



In the rolling foothills of the Langeberg Mountains you come across the gently vaulted roof of the Towerland Retreat. Shaped like an inverted basket woven from arching poles and thatch, it rests on the curved rock walls, half dug into the hillside and is covered with earth and plants.



TOP: The Towerland succulent roof garden with the Langeberg in the background.  
 ABOVE: Melting into the background. Towerland Wilderness Retreat fits harmoniously into the landscape, creating a fireproof roof which is a major consideration in the fynbos-covered mountain area.  
 Photos: Ernst van Jaarsveld.

## The Towerland succulent roof garden

by **Sue Davidoff**, Towerland Wilderness Retreat, **Keith Struthers**, Natural Architecture, Cape Town and **Ernst van Jaarsveld**, Kirstenbosch

Through nature we encounter ourselves. Most of us need to experience wilderness, but there is a very delicate balance that needs to be achieved so that an intrinsic wildness is not disturbed when we make 'nature' accessible to our needs. We are in the process of developing - as sensitively as possible - a wilderness retreat in the Herbertsdale area of the Langeberg/Outeniqua Mountains. Towerland is situated on the lower southern slopes of the Langeberg not far from the Gouritz River Poort. It contains pristine mountain fynbos, a generous river, two earth-dams, some renosterbos, some ex-grazing land being naturally converted to indigenous fynbos as well as porcupines, otters, rhebok, klipspringer, grysbok, bush buck, aardvark, Cape fox, bush pig, baboon, various wild cats, bats, swarms of bees and many birds including a black harrier that was nesting near one of the earth-dams last year. We have had to deal with a fair amount of alien vegetation, primarily silky hakea but also black wattle, rooikrans and lantana. Our aim is to create a space where people can meet in a wilderness context where, through proximity to the living forces of nature, real meeting can take place.

We have worked very closely with Keith Struthers from Natural Architecture in Cape Town, and succulent expert Ernst van Jaarsveld from Kirstenbosch. For the centre's meeting space, Keith designed a remarkable dry packed stone building with a roof made like a European 'sod roof', but planted with succulents to cope with the South African climate.

It has been a remarkable journey, still unfinished. Transforming vision into reality is daunting, yet inspiring, and sharing this journey with one another has been remarkable.

## Planning a Succulent Roof

*From Sue, the primary gardener's viewpoint*

I am not a botanist, but an enthusiastic gardener, and not very 'scientific' in my approach to gardening. My garden in Cape Town has unfolded through trial and error, through serendipitous explorations and offerings, into an indigenous fynbos space that attracts birds, bees, butterflies and other insects. Yet I have no idea why some plants have grown well and others have died; what would be best placed where...

So when Keith approached us about the succulent roof, we went to Kirstenbosch's succulent expert, Ernst van Jaarsveld, to ask for advice. I gathered and transplanted many succulents, bought seed trays of succulents and begged and borrowed from friends. We found nurseries selling interesting looking succulents, and so we started to build up a collection. When I arrived at Towerland at the end of 2002, the roof was ready for planting. Each succulent was planted lovingly, but without any thought as to the direction it was facing, or the slope of the roof (the side of the roof facing the west has a much steeper slope than the others). I simply spread the plants as evenly as I could.

The December that we planted in was hot and dry, and we watered each plant individually, regularly to give them a bit of support in this new and unusual environment. We also put small stones on the roof, next to the plants, to try to simulate the spaces that succulents are accustomed to. And so the plants began to grow. The welcome rains came, and some plants died, while some grew slowly, but for the most part they adapted well to this space. I felt as though I had built a relationship with each plant, and would climb on the roof to inspect their development every time I was at Towerland. We installed a sprinkling system on the roof, but because of the gravity-fed nature of the water system there was not enough pressure and we have since taken it down – in any case it looked ugly with those strange black pipes sticking out of the roof.

And then more and more rain came. We discovered some leaks in the building, which meant one thing: the entire roof needed to be dismantled and re-waterproofed, and then the soil put back on. What about the succulents that had begun to root themselves so

wonderfully? Would it mean losing all that we had planted and having to start all over again? I felt anxious and heart-broken, but should have learnt from Ernst how hardy they are!

We planned for the builders to come and dismantle the roof and, early in the morning, a friend and I painstakingly removed every single succulent and placed them on the floor in the building. With a dedicated team of men working on the roof after this, the entire operation was completed in one day. Towards the evening, we were replacing the last succulents on the roof. Happily I can report that not only were there very few casualties, but that in the re-planting, we were able to separate out some of the succulents, and plant them more evenly on the roof. We now have a roof with succulents that flower throughout the year and a roof that does not leak! The flow of the roof blends with the landscape, the building is tucked away within the hillside: it is unique and beautiful. Inside it is warm in winter and cool in summer.

We are now in the process of building chalets, which will also have succulent roofs.

