

The Western Cape of South Africa

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1 Introduction

On 22nd of September 2014 I travelled to Cape Town with Alex Summers from Cambridge University Botanic Garden and Bob Wooding from RBG Kew, this article is an account of the following two week period.

The smallest plant kingdom in the world is an obvious destination for anybody inclined towards the study of nature; Darwin famously referred to the diversity of the angiosperms as a 'diabolical mystery' but the geological, climatic and ecological foundations of life in the Cape Floristic Kingdom are so starkly heterogeneous that rampant speciation should probably be expected.

Even so it is startling to see such diversity, many of our hosts enjoyed asserting that table mountain is home to more species than the UK. Of the 9000 species which exist in the CFK 6000 are endemic and many are critically endangered. The need to safeguard the richness of the CFK is a profoundly important issue; urban expansion

and non-native invasive species are causing irreparable species loss. Observing the key role of horticulture within this paradigm of conservation management we have sought to gather experience in the cultivation of Cape plants for our own ex-situ collections, and to understand the markedly different position of horticulture in the Western Cape, where the primary focus is on representation and active rehabilitation of the native floras in the vicinity of the gardens. The connections between horticulture and habitat are strong in the Cape, for this reason part 1 of the document presents a series of field day accounts, while part 2 describes the horticultural practices witnessed at botanical institutes.

2 The Vegetation

A helpful yet simplified explanation of the Cape Floristic Region is that its existence is to a large extent governed by the geology of the Cape Fold Belt and the climatic conditions driven by the Agulhas ocean current. It has two principal components, the Fynbos and Succulent Karoo biomes. Small patches of Albany Thicket are also present around the South coast between George and Port Elisabeth, the Easterly extent of the CFR. Levels of local and regional endemism approach 70 percent in the Fynbos and there are 82 distinct vegetation units within 9 geologically defined categories, and this does not include the related Renosterveld and Strandveld vegetation. As the smallest floral kingdom on Earth many UK botanic gardens see fit to make representations of the flora, and often settle on exhibiting the Fynbos flora, usually in an area between 10 to 100 square meters. In our view this approach is ineffective; firstly because the interpretative value of the display is diminished, a phytogeographic exhibit which purports to represent such diversity through the display of a handful of plants in a greenhouse is simple to the point of dishonesty. Secondly, on a practical design level, it is easier and often more effective to narrow the palette of plants with which to design, this approach would allow the continual development of display collections focusing on a different vegetation types. Furthermore redeveloping displays along a similar time frame as their natural disturbance through fire dictates would provide a constant source of interest for both visitors and staff, potentially enhancing both the profile of a garden and the skill levels of horticulturists.

2.1 Fynbos

2.1.1 Jonkershoek

About four miles outside Kirstenbosch the Jonkershoek valley is a boundary line between the managed environment of timber forestry and the relative wilderness of the fold mountain ranges. The transition is surprisingly rapid; a manned gate on a dirt track leads towards the trail head at the farthest point of the loop road, for the first few kilometres we make good progress, passing through felled timber-land we are ushered on past sporadic roadside flowers by Miles, a student from Cornell who knows what lies ahead. When we hit the forestry line the car stops.

It is a humbling experience for a group of trained horticulturists to arrive in an area of such diversity 'what's that?' is a question which is quickly replaced with 'what could this be?' and 'Jesus, what do I actually know?'. For a visitor to understand anything of the cape flora it is important to return to first principles and look thoroughly at anatomy rather than rely on presumptions and general appearance, field botanising takes a lot of time and our pace slows dramatically. Our modest intention for the afternoon was to walk to the first waterfall on the trail, and even this begins to appear far-fetched.

Stuart Hall is a PhD student at Stellenbosch, his neighbour Pete is a biologist running a field project investigating effects of bird pollination on vegetation composition, the hillsides are speckled with nets to keep birds from his study areas. A parallel project is assessing the relationships between the vegetation pollinating insects. These investigations are being conducted in an area which is also managed for recreational pursuits such as hiking and mountain biking; narrow trails run through the scrub and skirt the feet of vertical crags which encircle the valley, our trail traverses the scree deposited below these cliffs and follows the river upstream for several kilometres. The walk in always takes far longer than the walk out, so never turn back at half time. The distractions come thick and fast, *Gladiolous alatus* is the first shocker and warrants, in old money at least, several rolls of film. *Lachanelia* is a curious genus of established horticultural merit, the striking thing about seeing them as part of the vegetation is that while many other plants exist as large populations *Lachanelia* are most frequently found as isolated individuals, this is true of other geophytic flora found in the more densely vegetated areas, perhaps they struggle to compete or perhaps we struggle to see them. The core shrubs of the area are the *Protea* and *Erica*, these share the landscape with members of the *Restionaceae*. The earth appears almost entirely mineral; coarse grained sandstone bakes well, even in the modest spring sun, and it holds very little water. This affects the vegetation in astonishing and predictable but well documented ways, it therefore comes as a welcome surprise when we turn right up a track towards the waterfall. Every few meters new plants are encountered as the mist from the plunge pool and the shade cast by the steep valley sides allows for more

Figure 1: *Gladiolous* on forestry line



verdant growth, this change in conditions is typified by the presence of *Sellaginella* on the rocky sides of the gorge.

Figure 2: *Erica cerinthoides*, a beautiful plant widespread in the Western Cape.



2.1.2 Bainskloof Pass

During our stay in The Cape we make two trips to Bainskloof pass; the first is incidental as we are returning from a day out at the Karoo Botanic Garden, the second is a shameless act of plant-twitching.

There are a couple of routes from Worcester to Stellenbosch, one of the most scenic includes Bainskloof Pass. Built in 1853 the pass remains as a feat of engineering and a monument to the bodies of convicts wrecked during its construction, it is the oldest mountain pass connecting cape town to the fertile land East. The sandstone

Figure 3: Exploring outcrops of Bainskloof Pass



outcrops we see are in their glory days, sculpted into fragile flakes and sweeping curves which will be river sand in the blink of a geologists eye. These rocks provide a range of habitats and are frequently occupied by plants fascinating to us for both their beauty and scarcity; of particular interest is *Nevenia stokei*, a member of the *Iridaceae* with an ancestral woody growth form, it grows in the most unlikely positions and when seen it is usually hanging out of a small cleft in the side of a crag. The vegetation is sparse enough to pass through and mainly grows to about 1m, *Serruria*, a genus previously unknown to us from the *Proteaceae*, is found in several types of fynbos and warrants recognition for its stunning flowers and compact habit.

