

In search of Cape Ericas:

– research visit to South Africa, October 2022



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A Cape heath, *Erica tegulifolia*



Visitors to the Arboretum's heather garden will already be familiar with hardy heathers: the winter-flowering heather, *Erica carnea*, is particularly striking, producing carpets of flowers as early as February. At the other end of the season comes the Cornish heath, *E. vagans*. In between, amidst the distraction of activity in the Rosarium, our native species are in action: the cross-leaved heath, *Erica tetralix*, and bell heather, *E. cinerea* (Fig. 1), as well as their close relative *Calluna vulgaris* – the common heather. In total, there are around 20 species of the genus *Erica* native to the heathlands of Europe and the Mediterranean (Nelson, 2012). Although they span a wide flowering season, they are generally rather similar in form: low growing shrubs with mostly small, pinkish flowers. The exceptions stand out, such as the tree-like forms of the tree heather, *E. arborea*, with its white flowers, and besom heather, *E. scoparia*, with its smaller, inconspicuous wind-pollinated flowers. Imagine then, a heathland landscape with hundreds of different species of heather with flowers in shades of green, white, yellow, orange, pink through to red and from less than 1 mm up to 5 cm long, flowering all year round. Welcome to the Cape Floristic Region (CFR), a bota-

Fig. 1 a (above) and b (below) | *Erica tetralix* (Cross-leaved heath), and *E. cinerea* (Bell heather).



nically unique area around the size of Eastern Norway in the south-western corner of South Africa. Of the approximately 850 species of *Erica*, 700 of them are only found in the CFR.

The long-standing question in Cape *Erica* is ‘why so many species?’, whilst the increasingly urgent concern is now for their future: many are threatened with extinction by habitat destruction and transformation, invasive species, and climate change. What can be done about this? Join us for a snapshot of heather diversity on show in October of 2022 and hear about some of the things we are doing to tackle both questions.

A first peek into the fynbos

Throughout the trip to South Africa in October 2022, we documented observations of plants – and even some animals – including field photos of all specimens collected. On the open platform iNaturalist, we presented these in a dedicated project: <https://www.inaturalist.org/projects/erica-bunch-in-the-cape-ii-october-2022>, which can also display our activities on a map (Fig. 2). On arriving in the Cape, our first field visit

Fig. 2 | Team *Erica*'s iNaturalist observations, October 2022, projected on a Google map at inaturalist.org. Field sites denoted with letters are referred to in the text.



was to the Heuningsberg Nature Reserve at Bredasdorp (Fig. 2a), where we knew there to be an unusual form of *Erica plukenetii* (a species we will come back to). The reserve covers an area of relatively low-lying fynbos vegetation on the outskirts of the town.

‘Fynbos’ is the name for heathland in the Cape, which occurs on the coast and into the mountains on low nutrient soils in areas of relatively high rainfall (mean annual precipitation of 480 mm (Rebello & al., 2006)). The vegetation is dominated by ericas and other shrubs with ‘ericoid’ needle-like leaves, by different genera of the Southern Hemisphere plant families Restionaceae (rush-like plants known as Cape reeds) and Proteaceae (including the archetypal *Protea*, and the pincushions, genus *Leucospermum*; Fig. 3) and is otherwise home to an enormous number of other flowering plants that are adapted in different ways to the regular natural fires. In surrounding areas where the soil is richer, you might find remnants of a different vegetation – renosterveld. This has now almost entirely been transformed by agriculture – sacrificed to fruit trees and Cape wines. In drier areas, such as in the rain-shadows of the mountains or further inland, there is more arid vegetation rich in succulents. Spectacular, diverse habitats, but devoid of heathers: we focus on fynbos.

Fig. 3 | *Leucospermum cordifolium* (Proteaceae) flowering in the fynbos vegetation of the Heuningsberg Nature Reserve at Bredasdorp.



The approximately 700 species of Cape *Erica* are spread unevenly across the Cape Floristic Region, with some species more common and widespread whilst many others are restricted to sometimes very small parts of the complex mosaic of Cape Fold Mountains. The Mediterranean, winter rainfall climate of the south-western tip of the African continent shifts to summer rainfall going east, and with it, different suites of species. Even in the same area, species composition changes with elevation and with transitions between soil types, aspects, and other factors resulting in distinct local microhabitats.

The Heuningsberg Reserve is small and does not span a large elevational range, but nevertheless we immediately encountered a morphologically diverse set of different *Erica* species, collecting 10 species in flower. Five of these are illustrated in Fig. 4. From experience, we know that there are different species flowering throughout the year, and that they tend to blend invisibly into the fynbos vegetation when not in flower.

