one of which was Dr Roberto Klein, after whom it was named – Ana Claudia had met him during her Master's degree. As far as we knew, the species had never been collected again.

During the 1980s and 1990s Santa Catarina Island became a popular destination for holiday makers, from Brazil and also Argentina and Uruguay. Land was sold, huge houses were built and new neighbourhoods appeared, while natural vegetation disappeared.

THE CHALLENGE

To find out more about this mysterious species, we first checked the protologue – the scientific publication that contains the first description of a new species. We then contacted a colleague in Brazil and asked if we could access the type collection – the specimen on which the description of the species is based. In this case it was held in the herbarium of the Federal University of Santa Catarina in Floripa. Not only did we receive the image of the type collection but also news that a student of orchids had made a collection – only the second ever – of this species in 2011.

While organising a fieldtrip to the type locality – where the first collection had been made – in Brazil, we discovered that another record of the species had been found, this time further north in the next state, Paraná. Perhaps the species had a much wider distribution than previously thought, and maybe it was not Critically Endangered after all. It became clear that we needed to investigate more than one location and conduct a more extensive search of remaining Atlantic Forest for this rare, elusive orchid.

Having received a grant from the Mohammed bin Zayed Species Conservation Fund enabling us to properly investigate *A.kleinii*, we were set to go. The challenge was to visit potential localities with healthy Atlantic Forest along a large part of the south coast of Brazil.

We relied on local expertise – in total 10 local botanists, three of them orchid specialists, from six different organisations, provided us with invaluable help.

FIELDWORK

The first fieldtrip in 2015 was to the type locality, where with the help of Brazilian colleagues we found the original population of *A. kleinii*. It comprised three tree-hosts, each with 20–50 mature orchids.

Young individuals were also found, suggesting that although the species is rare, the population is thriving. It was clear that *A. kleinii* is a shade-loving species that doesn't grow on tree trunks or branches facing the beach or exposed to direct sunlight. But it was not easy to find. It took several hours to locate the population and identify, record and photograph the host trees.

We visited a second location 15 kilometres north, where another population of *A. kleinii* was located. There, surprisingly, the species was found in a deep depression in a completely different kind of environment – shrubby, low forest vegetation on sandy soil that is known in Brazil as restinga. We again found the orchid on three trees of the same species and completely in the shade.

← **Left** *Anathallis kleinii* growing on the underside of a tree branch in coastal restinga vegetation near Rio Tavares, Floripa.
© Neil Brummitt
↓ **Below** Our counterpart Carlos Eduardo Siqueira counting individuals of *A. kleinii* on trunks of trees in the Atlantic Forest of Florianópolis.
© Ana Claudia Araujo

It took several hours to locate the population and identify, record and photograph the host trees

→ Clockwise from top left
A. kleinii is smaller than a thumb-joint, making counting the number of plants in the forest particularly challenging.
© Ana Claudia Araujo
The slopes above the western shore of Lagoa do Peri hold some of the only remaining primary forest left on Florianópolis – as shown by large trees of timber species still found there.
© Neil Brummitt
The tail-end of a tropical cyclone, that struck Floripa during the night, caused havoc with our fieldwork the following day – though we were able to survey the epiphytes on fallen trees more easily.
© Ana Claudia Araujo

The search then went further north to Babitonga Bay, 150 kilometres from Floripa, covering an area of around 40km^2. Although the Atlantic vegetation was well preserved, with about 25 orchid species, we didn't find *A. kleinii*. Further north again, on the coast of Paraná state, we located one species of interest, in a single location, after several days of searching. This turned out to be another species of the genus *Anathallis*, *A. corticicola*, which is very similar to, but different from, *A. kleinii*.

UNANSWERED QUESTIONS

When we returned the following year, our aim was to discover how well protected the areas where we had found the micro-orchid really were. How were the authorities conserving the forest while under pressure to house a growing population on a small, popular island? We wanted to search for *A. kleinii* further north on the island, to establish the true extent of its range. The presence of *A. kleinii* in two completely different environments also puzzled us. Clearly, it is not the habitat that affects its success colonising a host, but rather the intensity of light and the direction and force of the wind bringing the salty spray from the sea.

Yet, the tree-hosts bearing this micro-orchid were found not more than 150 metres apart in each population. Why was it not found more often in healthy, well-preserved vegetation when we had found it in such different environments? Could the answer lie in the history of the island?.

Across the whole of Santa Catarina Island very few primary, untouched areas of Atlantic Forest remain. Although it resembles a tropical paradise, most of the forested areas are actually advanced regeneration of secondary forest around 30–40 years old. Since the first colonisation by settlers from the Azores, most of the island has been farmed, with livestock even on the steep hillsides, and high quality timber has been harvested to build farmhouses and other buildings. A possible hypothesis was therefore that populations of *A. kleinii* reflect areas where there are rare pockets of untouched primary forest.

