

proteas With Altitude

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About

In 2011 Robert Blackhall-Miles and Ben Ram started the process of creating a garden (FossilPlants) at their home, in North Wales; a place to finally settle a collection of plants gathered over 30 years. Based on a long-standing interest in plant evolution and taxonomy, it was decided to plant the garden with species of plants related to those with a fossil record from before the K-Pg boundary (the event which caused the extinction of the non-avian dinosaurs). A website was created to document the development of the garden, raising awareness of the role these plants played in the Earth's history.

Receiving both horticultural and botanical interest in the garden, and through a desire to aid the conservation of these sometimes rare and endangered species, the garden became an institutional member of Botanic Gardens Conservation International (BGCI) in 2014. This allowed the garden to actively contribute in international plant conservation efforts. Of all the plant families in the garden, the Proteaceae have become the dominant feature. The garden is home to the Plant Heritage National Collection of South East Australian Banksia Species and currently holds 154 taxa of Proteaceae, nearly 10% of the worlds Proteaceae species. This family is considered difficult in cultivation and certain genera within the family require a deeper understanding of their germination and subsequent horticulture to aid future restoration initiatives.

The proteas are ideally placed as a flagship for raising awareness of the issues faced by South Africa's biodiversity hotspot and combating plant blindness. By engaging people in the stories of this colourful family we also hope to go some way towards helping people notice and value the plants in their environment.

Abstract

'proteas with Altitude' is a research project which facilitates the ex-situ conservation of *Proteaceae* in the UK through the creation of cultivation protocols that can be used for restoration.

In 2015, supported by the RHS, Scottish Rock Garden Club, Stellenbosch Botanic Gardens and the Western Cape Nature Conservation Board, FossilPlants embarked on an expedition to South Africa to study the habitat and growing conditions, as well as collect seed, of the high altitude *Proteaceae* in the Western Cape. This seed created the foundation for the 'proteas with Altitude' project.

Project Details

The *Proteaceae* are a large, charismatic family of flowering plants, commonly known as proteas and mainly found growing in the southern hemisphere. Named after the Greek, shape shifting, god Proteus, they come in a vast range of different forms. In 2015, an initial expedition was undertaken to study wild plants and collect seeds of *Proteaceae*, growing at high altitude, in the Western Cape of South Africa. Thirty species were collected as seed to be studied at Fossilplants' research nursery facilities in North Wales. A second expedition's (2017) aim was to explore more remote, mountainous terrain, to discover and investigate the habitat and growing conditions as well as to collect species not yet in cultivation and to bring into cultivation higher altitude material of those already grown. During this second expedition 43 species were collected, 16 being new to the 'proteas with Altitude' project and 6 being new to cultivation altogether.

Through these collections, FossilPlants is making steps towards meeting international conservation targets as well as increasing local botanical knowledge in South Africa. The IUCN's Technical Guidelines on the Management of Ex-situ Populations for Conservation states that 'Ex situ conservation should be initiated only when an understanding of the target taxon's biology and ex situ management and storage needs are at a level where there is a reasonable probability that successful enhancement of species conservation can be achieved; or where the development of such protocols could be achieved within the time frame of the taxon's required conservation management, ideally before the taxa becomes threatened in the wild. Ex situ institutions are strongly urged to develop ex situ protocols prior to any forthcoming ex situ management.

For those threatened taxa for which husbandry and/or cultivation protocols do not exist, surrogates of closely related taxa can serve important functions, for example in research and the development of protocols, conservation biology research.....' Through creating cultivation protocols for both endangered and less threatened species 'proteas with Altitude' works towards achieving the goals of this statement.

Species of *Proteaceae* can take between 5 and 15 years to reach reproductive maturity and as such the nursery facilities in which they are grown will develop alongside the long-term requirements of the plants. The intention is that plants will be distributed to other botanical collections over time and formal agreements with RBG;Kew, RHS Garden Wisley and Logan Botanic Garden have been set up in order for their horticulture to be studied in a variety of

climates and locations. This will also allow these botanical collections, the nursery site and garden to be used for the study of the widest possible range of species of high altitude Proteaceae species as new seed collections are made.