As we cross a river to arrive at a track which follows the Bobbejaan river towards a large waterfall we encounter many different micro-habitats. Plant species are present in niches, and the main constituent species are more or less dominant depending on proximity to water, wind shelter, aspect, slope and shade. Some of the paths we walk on are sodden and muddy, with little *Drosera* and *Utricularia* growing in them. We have come for *Drosera regia*, there are three populations of this plant in the world, and as time passes our expectation of finding any of them begin to fade. The ground in these areas reminds me of boggy moorlands in the UK; spongy to walk on, the mud kept in check by the presence of so much sand. Some of the puddles have tadpoles and frogs in them. *Drosera regia* is supposedly growing in a seep, an area of the mountainside kept damp by water consistently flowing from higher up. We try to look for plants that might suggest sodden ground. Late in the afternoon we hear an exaltation a few hundred yards ahead, Martin has found them in a seep well disguised by many close growing grasses and Restios. I was expecting them to stand out clearly to a searching eye, to glisten in the sunlight, and for the red glandular hairs to be obvious amongst so much green and brown, but as it turned out, the shining of the golden grasses, and the mottled burnished tones of the grasses and restios growing together made for pretty effective camouflage. I also expected them to be growing where they would have space for their leaves to move around their prey and not become stuck to neighbouring plants, but they grew in amongst the grasses. The plants are stunning, far larger than the specimens at RBG Kew. Leaves grow from a tapering fleshy base, which is anchored into soil with thick fleshy roots.

Figure 4: Martin Smit in *Drosera regia* habitat



Figure 5: *Drosera regia*



2.1.3 Marmare commonage and Blaumberg

Stuart lives on Jonkershoek road, about 3Km from the entrance to the park in a simple cottage with two Alsations which scare everybody but are far more companionable than razor-wire. We met while he was researching smoke effects on Cape Flat Sands species in the MSB at Wakehurst Place earlier in the year, his research at Stellenbosch focuses on the restoration of the Cape Flat Sands. His enthusiasm for the topic is moving, particularly given the near impossibility of the situation; the area is flanked by expanding townships and dominated by *Acacia saligna*, it takes a thick skin to work as a conservation ecologist in an area under such unrelenting attack. The *Acacia*, 'Port Jackson' is its common name, is incredibly well suited to life in the

Figure 6: Stuart Hall at a Blaumberg restoration plot



Cape Flats, being from a fire regulated environment and with vigour which greatly exceeds the native species it has long been considered enemy number one in terms of invasive species; seed viability is long and dormancy is broken by similar fire triggers to many fynbos species, germination is reliable, it survives fires which it intensifies, thereby killing native species and it resprouts when you cut it down. Stuart's figures show that to clear an hectare of *A. saligna* takes 700 man-days, and following that when a burn occurs dormancy is broken and the seed-bank rears its ugly head.

But the flora is stunning, the emergent growth following clearance revealed some stunning flowers which merely hinted at the spectacle we would be treated to at Marmare common, the reference site of almost pristine CFS fynbos which served as the benchmark for Stuarts toils.

The flora at Marmare common is simply overwhelming and it quickly becomes clear where Stuarts enthusiasm comes from, this area is on the outskirts of Atlantis, a 15 year old urban planning failure and the entrance is a dumping ground for rubbish, but after a short drive up a sand track the world outside is quickly forgotten. The ground is pure white sand which is strongly acidic and retains very little moisture; we arrive during a morning rain and by the time we return to the car the ground appears completely dry again. The flats are in fact gently undulating and have the look of a vast dune complex, the vegetation is ericoid shrubland with a strong asteraceous component, we also find *Serruria decipiens* and *S. cyanoides* which add considerably to our interest in the genus. around and between these shrubs is a wealth of geophytes and perennial herbaceous plants including the spiral leaved *Gethyllis* and *Babiana ringens* an outstanding plants with an unusual rigid growth which serves as a perch for pollinating sunbirds. 80 percent of the Cape Flat Sand Fynbos has already been transformed and the vegetation is considered critically endangered, with only 1 percent statutorily conserved, a symbolic flower of the vegetation is *Disa barbata* which has been the subject of conservation efforts in the Kennelworth Racetrack.

Figure 7: *Leucospermum hypophyllocarpodendron*, an unusual ground flowering species.



2.1.4 Table mountain

Meeting experts is exhausting, so we took our own company up table mountain for a days rest. We had been informed time and again that this hill was host to a greater number of plant species than the British Isles. But undaunted we strode out armed only with a map scribbled in pencil on a scrunched up scrap of paper and a copy of The Levyns Guide to Plant Genera. Along the roadside we encounter far more *Lachanelia* than we have seen in previous excursions, but again they are emerging from the most unlikely patches of compacted trampled verge. The typical mosaic of *Erica/Restio/Protea* shrub vegetation covers the lower scree slopes of the mountain, but as we ascend Platyklep gorge and the gradient steepens, the shrub layer thins out and many geophytes, succulents, chasmophytes and cremnophytes can be found.

The top of table mountain is usually draped in cloud so we are expecting to get a little wet, as it happens we arrive at the summit in clear sunshine and can see down towards cape point in the south and across to the flats beyond Capetown. What has happened is that the cable car which we planned to descend in is not operating due to high winds and the temperature has dropped significantly, it is little wonder there is such a great diversity of species on the mountain, where conditions are so variable. Kirstenbosch is only down the road, perhaps 2 miles away, and it receives less than half the rainfall which drops on table mountain, and there are also frosts up here during the winter months. The mountain top itself is an undulating plateau of hard sandstone, with very little accumulation of organic matter, plants grow out of cracks in the rock and anywhere where some relative protection from the wind is afforded. What soil there is up here consists of a couple of inches of acid lithosol, a material which looks like gritty sedge peat.