NATURAL FORCE – NATURAL OBSTACLES

On our second trip we visited all of the known sites of primary forest. To the south we visited the highest point of the island and the hillsides above Lagoa do Peri, where the most intact primary Atlantic Forest lies. Both sites are protected parks under the state government agency (FATMA) or the municipal government agency (FLORAM), respectively.

Even in these places – where species of valuable hardwood trees are still to be found – we did not encounter a single *A. kleinii*.

We had to carry out our fieldwork after a thunderstorm with winds of more than 75mph and a month's rainfall had struck which made it very challenging. The force had twisted and broken several trees as tall as 40 metres with canopies of more than 100m^2. The tall trees lying across the hillsides made searching for organisms growing on their trunks – epiphytes – easier, as they are sometimes too high to be spotted, but made exploring a big area particularly hard. We recorded and saved many epiphytes, several of them micro-orchids, that otherwise would have rotted on the ground. These were transplanted in different areas of the park by local biologists.

Despite the damage wreaked by the storm we were also able to search the northern part of the island. There we once again spotted several epiphytic species, mostly orchids, some of which are certainly from the genus *Anathallis*. The precise identification of these is ongoing but we are hopeful that monitoring these areas will bring positive results.

A NEW RED LIST STATUS

The initial assessment of *A. kleinii* as Critically Endangered was made at the Royal Botanic Gardens, Kew during the first phase of the Plants Under Pressure project, without the help of any detailed information from fieldwork.

It was then only known from a single collection in an area not appearing to be under any level of protected status, and it was evident that there was habitat destruction and urban expansion in the area. It was therefore rated as Critically Endangered due to a very small area of occupancy (one of two separate measures of geographical range for the IUCN Red List), a single location, on-going habitat loss and lack of any formal protection.

Happily, as a result of our work, we have now been able to confirm the existence of *A. kleinii* in its original locality, in a second location and probably also a third. This has increased the known range of the species and means that its area of occupancy in now above the 10km^2 threshold (in fact about 60km^2). Its Red List status has therefore improved from Critically Endangered to Endangered and, if current plans to strengthen the protected area system on Floripa come to fruition, it may be possible in the future to raise its Red List status further.

SMALL STEPS TOWARDS SOMETHING GREATER

Santa Catarina Island has several small protected areas established as natural parks across two mountainous formations – the 'North Shield' and the 'South Shield'. The agency responsible for the protection of these sites, FLORAM, is a very small team unable to survey all of the parks, but it re-enforces the protection of their boundaries by bringing together the inhabitants neighbouring the parks through educational activities.

The long-term aim of local biologists and conservationists is to raise those parks, including green belts known locally as Areas of Permanent Protection (APP), to a higher status of protection. Better still would be to connect all the APPs into two bigger conservation units, the North Shield and South Shield areas of protected Atlantic Forest.

The team lacks a piece of the puzzle key to achieving such a dream: the backing of a scientific study that will provide strong evidence to support the stengthening of local conservation policies. Now, through the study of *A. kleinii* led by the Plants Under Pressure project, this is finally achievable.

We hope that as a result of our work many other micro-orchid species as well as other plants and animals native to the remaining Atlantic Forest will be better protected.

Find out more about the Plants under Pressure project at **www.nhm.ac.uk/discover/plants-under-pressure.**

The Plants Under Pressure project has been generously supported by the Prince Albert II of Monaco Foundation and the Mohammed bin Zayed Species Conservation Fund.

Plants Under Pressure

- When many plant species have their conservation status assessed, there is very little to build the initial assessment on beyond their initial scientific publication as a new species. *Anathallis kleinii* is quite typical in this respect.
- Together with the Royal Botanic Gardens, Kew we have now completed conservation assessments for more than 4,000 plant species worldwide from major plant lineages, although while we continue with new species assessments, we rarely have the opportunity to supplement these with detailed field data.
- Each assessment undertaken for the Plants Under Pressure project follows the internationally-adopted IUCN Red List Categories and Criteria, which detail the information needed to assess the likely extinction risk facing each species. These assessments are then submitted to IUCN for inclusion on the Red List.
- As accurate field data is not usually available for plant species, the first step is to gather and compile the existing specimen information, detailing exactly when and where that species has been found. For the assessment, precise geographical co-ordinates are needed.
- When we apply the Red List criteria, we usually then make use of IUCN Criterion B, an evaluation of the geographical range of the species and whether or not species with small distributions have fragmented ranges or are undergoing continuous decline or extreme fluctuations in their distribution, habitat or numbers of mature individuals.