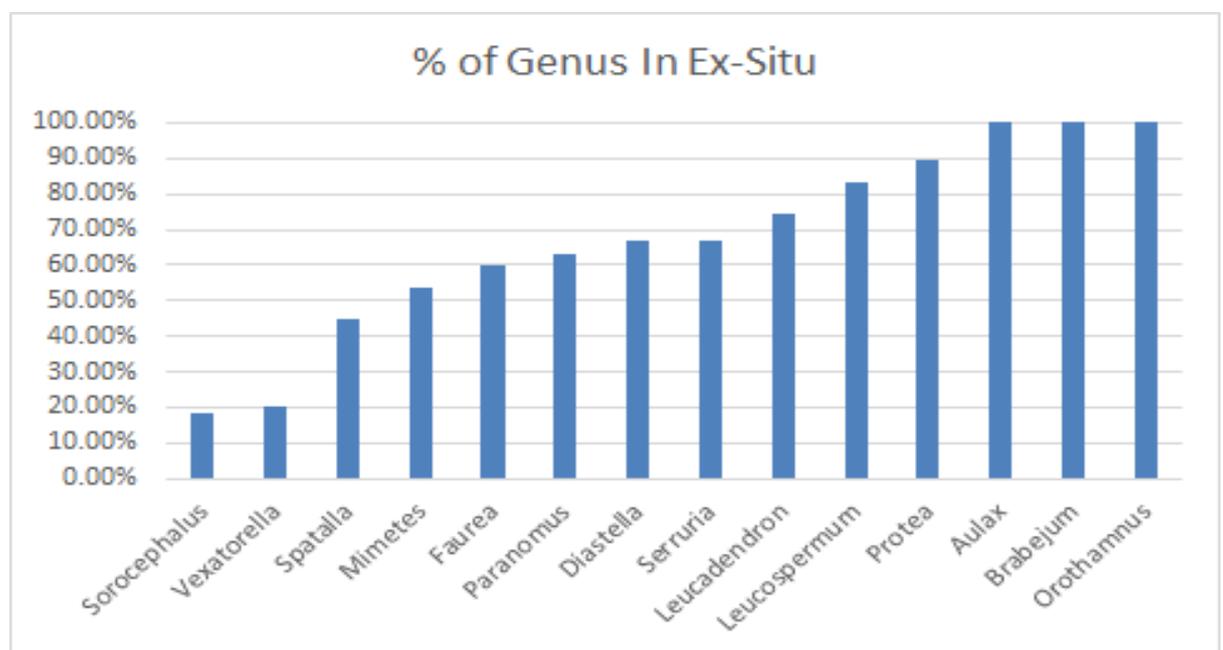
The nursery site from which 'proteas with Altitude' is run also allow the propagation of a range of other plants; the sale of which will secure future funding of the project. Plant sales will also assist with funding the ex-situ conservation efforts to reintroduce to the wild the endangered *Iris lortetii*, in association with Tel-Aviv University Botanic Gardens.

An annual project report will be published, which will be submitted to all concerned parties including CapeNature (the Western Cape Nature Conservation Board), the RHS and the wardens in the reserves in which we have worked. The project has been lucky in receiving promotion in both the horticultural and mainstream press, including social media.