Management of the area is interesting; the cable car acts as the honey pot, drawing the majority of visitors and the area around the top of the car has interpretation panels and concrete paths which fan out for about half an acre. It is clear that this area is affected by visitors far more than the rest of the mountain, which is cut by a few rough tracks, for such an iconic area it seems to be enduring the footfall well, perhaps because the whole Cape Peninsula area is governed as a national park, there is little ingress of alien weeds and the vegetation type (Cape Peninsula Sandstone Fynbos) is considered to be the most studied and least threatened.

2.1.5 Grootbos

Prior to venturing East we had been informed of the impressive work at Grootbos; the reserve has established a reputation as one of the most successful restoration projects in the Western Cape and the scale of the project is astounding. The Grootbos reserve is 2500 Ha, and the conservancy exists as a co-operative conservation programme incorporating 17 land owners, it is the expressed intention of Sean Privet, manager of the Grootbos conservancy, to expand and form a functional corridor covering much of the Walkers Bay region.

Lily, our host manages the Grootbos Foundation, a third branch of the enterprise which gains funding as a social development programme training and employing young people from deprived areas, there is a nursery and farm shop on site and trainees work in the reserve and receive some horticultural training. Lily lives in Stanford with her mother Sanette and their house doubles as an art studio; many of the small towns in the area have an air of creativity which feeds the artistic whims and nostalgia of Cape towns wealthier residents. They make a hearty breakfast which sets us up well for a day out in the field. The previous evening we had bumped into Michael, the owner of Grootbos over dinner and the following morning we were invited for coffee with him and Sean. Michael is a driven businessman and it is fortunate that he has a fondness for the native flora; if his interests lay in livestock the whole region would look very different. He appears tireless in his efforts to drive the agenda of Grootbos and has a pragmatic approach to the kind of projects other people would dismiss as flights of fancy. Sean is the ideal botanist for this kind of project, he has accumulated an extensive knowledge of the local flora and works damn hard because he is aware of what failure means for the ecology of the area.

Sean takes us for a drive out into the reserve, the Grootbos field guide identifies over 20 vegetation types, whereas the SANBI vegetation survey identifies only recognises only three, neither is incorrect but issues of resolution are complicated in a region so diverse that any detailed view reveals a mosaic. The first vegetation type we visit is Overberg Dune Strandveld, the effects of land management are clear; as we drive up a track a fire break to our right is showing signs of emergent vegetation; *Gladiolous*, *Satyrium*, *Disa* members of the *Campanulaceae* these plants are growing vigorously in the tatters of the flailed shrub vegetation whereas once among the shrubs they are generally dormant. As with other areas visited it is fire which governs the vegetation, beyond the break is an area of over 1000 hectares which needs to be burned, this is evident from the density of the shrub layer but also by the presence of *Knowltonia*, a pretty member of the *Ranunculaceae* which requires shade and therefore serves as a bio-indicator of overdeveloped shrubland.

Fire is necessary for the maintenance of the vegetation and also for the security of the reserve; less than two years after the construction of a top-end eco-lodge 60000 Ha of land, the entire lodge and most of the farms in the area were consumed by a vast fire. The dynamics of fires are complicated and the natural periodicity can only be guessed at, if accompanied by a S.E. wind the fire will burn hotter and rip through a far greater area than if northerly winds drive the fire towards the coast and keep it from the inland hills. These S.E. fires occur at 15 - 25 year intervals, whereas fires of some sort tend to sweep through every 5 - 10 years. The extent of the destruction depends on topography, vegetation, weather and geology; thicket species occupy dune slacks where higher levels of soil moisture limit damage in all but the fiercest fires. Similarly the calcrete substrate of the milkwood forest areas provides a buffer which has afforded the development of a significant canopy and a richer bryophyte flora than is found elsewhere. As the track fades into trail we pull over and take a walk up an outcrop dominated by *Leucospermum* and *Protea obtusifolia*, this is Agulhas Limestone Fynbos and fortunately for us is in full flower, less fortunate is the heavy rain, though this does bring forth a chorus of frogs. *Leucospermum* flowers are a marvel of co-evolution showing sunbird specific polination morphology and aliases on seeds which implicate ants in their dispersal. They also exhibit secondary pollen presentation, it is hard not to think of them as being clever.

Certainly they are far better adapted to their environment than English gardeners are, in the afternoon we take a hike along a stream and into a gorge where the scent of mammal rests heavily in the air, we hear barking and the sound of cracking branches. Why did nobody mention the baboons? They flank us as we walk up a trail between two hills, screaming and lunging through the vegetation. We each wield a rock in one hand and a large stick in the other, cold sweat and eyes wide we tramp past them to the top of the hill where we are greeted by a beautiful *Drosera* which we have still not identified. When we get back we are invited into a rangers house for a glass of wine, he tells us the baboons are harmless, but he also thinks *Morea* is a weed.