Local endemics in peril

The narrow distributions of many Cape species make them intrinsically vulnerable. Ploughing to plant rooibos plants,

Fig. 4 | Flowering Cape species at a single site at Bredasdorp, 5th October 2022: anticlockwise from top left, *Erica serrata*, *E. viscaria* ssp. *longifolia*, *E. bruniades*, *E. melastoma* var. *minor*, and *E. plukenetii*, top right: MP amongst the fynbos.



allowing an expansion of invasive Australian wattles, setting too many fires (or indeed preventing fire regeneration altogether), can have an enormous impact, and many species are threatened (Raimondo & al., 2009). We were privileged to be granted access to the protected locality of a critically endangered species, *Erica recurvata* (Fig. 5). Guided by Stephen Smuts (local conservation coordinator) and Dave McDonald (botanical specialist), a small group of *Erica* researchers visited the site near Napier, home to the only known population. The species is now only represented by a few dozen individuals in the wild but has been successfully brought into ‘ex situ’ conservation – protection outside of the native habitat – as plants at the South African National Biodiversity Institutes’ botanical gardens, particularly Kirstenbosch Botanic Garden in Cape Town. Certainly, ‘ex situ’ is a poor substitute for ‘in situ’ conservation – within the native habitat – but it may be the only means of avoiding extinction for the most critically endangered species.



Fig. 5 | Critically Endangered *Erica recurvata* in the collections at Kirstenbosch Botanic Garden, Cape Town.

Erica recurvata is a strikingly unusual *Erica* with unique floral morphology and could be an effective flagship species for *Erica* conservation campaigns if displayed as part of ex situ collections in botanic gardens more widely. To support *Erica* conservation through the international community of botanic gardens, we established the Global Conservation Consortium for *Erica* under the auspices of Botanic Gardens Conservation International (BGCI) <https://www.globalconservationconsortia.org/gcc/erica/> (see (Pirie & al., 2022b) summarised in Norwegian in (Pirie & al., 2022a). One of our aims for the living collections at the Bergen University Gardens is to bring in priority threatened species to conserve and display to the public as part of this distributed conservation collection. Moving biodiversity out of the country of origin is a sensitive topic. We hope to facilitate this in a way that will be acceptable, by collaborating with local organisations within the regulatory framework of the Convention on Biological Diversity (CBD, 2006).

Fig. 6 | Just part of the variability of flowers of *Erica plukenetii*. Bottom right: *E. plukenetii* ssp. *plukenetii* and ssp. *penicellata* at Fern Kloof; Left: ssp. *bredensis* at De Hoop; top right: a hard-to-place form at Bredasdorp.



Fynbos of the south coast, and a diversity of

Erica plukenetii

Travelling east to the Fern Kloof Nature Reserve (Fig. 2b), we followed fynbos up from the edge of the coastal town of Hermanus into the mountains. Blue skies transformed into cloud cover at the plateau. Our finds included a mixture of distinct forms of *Erica plukenetii*: one of *E. plukenetii* ssp. *plukenetii* with small sepals, and of ssp. *penicellata*, characterised by long, deeply grooved sepals with protuberances at the base, plus individuals that appeared intermediate between the two (Fig. 6).

Erica plukenetii is an excellent example of a widespread and enormously variable Cape *Erica*. Five subspecies are currently recognised (Oliver & Oliver, 2002) – these are formally described, much like species, but represent distinct forms of the same species. Flowers of *Erica plukenetii* appear in a range of colours and shapes but most, including all in Fig. 6, are otherwise typical of pollination by the short-billed orange breasted sunbird. Of two major exceptions, a small, night scented, white-flowered form is recognised as *E. plukenetii* ssp. *breviflora* and has been shown to be pollinated by short-tongued noctuid moths, and a much larger-flowered form, currently considered just part of the wide range of variation included in *E. plukenetii* ssp. *plukenetii*, is pollinated by the long-bea-

Fig. 7 | *Erica regia* at the De Hoop Nature Reserve.



ked malachite sunbird (Van Der Niet & al., 2014). These are important differences because they restrict cross-pollination, keeping populations separated. Populations visited by different pollinators might already represent independently evolving species that have diverged in other traits – such as tolerance of particular kinds of soils.

At De Hoop Nature Reserve (Fig. 2c), also on the coast, the soils have a much higher pH due to the underlying limestone sediments, and there are several *Ericas* that are only found there. One is *Erica regia* ssp. *marinae*, tall growing rather spindly plants with deep red long-tubed flowers (Fig. 7). There are also further special forms of *Erica plukenetii*: including ssp. *bredensis* which we found on the Potberg trail at de Hoop (Fig. 6).