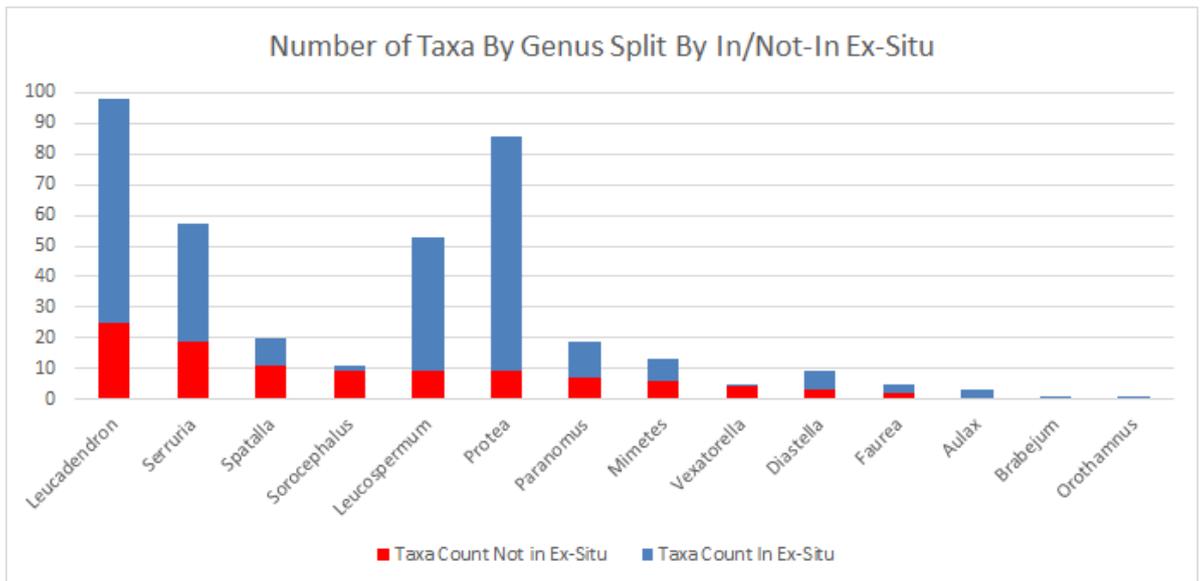
Gap analysis of South African Proteaceae held Ex-Situ

To inform the 'proteas with Altitude' project a gap analysis was conducted of South African Proteaceae in documented ex-situ collections (both seed banks and living collections) to inform priorities.

Regarding this analysis, broadly speaking, the genus of most concern is *Sorocephalus*. The following graph shows a break down by genus of what proportion of the taxa in the genus are in ex-situ collections, including both seed banks and living collections:

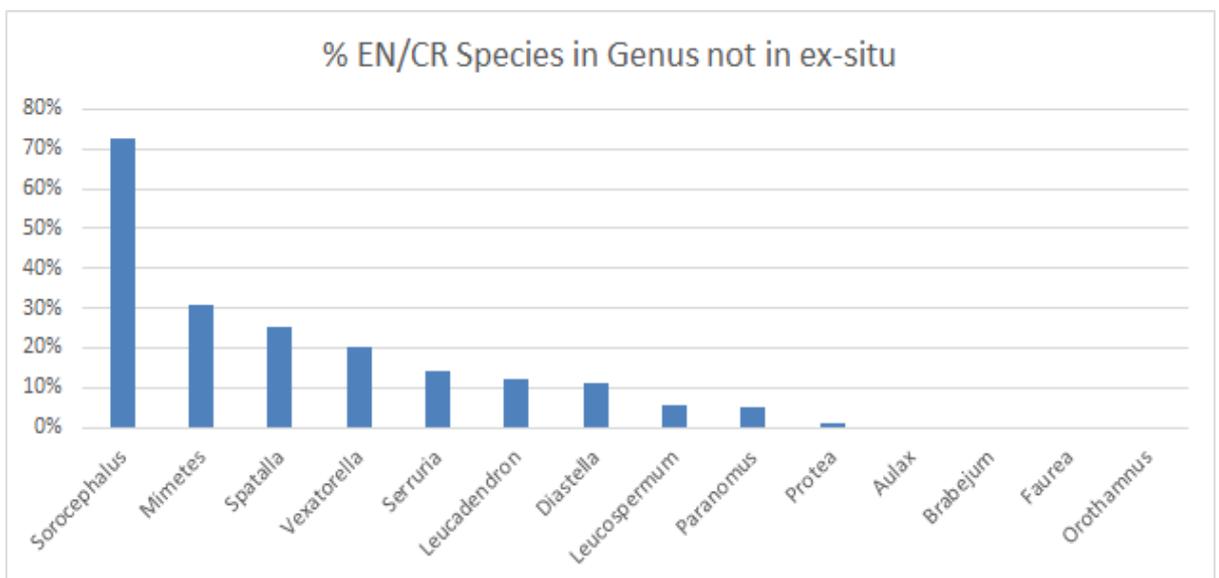


For the small genus of *Sorocephalus*, currently just two species out of 11 are being conserved ex-situ. This is also worrying because *Sorocephalus* has 5 species which are Endangered and 4 which are Critically Endangered. These are unassuming plants which are often difficult to find in the field even when they are in flower and often grow at high altitude. The following graph shows a similar breakdown by genus but this time using actual number of taxa split by 'In Ex-situ' (blue) and 'Not in Ex-Situ' (red), ordered by the latter.