Figure 8: Lush milkwood forest exists in damper areas of the reserve

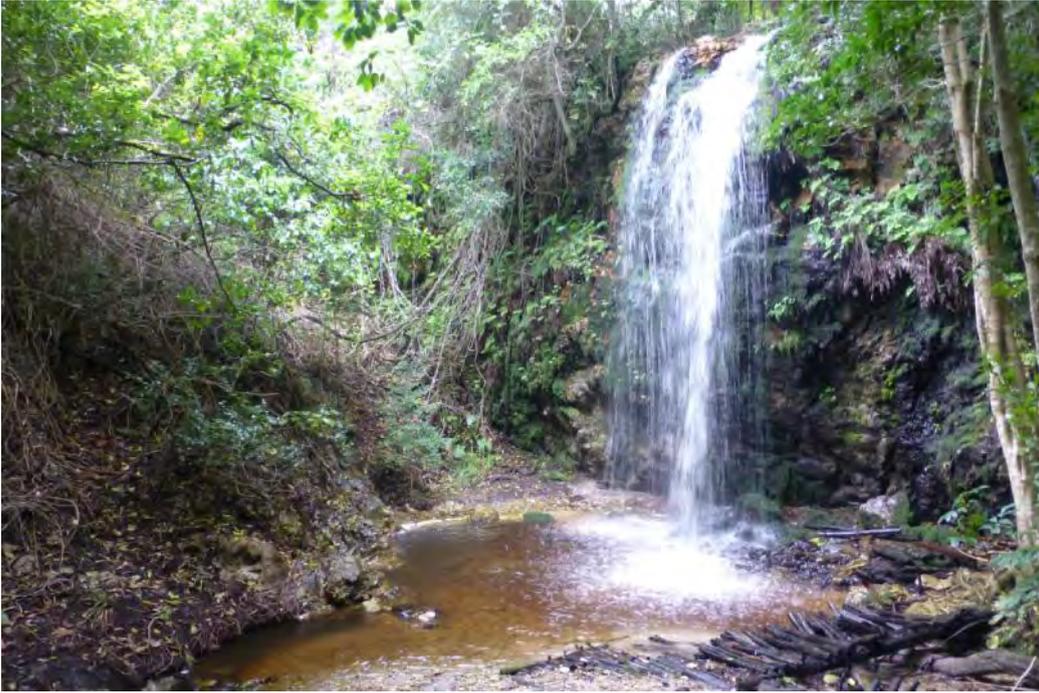


Figure 9: *Drosera* sp. The leaves are 10cm long.



2.2 Renosterveld

'Shrubby grassland or grassy shrubland?' this seemingly absurd question caught my attention as a headline in Veld and Flora. The question is actually one of prehistoric agricultural practice and changes in land use over several thousand years. Renosterveld currently appears intangible; we have the scraps of relics to interpret a thing which may have existed in contexts we may never understand. But this is the long view back. More pressing is the rapid loss of this vegetation type to modern agriculture in the last hundred years. It is a vegetation type which is home to the greatest diversity of geophytes on Earth and only a tiny fraction of it is afforded statutory protection.

2.2.1 Tienie Versveld

It is Braai (barbecue) Day, officially known as heritage day, and originally a celebration of the Zulu King Shaka, but as the Afrikaans language itself shows us, culture is an accumulative and adaptive process, lest we forget. Brai Day means day trips so we head North with Martin, Marenka and their daughter Aria towards West Coast National Park, on the way we stop off at Tienie Versveld.

Tienie Versveld is one of the few protected areas of Swartland Granite Renosterveld, due to its topography and soils 80 percent of this vegetation type has already been taken by agriculture, the reserve lies N.E. of Darling on the R315. There are no bells and whistles about the place, we pull over to the side of the road and hop over a stile where a simple but thorough bit of interpretation explains the significance of the area. It reminds me of places I visited with my uncle while young, back when information boards were written by experts and not professional storytellers.

We have come for the geophytes and we are not disappointed. The mass flowering of daises peaked about two weeks previously, following seasonal rains which occur almost entirely between May and August, but now an array of *Geissorhiza radicans*, *Mansonina* and *Wachendorfia thyrsiflora* fan out from paths trodden through the low vegetation. The diversity of the area is startling, though the productivity appears to be fairly low, perhaps this is why the area remains while others have fallen under the plough, the earth appears particularly sodden in low areas and the ground is very firm, *Drosera* and a succulent reminiscent of *Salicornia*, with their novel adaptations to life in arduous conditions illustrate the challenges presented to plants growing here.

Figure 10: *geissorhiza radicans*



Figure 11: A locally endemic red form of *Drosera*
.JPG



During July Stuart joined us on a field trip to West Wales, at St. Davids head he kept saying how similar the landscape was to parts of the Cape. It's hard to believe, but it is true; at West Coast National Park barren rocky outcrops with low grass cover the upper slopes, there are sclerophyllus shrubs below and succulent vegetation near the coast, just as it is in Wales. The big picture is similar, but the differences are exciting. *Laperousia* is a genus pollinated by long proboscis nemestrinid flies, as such the flowers have long tubes and often have colourful 'nectar-guide' markings on the petals, it grows in the nutrient poor reddish sandy soils. Aloes grow out of bare granite alongside *Andromischus*, and even stunted *Salvia africana*. The grasslands are occupied by Springbok, Emu, Zebra and a host of other beautiful and delicious animals we have been enjoying as dried snacks for the last week. In the evening we barbecue snoek, an abundant fish with firm texture and quite strong flavour in a marinade of apricot jam, olive oil and garlic. We toast to the days adventures while a whale plays out at sea.

2.2.2 Around Barrydale

The areas around Barrydale are largely composed of Montagu Shale Renosterveld, though this vegetation type has common components with Karoo units. Our first day in the field takes us into the hills just north of the town. The principal shrub vegetation is of *Elytropappus rhinocerotis*, it takes a while to get your eye in and see through the shrubs to the low and diverse succulent vegetation which lies below. The finest and most accessible displays of these plants are on south facing bluffs where the folded shale juts out in bands providing an array of moister crevices.

At the top of the hill quartz becomes abundant and the change in exposure and the physical properties of the soil is expressed in the growth forms; vegetation is far sparser here, and what does exist is radically stunted, a good example is *Trichodeadema* which is barely perceptible from the soil surface. As we pass along the trail many incredible plants are found, one of the finest being a group of *Boophone* which are situated just off the path, their presence here is surprising to Hildegard Crous, our guide because they are fine old specimens which would fetch a high price. One of the biggest conservation problems in this area is illegal plant collection, another is a lack of study and solid survey work.

During this excursion we experimented with the use of 'Biology Sample Collector', a mobile phone app. which plots photographs over a GPS derived route map, the results are useful but concerns are raised over the open availability of location data of rare taxa. A similar issue is raised over I-Spot, a location programme which is widely used by CREW, the Custodians of Rare and Endangered Wild flowers. The dissemination of information

Figure 12: shale outcrop above Barrydale



has great potential benefits but also has potential consequences because it provides a short-cut for unscrupulous collectors.