### The Roof Construction

*From Keith, the architect's viewpoint*

The vaulted earth roof was constructed from gum poles, thatching, and a waterproof membrane, and planted with indigenous groundcover succulents. These plants are ideal as they have small and contained root structures, and can survive through long drought periods while still providing an insulation layer that supports a micro-ecosystem. The roof is also fireproof, which is a major consideration in the fynbos-covered mountain area.

The form of the roof is a vaulted timber shell. The overall structural integrity of the roof was calculated by Vernon Collis. He explains: 'The restrained vault is an incredibly efficient structural system. The evenly-spread load, approximately 50 mm of wet top soil throughout (and a nominal amount of live loading when planting) creates even compression in the vault and transfers to the shortest spans. We were able to keep the size of the pole framework relatively modest at 75 mm, despite carrying a fairly significant load over the shorter 6 m span.'

Constructing this required a measure of innovation and unconventional improvisation, as well as open-minded and actively supportive clients. The

main contractor, Frikkie Oosthuizen, harvested the poles, treated them immediately and then transported them to the site. While the poles were still wet and pliable, the building crew bent them into a bow shape using a chain and ratchet, and then bound them in this position with wire. They bowed unevenly as the thinner tapering ends bent more easily than the thicker ends. This resulted in a naturally eccentric shell structure. They were left to dry for a few weeks, then sorted in preparation for the gradually ascending and descending vault. By using poles dried to shape, their implicit strength was increased. The poles were fitted between the walls, their tie wires cut, and they naturally sprang out to kick against the ring beam, which was later clad in rock. A second system of poles was fixed longitudinally, and local

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thatching was used to fill the gaps. A waterproof membrane and topsoil from nearby finished the first phase of the job. As Frikkie exclaimed on completion of the harmonious form echoing the surrounding foothills, 'die dak gaan iets besonders wees.'

Anticipating the impact the built environment has on our inner life during the process of conceiving and building requires a fundamental shift of awareness, from treating the structure as an end product to perceiving it as a medium for transforming consciousness. What shapes our buildings is embodied in every aspect of the structure which then shapes us. Our evolving consciousness is the final work of art, not the building.

### The Succulents on the Roof

*From Ernst, horticulturist's viewpoint*

When Al, Sue and Keith came to see me about their plans for a succulent plant roof garden I was delighted, and what a great idea! It is high time that local architects explored new territory and this living roof melting in with the background and simply creating a habitat for local succulent plants is inspira-

tional. This is a first for South Africa.

Sue and Keith discussed their plans with me and I immediately offered help with species choice and practical propagation and cultivation ideas. It is always better to make use of local indigenous succulent plants and the vegetation on the Towerland farm is predominantly fynbos with thicket vegetation along the Gouritz River. Although the area is situated in an all year round rainfall area, the fynbos plants here are adapted to dry summer conditions as most of the rain falls in winter and spring. The slightly sloping roof of the building provided good drainage runoff and the shallow layer of soil and its position in full sun made it a suitable habitat for succulent plants growing on the surrounding quartzitic sandstone outcrops. The families Crassulaceae and Mesembryanthemaceae\* are well represented here, naturally occurring in shallow soil where there is little competition from woody, herbaceous perennials and grasses and this is where the solution lies in finding suitable plants for the roof garden. The climate is dry, sunny and too harsh to sustain grasses and other perennials that are found on roofs in Europe. These succulent plants have shallow roots and with each rainfall, water is taken up and stored in their leaves or stems. Thus even if the soil moisture content drops dramatically, these plants are able to survive by simply resting until the rainy season starts again. The shallow soil restricts root growth and the succulents are non-invasive and once established, should be self-sustaining. Also many of these crevice and shallow pan succulents are 'socially adapted' and I have seen up to

a dozen or more miniature succulent plants all occupying a single soil pocket or crevice in a natural outcrop.

But, explained Sue, the roof succulents should not be attractive to baboons, which immediately excluded sour figs and relatives in the *Carpobrotus* family. Plants needed to be small and it was important that the soil should be bound as soon as possible with their roots, thus minimizing erosion. Plants with a mat-forming habit, or that root quickly from their nodes, got preference. Tufted plants were also highly successful. Fast establishment and easy growth are just as important and plants must also be able to grow in full sun and endure months on end without rain.

One also had to consider flower displays, leaf colour and texture: plants must be practical but floriferous. Many of the local shallow crevice succulent plants have grey coloured leaves caused by a powdery waxy bloom that is an adaptation to reflect the harsh sun and minimize transpiration. Some leaves such as *Crassula pubescens* subsp. *radicans* turn a beautiful red colour when stressed as the purple-red colours block out harmful rays. Some have glittering bladder cells like the douvygies (*Drosanthemum*) or have a densely hairy surface, all of which minimizes water-use. These plants are waterwise specialists from which we humans can learn a lot!