Leucadendron is the largest genus in the family and has the most number of species not in ex-situ collections (both living and as seed).

If you consider that GSPC Target 8 prioritises threatened taxa, the following graph, showing which genera have the largest proportion of endangered/critical taxa not in ex-situ and again points at Sorocephalus needing some attention.



Mimetes and Spatalla were also highlighted in our gap analysis and are interesting, since although it would be worth collecting seed of these endangered taxa, they, along with Sorocephalus, suffer inconsistent (almost non-existent for some taxa) germination of their seed and troubled subsequent cultivation on their own roots, as opposed to being grafted (Thomas pers coms). This means that some work would be needed to avoid destroying batches of precious seed in viability tests as these species do not react in the same manner as other Proteaceae genera and have complicated dormancy breaking processes - our work in the creation of cultivation protocols aims to understand and document these mechanisms.

Budget

Initial breakdown of expenditure:

Keder Greenhouse (inc. delivery, construction, staging, ventilation):	£6408.68
Greenhouse extra door:	£480
Rabbit proof fencing:	£160
<u>Polycarbonate Sheets</u> x 5 (2500mm x 1050mm) :	£167
Mypex Weed-proof Membrane:	£130
8 tons of Sand:	£320
4000L of Melcourt Bark:	£150
Raised bed construction (4 beds of 8m x 1m x 0.5m):	£360
Sundries (Hose, watering can, pots etc):	£250
Shed (6ft by 4ft):	£300
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Total Start-up expenditure:	£8725.68
Rent: annum	£480 per

Funding:

Total funding received: £2600 through a crowdfunding project attracting 64 pledges.

Plant Heritage Brother Bursary £400

The Stanley Smith Horticultural trust £5000

Summary

The last significant piece of work regarding the care of Proteaceae in the UK came in 1809 when Joseph Knight authored 'Horticultural essays. I. on the natural order Proteæ'. Since then horticultural practices have changed in ways that often do not suit these plants. They have unnecessarily earned a reputation for being tender and difficult to grow, due to the current commercially available species being more suited to cultivation in the southern Mediterranean. They also suffer an almost total intolerance to phosphates. Whilst South Africa's botanic gardens are able to grow many species at low altitude, others prefer a cool, mild climate much more akin to ours here in North Wales and other areas of the UK.

Climate change, disease and other human pressures are having a huge impact on these plants and whilst it is always better to conserve 'in-situ', it is also prudent to ensure there is a backup in the form of seeds and cultivated plants, as well as the knowledge of how to grow them. By better understanding the intricacies of their horticulture not only will we be able assist in gaining this knowledge for conservation but also improve and promote the general understanding of this interesting and varied group of plants.

Plants clothe us, feed us, cure us and allow us to breathe. They, through capturing the sun's energy, provide the building blocks that provide for all of the Earth's incredible biodiversity. There are around 400,000 plant species in the world and at least 25% are threatened; unfortunately, there is no quick fix. Horticulture, however, can do something significant to ease this problem and this project can play its part by building the specialist skills to make sure at least some of them are safe in cultivation. Doing so will provide the knowledge that will allow horticulturalists to care for just a few of them in safety, away from the threats they face in their native habitats.

Plant Profiles of species being conserved through 'proteas with Altitude'

Species: *Protea stokoei*

Common name: Pink Sugarbush

Threat status: Endangered

This classy Protea only grows above 900m in a restricted range of mountains in South Africa. It is threatened in the wild partly due to too frequent fires and slow maturity. It can take up to 10 years to flower and is killed by fire. Cultivation in South Africa has proven difficult, probably due to temperatures at low altitude being too warm, however gardens in the South Island of New Zealand have had more luck, as hopefully will FossilPlants.



Species: *Spatalla nubicola*

Common name: Medusa spoon

Threat status: Near Threatened

The Medusa spoon has never been cultivated before and the whole genus is deemed difficult to grow from seed. Climate change is increasing the risk of fire, reducing the rainfall and increasing temperatures in its mountain top home. Add to this that it is only found on top of a couple of mountains within a 34km² area and, should the current situation change, this spoon may become increasingly at risk.