The following day we take a short trip to a field just South of Barrydale to have a look at *Bartholina etheliae* a beautiful terrestrial orchid which grows under the renosterbos shrub layer alongside a species of *Holothrix*. *B. etheliae* is a rare and locally distributed species and the field in which we find it is a stones throw from a large fruit farm, the plant appears to prefer rockier ground and it seems likely that this may act in its favour as any farmer would have to think twice about annexing this patch of land. The soil is stony and clayey, we take a sample back to Hildegard's lab and discover that it has a pH of 4.6!

Figure 13: *Bartholina etheliae*



3 The Collections

3.1 Stellenbosch

Martin Smit has held the post of Curator at Stellenbosch Botanic Garden for a little under two years. The garden stands apart from the SANBI gardens in that it holds exotic collections as well as representing native flora. It is a small site which holds a central location within the town. These factors, combined with an open door policy make it one of the most publicly used gardens in the country.

A central question which occupies most gardens is 'why do we grow these plants' and so it is at Stellenbosch. The story is familiar, charting a course through a backlog of dormant research projects is a daunting task and preservationist attitudes must be measured against the call for constant change. Martin has keen an interest in ethnobotany and has established a project with a local bossidoctor to explain the traditional medicinal value of the plants held in the garden, some of which are incredibly old specimens. Something Miles and Martin have been working on is setting up the Iris database system, something they are particularly keen on, and may be worth exploring further.

The design of the garden has strong Italian influences with strong lines of symmetry and simple geometric shapes which underpin the planting schemes. A central house used to function as a recording studio but is now used as a cafe which provides valuable revenue to the garden. Much of the produce for the cafe is provided by Babel, a private farm working in coloboration with Cape Nature and the Biodiversity and Wine Initiative to run a profitable, sustainable business that actively works to support the conservation requirements of the area. The garden is also home to a large collection of bonsai trees, and during the course of the morning we meet the president of the South African Bonsai Society who explains the significance of the collection and proudly tells us that there are a number of internationally recognised bonsai styles attributable to South Africa.

3.2 Kirstenbosch

At Kirstenbosch National Botanical Garden, we were fortunate enough to be given tours of the collections by two very knowledgeable horticulturists, Graham Duncan and Anthony Hitchcock. We were met by Graham, who took us first to view the conservatory. In the warm, seasonally wet climate of the cape, the glasshouse serves to protect from excess water rather than cold. Annual temperatures in the conservatory naturally range from 7-37°C thereby eliminating the need for heating, and this along with protection from rain enables the cultivation of plants from very dry areas such as Namibia, Angola and Namaqualand. Good ventilation is essential for these collections, and is achieved by having open-slatted lower windows to ensure air movement at ground level, and fans in the top of the house to circulate air further. Smaller side rooms contain a Fern collection grown alongside riverine forest species, and bulb displays, which are all protected with canvas shading in the hotter months. Bulbs temporarily displayed are in terracotta pots in front of raised beds containing special permanent plantings such *Brunsvigia josephinae*, *Boophone disticha* and *Scadoxus nutans*. Another side room contained a wonderful Namib desert display with *Welwitschia* and flowering *Hoodia parviflora*. In the staff room we met Anthony Hitchcock, the gardens *Erica* specialist. He gave us a tour of his collections and at our request also provided us with a wealth of information about conservation projects in the Western Cape, as this is the principal function of the garden. Conservation is the foundation on which all the nursery collections are built. In a country so rich in diversity, and where economic progress and development are so important, it is essential for conservationists to focus on directly threatened species. It would be close to impossible to introduce all threatened species to cultivation, as there are simply too many. Many fynbos species are difficult to cultivate, short lived and susceptible to disease, thereby increasing the time and resources needed for their care. For example, *Proteas* quickly become old and woody, and *Mimetes* are very susceptible to phytophthora. When collecting material, provenance information is essential, and often displayed on plant labels, this is important because while species names may come and go, populations are safe from the whims of taxonomists. Many current conservation projects linked to Kirstenbosch focus on winter rainfall geophyte flora as urban sprawl in the lowland areas threatens these the most. Many people responsible for development do not realise that these species and habitats are not the same as ones in the already preserved (and less commercially valuable) mountainous areas.

Within the conservation network, there is masses of work to be done. Flora recovery time is different in different rainfall areas, there are varied opinions on how regular burns should be, and many other variables and issues are still being worked out. There is a need for more test sites and protocols for in situ conservation. But back to the ex situ conservation. South-facing stockbeds are utilised for *Proteas*, and watered regularly only in winter; in the summer they are kept very dry to prevent disease. Cultivation is improved by using stockbeds, and these are a far more efficient use of space than pots. These plants provide source material for restoration work. The bed mix contains 6-12mm milled pine bark, industrial sand of 6.5pH, and Malmesbury sand, which is less acidic, but provides better structure. *Protea* are sown directly into these stockbeds, *Erica* and *Restio* into trays containing the same mix. Seedlings are transferred into 5cm fluted plugs kept in metal grids, enabling

them to dry quicker. Care is taken to keep moisture off leaves to prevent fungal infections and disease. All plants are fed with organic liquid seaweed based feed. Osmocote is sometimes used but there are some *Erica* that don't respond well to it. In these cases they have tried Bounce Back, which gives a boost of energy at first application, but has led to scorching in the long run. *Erica* seedlings are pinched out when only 1 inch tall, as regular pruning from an early age helps to keep cultivated specimens compact and vigorous. This is particularly true of *Erica* that resprout after fire, rather than regrowing from seed. If *Erica* have been left for many years without pruning, regenerative pruning will encourage resprouters, and if the habit of the plant is ruined it will at least provide good cutting material. Re-seeders will not respond well to hard pruning. One simple tip can help with *Erica* cultivation; if foliage is green and soft it comes from a seep area, tougher more silver or scaly forms are from a dry habitat.