With all this in mind I started with a tentative list and passed it on to Sue. She was able to obtain most of them, but she also tried out succulent species from other parts of South Africa which turned out to be highly successful and effective. I also explained to her that although the plants can be established at any time of the year if initial watering is provided, the best time is late autumn as it coincides with the winter rainfall.

One November, a year or more after Sue had established the roof garden, a group of us were privileged to go to Towerland to see the results. I was astounded: the roof was covered and blended in perfectly with the environment. The shallow soil of the roof was effectively root bound with no signs of erosion. The plants, although drought stressed (which is normal at this time) had a natural look and were in very good condition. Even those species Sue tried from the summer rainfall northern parts of South Africa, such as the muis-hondblaar *Plectranthus neochilus*, have proved to be a great success. 🌱

## Succulent plants for a roof garden

### Apocynaceae - carrion flower family

**Aasblom** *Orbea variegata*. Tufted and trailing, roots at nodes, yellow mottled flowers.

**Melktou** *Sarcostemma viminalis*. Tufted and trailing, roots at nodes.

### Asphodelaceae - aloe and bulbine family

**Kopieva** *Bulbine frutescens*. Tufted to spreading, roots at nodes, yellow flowers.

**Kliprosie** *Haworthia retusa*. Tufted, turns red when stressed, small white flowers.

### Asteraceae - daisy family

**Kruip-astertjie** *Othonna camosa*. Spreading with grey to reddish leaves, rooting at the nodes, yellow flowers.

**Tonteldoosbossie** *Senecio haworthii* Tufted with erect spindle-shaped, grey felted leaves and yellow flowers.

### Crassulaceae - Stonecrop or pigs ear family

**Polplakkie** *Crassula nudicaulis*. Tufted growth, red leaves, grown easily from leaf cuttings.

**Rankplakkie** *Crassula pellucida* subsp. *marginalis*. Growth spreading, mat-forming, roots at nodes. Leaves turn purple-red with drought stress.

**Rooi Karoo plakkie** *Crassula pubescens* subsp. *radicans*. Mat-forming, roots at nodes, reddish leaves.

**Red-leafed kalanchoe** *Kalanchoe luciae*. Tufted, leaves reddish, whitish flowers.

### Lamiaceae - sage family

**Muishondblaar** *Plectranthus neochilus*. Tufted but spreading, roots at nodes.

### Mesembryanthemaceae\* - mesemb or vygie family

**Rankvygie** *Cephalophyllum*. Tufted with erect spindle shaped leaves, but with annual procumbent runners. Large yellow to orange flowers.

**Komersvygie** *Delosperma calycinum*. Spreading and mat-forming, pink to reddish flowers.

**Rankvygie** *Delosperma laxipetalum*. Spreading and mat-forming, white flowers.

**Kusvygie** *Delosperma litorale*. Mat-forming, roots at nodes, white to slightly mauve flowers.

**Blinkblaarvygie** *Delosperma prasinum*. Spreading and mat-forming, purple flowers.

**Douvygie, padvygie** *Drosanthemum hispidum*. Mat-forming, roots at nodes. Pink flowers in spring.

**Worcester vygie** *Drosanthemum speciosum*. Spreading with red to orange flowers.

**Volstruiskos** *Glottiphyllum depressum*, *G. linguiforme*. Tufted growth and very large, flat, spreading succulent leaves and yellow flowers.

**Kus rankvygie** *Jordaaniella dubia*. Mat-forming, with grey-green erect leaves and yellow flowers.

**Roosvygie** *Lampranthus roseus*. Spreading with grey leaves and reddish flowers.

**Brakvygie** *Malephora purpureo-crocea*. Mat-forming, roots at nodes, red to purple flowers.

**Klipvygie** *Oscularia deltoides*. Spreading with grey toothed leaves and pink flowers in summer.

**Platblaar-vygie** *Prenia pallens*. Mat-forming.

**Matvygie** *Ruschia lineolata*. Mat-forming, roots at nodes. Pink flowers in spring.

**Elandsbaai vygie** *Ruschia maxima*. Erect shrub, pink flowers in spring.

### Portulacaceae - spekboom family

**Spekboom** *Portulacaria afra*. Cultivar 'green carpet'.

\*Going by the family groupings in *Plants of southern Africa, an annotated checklist*, edited by G. Germishuizen and N.L. Meyer. J. Manning and P. Goldblatt have placed the Mesembryanthemaceae within the family Aizoaceae in their book *Cape plants: a conspectus of the Cape flora of South Africa*. Both books are published by the National Botanical Institute (now SANBI).

BELOW: *Plectranthus neochilus* and other succulents growing contentedly in the succulent roof garden at Towerland. Photo: Ernst van Jaarsveld.