Riviersonderend Mountains, and we are preceded by fire

Past the town of McGregor, a popular hiking trail leads up and across the Riviersonderend Mountains (Fig. 2d) and south to the town of Greyton. Here, we were faced with an important – if inconvenient – feature of fynbos ecology: fire (Fig. 8). No botanists were risked: the fires had passed through months previously. Orchid and iris specialists jump at the possibility to visit fynbos after fire, because this is the moment that bulbs, dormant under the soil while the vegetation grows up around them, emerge and flower. By contrast, individuals of most *Erica* species are killed by fires, their seeds requiring the resulting smoke to stimulate germination, after which they often require several years before flowering. Some species have a different strategy, building woody stems under the ground from which they can resprout after fire. There was no shortage of the common and widespread ‘re-sprouter’ species *E. coccinea* and *E. cerinthoides*, though we also found some identifiable patches of our key ‘re-seeder’ species, such as *E. plukenetii* ssp. *plukenetii*, that had escaped the flames.

Hex River Mountains

Although the Cape climate at sea level is Mediterranean, you can find an alpine-like environment in the higher mountains in the Cape, and even go skiing in winter. Out of season, ski huts can be used by hikers on the lookout for species adapted to winter freezing temperatures and coverings of snow. The University of Cape Town’s Mountain Club maintains a hut in the south-eastern corner of the Hex River Mountains near Waaihoek peak (Fig. 2e), its sanitary facilities glorying in the name ‘the loo with a view’ (Fig. 9).

We hiked up and spent the night there before returning

the following day. Our main target was *E. goatcheriana* ssp. *goatcheriana*, which we found growing in fynbos otherwise dominated by restios. The star turn, however, was provided by species growing in rock crevices on the plateau: one, *Erica cameronii*, producing enormous bright red flowers (Fig. 10).

The Langeberg

The Cape Fold Mountains extend east, parallel to the south coast, in a range called the Langeberg – the long mountain. At regular intervals, the mountains are crossed by passes, allowing access to the fynbos found at higher elevations. The low nutrient status of soils that support fynbos is due to the largely quartzite or sandstone underlying rocks. There are different plant adaptations to low nutrient soils, but perhaps the most fascinating is carnivory. Across the sites we visited, we found species of sundew, *Drosera*, with their sticky flypaper leaves (Fig. 11), and on the Sleeping Beauty trail leading from Garcia's Pass (Fig. 2f), we also found *Utricularia*, which captures supplementary nitrogen by means of traps on their submerged roots that rapidly suck in and digest prey that triggers them in passing.

Hottentots Holland Nature Reserve

Our final site was to the area of Landdroskop in the Hot-

Fig. 8 | The trail leads to Greyton – but the fynbos vegetation has recently burned.