To propagate *Erica* from cuttings, use a bark and polystyrene or peat/perlite mix. Take heels from the lower half of the plant, where they will be a little tougher and less prone to rot. Take from the centre of the plant when possible as these are more likely to grow straight. Material should ideally have a woody base but be as thin as possible; not fully lignified, last seasons growth is usually the best. Remove the tip from the heel, and defoliate 1/3 of the cutting. Use rooting hormone 2000 ppm IBA and put straight into plugs. South African mycologists are inclined towards the notion that in *Erica* the associated native mycorrhiza are not substitutional, and this may be a reason for difficulties in cultivating certain species in the UK, though more research is needed to establish this thoroughly, and it should not be used as an excuse for not trying.

The genus *Erica* demonstrates a vast variety of flower shape, size, colour and texture; Sunbirds and long proboscis flies are common biological pollinators, and flowers that give off clouds of pollen and have exerted stigma are wind pollinated. Some flowers are sticky to prevent the robbing of nectar by insects unsuited to their pollination mechanisms.

Figure 14: *Erica massonii*



Some species of *Erica* use other plants for support in the wild, growing up through Restios or *Bruniaceae* and putting on most foliage and flower once through the canopy of their chosen crutch. It is sensible when growing these plants for display to sandwich them in between other plants to provide the necessary support and disguise their spindly habit, as is shown in the gardens of Tresco Abbey on the Scilly isles. Species with this tendency often grow naturally by rivers or on steep slopes. I asked Anthony about *Erica* potentially suitable

Figure 15: *Erica recurvata*



for the growing conditions at the Eden Project, and he suggested *Erica scabriuscula* which grows up to 4m tall and flowers prolifically, and *Erica nana*, which stays small, doesn't need pruning and is easy to propagate from cuttings. For obtaining seed in the UK, he suggested contacting himself if the plants were for a Botanic Garden, and also Silverhill seeds as they are responsibly wild collected. A core part of the work of Kirstenbosch BG is habitat restoration and a committee with representatives from Kirstenbosch BG, the conservation department of SANBI and National Parks is formed to plan a regime for restoration on a specific site. Details to discuss will include alien clearance and setting a suitable burn cycle. Vegetation surveys are utilised to form a list of plants to propagate and reintroduce. Woody shrubs are often the component most in need of reintroduction as these are lost from the natural seedbank after the least amount of time. The list will contain a mixture of core species and selected species special to the area. After plants have been propagated, specialists will do the physical work of planting as it is essential that they are correctly placed within the site to maximise their ability to thrive and encourage the natural plant relationships. Personnel consistency throughout a project greatly enhances its chances of success. There is rarely any opportunity for additional watering after planting, so plants must be healthy, well-placed and planted at the correct time to best promote their survival. To this end, species are sometimes introduced in a number of different ways to deduce the most effective way of growing them. In one spot, a plug, plastic bag prop and seed may be planted together and monitored to see which does best. After establishing a new site, a monthly survey is taken of the site vegetation to assess survival and success rates and document any plants emerging from the seedbank. Success is eventually measured in the ability of the plants to form a functional ecosystem and reproduce without human intervention.

After lunch Graham provided a tour of his geophyte collections. Many bulbs are grown in stockbeds 1 ft deep containing 50 percent silica sand and 50 percent fine bark with a top layer of sand. Sand provides drainage and retains heat, bark holds moisture and improves aeration. This system is far less labour intensive than annual re-potting and will be introduced to Cambridge University Botanic Garden in the near future. Bulbs cultivated here come mainly from winter rainfall areas, as summer rainfall bulbs are harder to cultivate in the Kirstenbosch climate, the most significant problem posed by getting bulbs hot enough but with sufficient airflow. Winter and summer growth bulbs are kept separate. Careful monitoring and watering of geophytes is necessary to keep them in growth for as long as possible to promote storage organ growth. However, many bulbs tire quickly in

cultivation, especially when displayed in the gardens away from nursery standards of care, so regularly refreshing collections with seed is essential. To collect seed, flowers are protected and hand pollinated to prevent crossing.

Figure 16: *Morea tulbaghensis*



Some bulbs, such as Lachenalia, do better in pots, as more control of watering is possible. However, it is best to resort to pot cultivation only when necessary, as it is far more demanding of expert knowledge and time. Pots are filled with the same mix as the stockbeds, but with an added 2cm base layer of compost. Using terracotta pots can help bulbs stay dry enough, but if not plunged in the summer months can lead to desiccation. As we have seen in other gardens, pest control relies on chemicals not available on the UK market.

3.3 Harold Porter Botanic Garden

On the coast, and flanked by the stunning Kogelburg mountains, Harold Porter is an intensely landscaped garden with a lot of interpretation, much of it about uses of native plants by native people. Some displays were designed as snapshots of vegetation types, for example the Limestone Fynbos garden, showcasing this rare local flora. Others were more ethnobotanical, like the Khoisan medicine garden (Khoisan are a native South African people). Like Karoo Desert Botanic Garden, the collections form a relatively small part of the estate, and the rest involves walking on hiking trails through conserved natural habitat. The gardens felt somewhat dated in their style, with wide manicured lawns that seemed luxuriously inappropriate, and carefully planted island beds. Although there was a good deal of information about some plants, there was a lack of basic labelling that was frustrating for a visitor like myself, who was keen to put names to plants seen in the wild, or learn new plants to look out for. SANBI refer to their gardens as 'Conservation Gardens'; a term for botanical gardens that include both landscaped and natural areas within their boundaries, the hiking trails around the gardens are very popular and boast leopards pool, reputedly the finest mountain pool in the land.

Figure 17: Garden style at Harold Porter Botanic Garden



3.4 The Disa House

Hildegards nursery is an exercise in high minded common sense. Nothing is more complicated than necessary and technology plays second fiddle to pragmatism. Running a micro-prop lab from your back garden appears possible after visiting the Disa House. The problems of *Disa* cultivation in Barrydale are basically an irregular water supply, power cuts and excessive summer heat. The solutions are wonderfully simple; the grow room has been built in a south facing room, avoiding the heat of the sun and has thick walls to buffer the summer heat. While summer temperatures can reach 48°C the grow room is able to maintain a consistent temperature of 27°C and the fans have only been used twice. Lighting in the grow room is provided by domestic low energy lightbulbs, these do not require ballast, emit far less heat and are far cheaper to run. There are no visible effects on plant health.