Species: *Protea cryophila*

Common name: Snow Protea

Threat status: Near Threatened

Snow Protea grow as rhizomatous or creeping shrubs in the Cedarberg Mountains. Their flowers are born at ground level where their strong, yeasty, scent attracts rodents to pollinate them. Never found growing below the snowline, these plants actually require the cold in order to stimulate flowering. Unfortunately global warming is having a huge impact on these plants and increased fire alongside an ever receding snowline means that their flowering and setting of seed is becoming far from predictable, as they don't recover from fire.



Species: *Mimetes pauciflorus*

Common name: Flame Pagoda

Threat status: Vulnerable

Mimetes pauciflorus seeds are distributed by ants, a process known as Myrmecochory. The seed can remain dormant in the ground for many years waiting for a suitably hot fire to pass through. Not previously cultivated and little known in their native habitat. These plants are increasingly subject to the pressures of climate change, the increased risk of insufficiently hot fire and reduced rainfall. All this alongside a non-native, invasive, species of ant from Argentina that doesn't bury seed properly and the disease *Phytophthora* and these plants are destined for disaster.

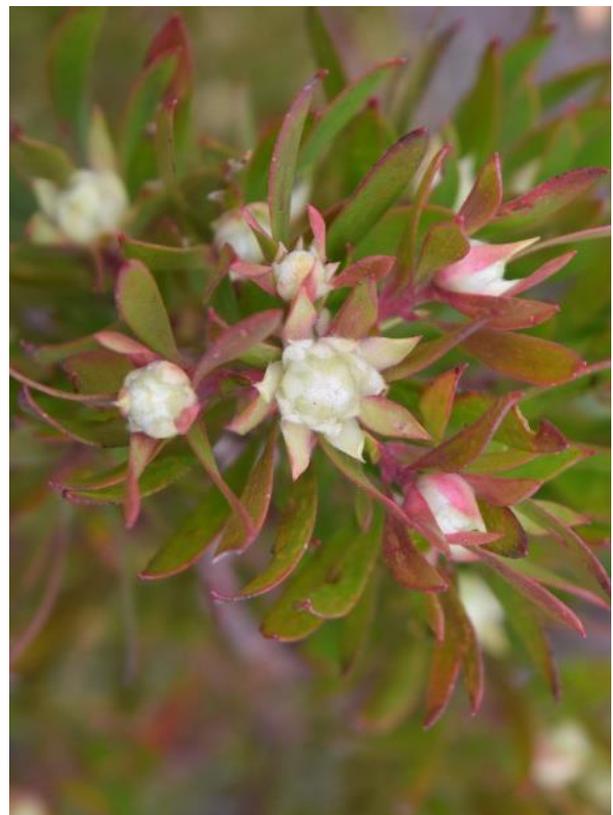


Species: *Leucadendron conicum*

Common name: Garden-Route conebush

Threat status: Near Threatened

Leucadendron conicum's natural habitat is damp stream beds and kloofs (valleys) and is described as growing between 300 and 1000m in altitude (although we found it grows as high as 1450m). Many populations of this species have already declined with forestry development and non-native, invasive species being a real threat to the Garden-Route conebush. At the rate that things are going there could be a population reduction of 30% by 2025.



Species: *Protea grandiceps*

Common name: Red Sugarbush

Threat status: Near Threatened

Populations of this plant in the wild are small, fragmented and fluctuating. They suffer severely from the impacts of the increased occurrence of fire and often lone plants are found, far away from the rest of the population, in a fire refuge. The species takes a long time to reach flowering size and add to that the threat from wildflower harvesting for the cut flower industry, collection for firewood, hybridisation and drought, the species' chances are slim. *Protea grandiceps* is proving very hardy here in the UK.



Species: *Protea montana*

Common name: Swartberg Sugarbush

Threat status: Vulnerable

Another mountain species, this carpeting shrub looks like a mat of grass at first glance. It is only found in the Swartberg and Kammanassie mountains of South Africa. The low growing, rodent pollinated Swartberg sugarbush is found growing only on steep slopes between 1600 and 2000m. Its population is showing a steady decline, particularly in the Kammanassie Mountains and forecasts only show this to get worse.



Leucadendron radiatum, in situ, in Boosmansbos.