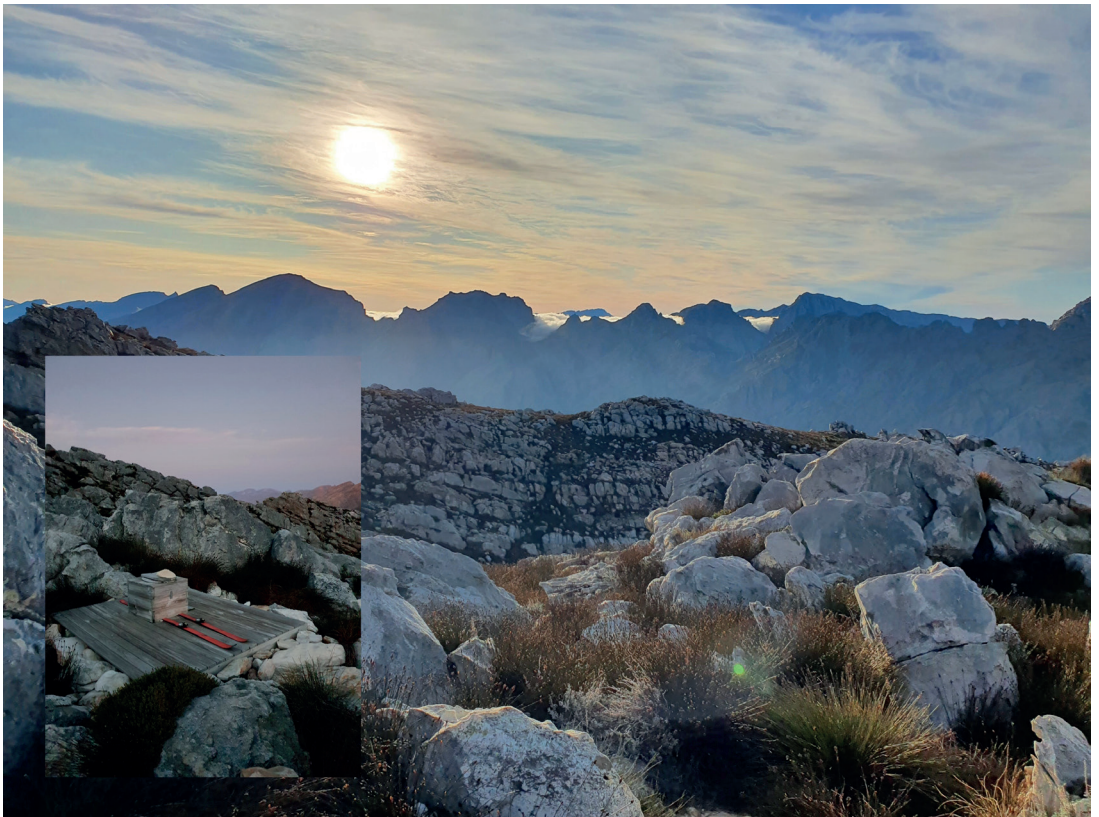


tentots Holland Nature Reserve (Fig. 2g). Even within the biodiversity hotspot that is the CFR, species richness is not distributed evenly, and here in the south-western corner of the Western Cape, we were close to the epicentre of Cape and *Erica* species diversity. At the plateau, we were met by a mass flowering of *Erica fastigiata* (Fig. 12), turning the hillsides pink, and 20 different identifiable species within a few kilometres of Cape Nature’s idyllically placed Landdroskop hut.

A meeting of minds and the way forward

During the trip, we held an *Erica* conservation and research meeting at SANBI’s research centre at Kirstenbosch Botanic Garden in Cape Town. There were 17 participants in person, with at least a further 17 online including several from botanic gardens and universities in Italy, Spain, Switzerland, and the UK. Talks covered topics from conservation (of threatened species and habitats), pollination ecology (understanding interactions between flowering plants and their – sometimes highly specific – pollinators), phylogeography (reconstructing past shifts in geographic distribution of populations through time), and anatomy (in this case, the structure of

Fig. 9 | The view from the loo (inset) near Waaihoek peak, high in the Hex River Mts.



heather wood and its adaptations to drought and cold stress). Most presenters agreed to make their talks openly available, and they can be watched on the UM University Gardens' YouTube channel. Afterwards, participants joined the manager of the *Erica* living collections at Kirstenbosch Botanical Garden for a tour behind the scenes at the nursery (Fig. 13).

During the meeting's discussion forum, we covered topics including funding, objectives, and priorities for the different participants, needs for data and taxonomic expertise, and possibilities for collaboration.

With large plant groups such as *Erica*, identifying specimens is far from a trivial task. Vanishingly few people know more than a small proportion of the species by sight, many are distinguished by minute characteristics such as appendages on the anthers or numbers of chambers or ovules in the ovary, and widespread species such as *Erica plukenetii* can vary dramatically in appearance across their range. Taxonomic experts such as E.G.H. Oliver have described and documented the differences between many species in a series of

Fig. 10 | Surviving in rock crevices: *Erica cameronii* (TE inset).





Fig. 11 | *Drosera cistiflora* at the Hex River Mts.

publications (such as (Baker & Oliver, 1967; Oliver, 2000)) and even produced an electronic identification aid that can help narrow down the possibilities through selecting from a limited number of diagnostic characters (Oliver & Forshaw, 2012). One result of the meeting was agreeing to update and improve this ID aid, and we have already made a new version available (<https://www.proteaatlas.org.za/ericakey.htm>). With careful observation, documentation, and the use of these tools, it is possible to come to a likely suspect in many cases. By using iNaturalist, we are also able to share the task with a community of enthusiasts, including many experts in their local floras, who can suggest identifications or point out the extra information needed to come to a name.

Species identification is only possible if we have adequate knowledge of species and their natural variation. Of the 114 herbarium collections we made during the trip, we have identified 65 different *Erica* species. We collected 2 or more examples of 14 species in different places, including 21 examples of the various forms of *E. plukenetii*, some of which do not fit the current descriptions for formally recognised subspecies.



Those are one of our ongoing research priorities. If a species (or subspecies) is not formally named, its threat of extinction in the wild cannot be formally assessed, and it cannot be protected effectively. We will work with our international partners to address this across *Erica* in the coming years, combining traditional approaches with modern molecular methods to better understand and describe species diversity.

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Fig. 12 | *Erica fastigiata* at the Hottentots Holland Nature Reserve.

for study to herbarium BG at Bergen's University Museum. We are grateful to the staff at the Compton herbarium at SANBI for further assistance. In addition to Stephen Smuts and Dave McDonald, we were grateful to be joined in the field by Seth Musker (University of Bayreuth), Timo van der Niet (University of KwaZulu-Natal - UKZN), and Anina Coetzee (Nelson Mandela University - NMU), and Corinne Merry, and to Nicola Bergh and Tony Verboom for hosting us in Cape Town.

Fig. 13 | participants at the *Erica* conservation and research meeting; bottom left TE and MK are introduced to part of the *Erica* propagation process by Benjamin Festus, manager of the *Erica* collections at Kirstenbosch Botanic Garden.



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