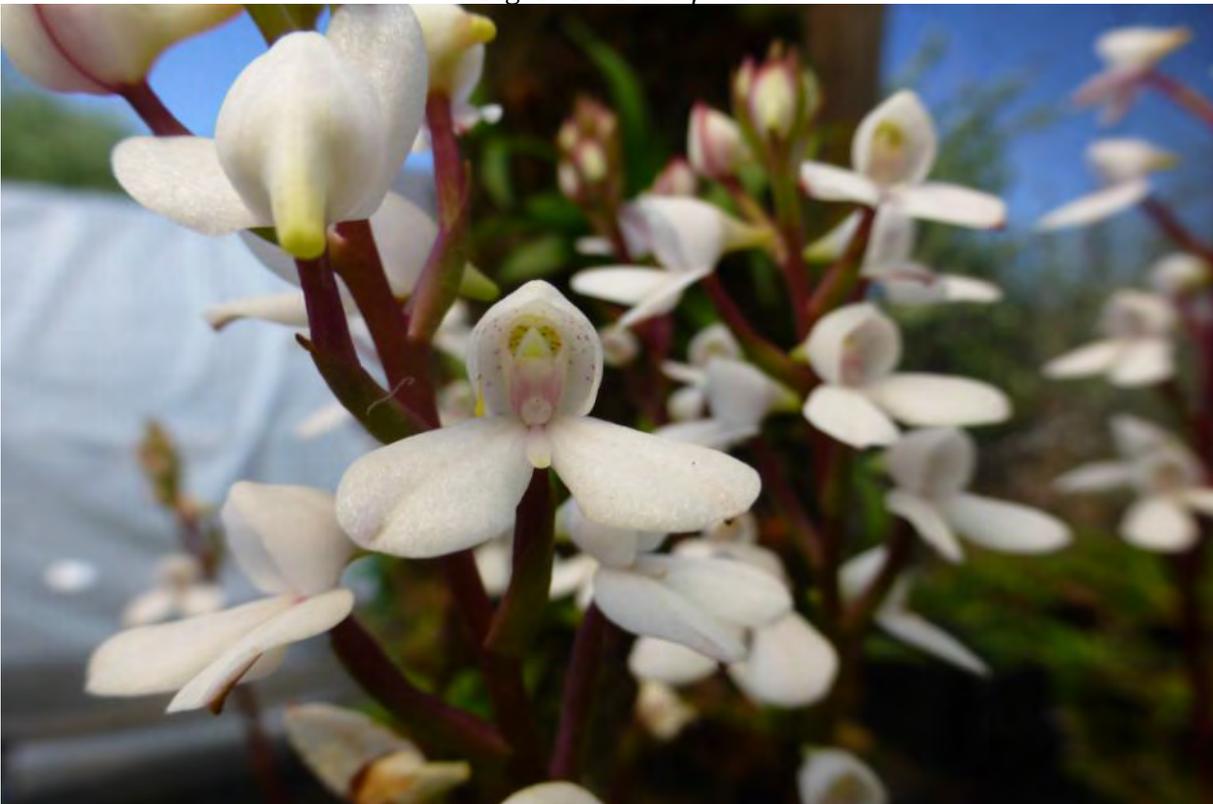
Dealing with an ephemeral water supply is trickier, but using drip irrigation and recycling water for secondary use as evaporative cooling means that losses are minimised. Benches in the shade tunnel are flooded to irrigate potted plants and this water is also stored after first use.

The in-vitro propagation and culture of *Disa* species proceeds as follows: sow into plain Phytochem media with 5g/l agar, increasing sugar content of media at re-plating. Propagules are grown with 16hrs light at 27°C. Young plants can be packed into cellstar tubes and shipped internationally as they are aseptic and therefore do not require phytosanitary certificates. Alternatively the plants are weaned by opening flasks and adding water to half the height of the plant, opened flasks are left out of direct sun for two days then the agar is carefully removed by soaking in a thin bleach solution (1 cap per gallon bucket of water). The plants are then kept in 70 percent shade cover and a layer of garden fleece for one week, after this they are potted into plug trays of sphagnum moss and removed to the shade tunnel. Plants can also be planted into plastic mesh bags full of sphagnum with a drip line irrigating from the top, the moss grows to consume the plastic mesh and they make very decorative 'hanging baskets'.

Figure 18: Hildegard Crous explaining use of flood benches. Note moss columns in background



Figure 19: *Disa tripetaloides*



3.5 Karoo Botanic garden

We visited the Karoo Desert National Botanic Garden as a day trip whilst staying in Stellenbosch, it being a mere hours drive to the North-East in Worcester. As with most of the trip, the drive there and back provided its own interest as a means of becoming familiar with the ever changing landscape and vegetation. Sharp divisions between wide flat plains used exclusively for viticulture and seemingly untouched and disregarded mountainous areas.

Collections for the garden started in the 1920's and were moved to the current site in 1946. Funding comes at least in part from entrance fees, tours, and plants sales. Some educational activities for schools take place in the garden, but there is currently little active collection or use of the collections for research. On arrival we were met by Shireen Harris, one of the Horticulturists responsible for the collections. She provided us with a tour of the gardens and nursery areas, and was a mine of information, answering all of our many questions and providing many interesting facts and observations besides. She was also kind enough to provide copies of a plant list for all the plants that grow naturally in the garden, and her 'continuance programmes' for geophytes and succulents; these are the documents that contain all the cultivation information necessary to care for these collections- an invaluable tool for anyone working with these plants!

In the nursery we were shown the succulent collections, in the main consisting of representatives from Euphorbiaceae, Crassulaceae, Aizoaceae (Ice plants, Mesembs or Vygies), Asphodelaceae [sic] (APG3 Asphodeloideae; Aloes and Aloe-like plants), Apocynaceae (inc. Stapeliads), Portulacaceae, Adenium and Pachypodium.

I looked most closely at the many Gasteria and Haworthia, in response to which Shireen furnished me with some interesting facts. Gasteria are pollinated by malachite sunbirds, and the stomach shaped flowers for which they are named are actually edible! Easily digestible (no pun intended) tidbits of information like this are perfect for the type of public interpretation favoured at the Eden Project, and I endeavoured throughout the trip to note as many as I could. The 'skin' of Haworthia maxima can be peeled off and soaked to provide a soapy solution for washing, and it is a peculiarity of the genus that they turn white when sun scorched. Sarcocaulon, a genera of fat-caudexed Geraniaceae is known as bushmans candle. Cut a piece, dry it and light with a flame and it will burn like a torch.

Throughout the collections, colour-coded labels are used to mark plants out as from Winter/Summer/Constant rainfall habitats. These divisions seem completely arbitrary when placed against the taxonomic/alphabetic system in which the plants are kept, and to anyone who has worked in nursery throws up an instant vision of painstakingly slow daily watering, but in this case, the horticulturist must work around the botanical system. Coloured labels are also used to clearly mark red-listed endangered plants, and plants not native to South Africa. To a British horticulturist, these also paint a clear picture, where the potential envy one might feel for a country so stuffed-full with endemics there is barely room to represent plants from other countries in their botanic gardens is tempered by the sobering fact that such a high proportion of them are endangered.

The plants are collected with a soil sample, 15 percent of which is always added to the first potting. This helps them to establish in pot culture, and to live longer, most likely because of the trace minerals it provides. Natural mycorrhizae present in transferred soil may also have a bearing on plant health. A selection of small rocks and pebbles from the site of collection are taken to make a miniature display of each pot, which is as illustrative as it is beautiful, and also acts as a mulch. Interestingly *Tylecodon* species appear happy growing in a medium which feels like concrete. Ground covering plants are kept in trays; as they are relatively shallow rooted, and have a slow vegetative spread, repotting is kept to a 5-7 year cycle. Plants ready for repotting are easily spotted as they begin to bulge up out of the trays when clustered too close.

The sheltered growing areas are netted and doors are kept closed to help prevent cross-pollination and all flowers are cut after flowering to prevent seed developing and polluting the collections. Hand pollination or cuttings are used when propagation is required. Variegated succulents are harder to propagate.

Feed is provided in the form of 'Bounce back', a chicken manure product. 4-5 pieces are placed on soil surface every 6 months and are gradually broken down by watering. Shireen mentioned that she would prefer to use liquid feed, as after a period the chicken manure stops being effective, but that it was not available.

The main pests encountered are mealy bug, red spider mite and white scale. These are controlled with pesticides, all of which are now banned in the UK. Flowers of sulphur are used against any rot and for sealing wounds.

Water used is rain water from small storage tanks when available, and municipal water which is apparently perfectly suitable for the plants without any treatment. Plants to be watered are drenched until water runs through. Tile floors are hosed down to cool them. During the hotter months it is essential to water before the sun is high, and in winter it is necessary to wait until the water in the tanks has been warmed as water too cold will shock the plants.

Standardised soil mixes are used for each of the main groups of plants cultivated according to their needs, but the main concern throughout is to provide sufficient drainage. Present in all the mixes to some degree are sieved river sand (supplied by Afrimat, a local aggregates company) and well-rotted sieved compost. Bonemeal is also added to most of the mixes. Stapeliads are grown in a 50/50 mixture of red soil and silica sand, with the novel

addition of one naphtha mothball per pot to prevent pests.

After viewing the succulent collections, we had a brief look over the geophyte collection, mainly consisting of *Iridaceae* and *Amaryllidaceae* representatives, but as the majority were in a period of dormancy we moved swiftly on. There were a few specimens to one side growing in plastic bags, which is a system I have seen used in Peru, but when I asked Shireen about it she explained that as the bags become brittle in the sun (it regularly hits 47°C in February in the Karoo) it was an experiment quickly abandoned. It made me realise that of the various places in Peru where I had seen them used, they were always kept in shallow pits under shade netting to conserve moisture.

Outside the reception and plant shop, a display is under development to showcase key species from each of the distinct Karoo regions; Great Karoo, Little Karoo, Sirus Tankwa and Worcester Robertson. Beds have been made with clay, spent mushroom compost and sand, and are decorated and partly formed with representative rocks from each area. The gardens spread out from this area with a few paths taking visitors through the cultivated collections, which take up a relatively small part of the site.

Figure 20: Karoo Botanic Garden



The rest is natural habitat, with a series of paths from which visitors can spot plants and birds with the help of frequent interpretation boards. We identified an African harrier, Pied barbet and Red-breasted sunbird. Highlights of the displays included *Aloe pillansii*, which Shireen informed us is becoming increasingly rare due to poor seedling recruitment, a fact attributed to global warming, the strange and wonderful *Aloe dichotoma* (Kokerboom), excellent specimens of *Aloe microstigma*, a common Karoo plant and *Pachypodium namaquanum*.

However, the undisputed sight of the day was *Hydnora africana*. We first spotted this bizarre parasite flowering at the base of a *Euphorbia mauritanica*, and sniffed out another specimen close by. These wonderful monsters reek of rotting flesh on the first day they open, and with this smell and lurid appearance attract their pollinators.

A number of parasitic plants thrive in the Karoo, *Viscum* (Mistletoe) growing on *Searsia* (Rhus), and *Hyobanche*. Another interesting fact from Shireen was that although Karoo hardly seems an ideal environment for farming, Karoo lamb is highly valued as grazing on Skaapbossie, Kapokbossie, Ankerkaroo and Rivierganna gives the meat an intense spicy flavour. Finally we returned to the office and were greeted by Werner Voigt, the Curator. We had an interesting discussion with him about *Welwitschia*, during which he informed us that they grow in a fog belt region 70-80km from the West coast, and this is why they require not only very high heat but also plenty of water, following this advice several *Welwitschia* are now growing in the tropical holding house at Cambridge University Botanic Garden. We also learn that after the plants have lost their cotyledons they cannot be transplanted, so a good deal of foresight is needed when selecting the location for such a slow growing and long lived plant. Seed of *Hydnora africana* has been sown in a pot containing *Euphorbia mauritanica* at Cambridge University Botanic Garden

Figure 21: *Hydnora africana*



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