

Stretching the flora

The Cederberg-Tanqua tension zone

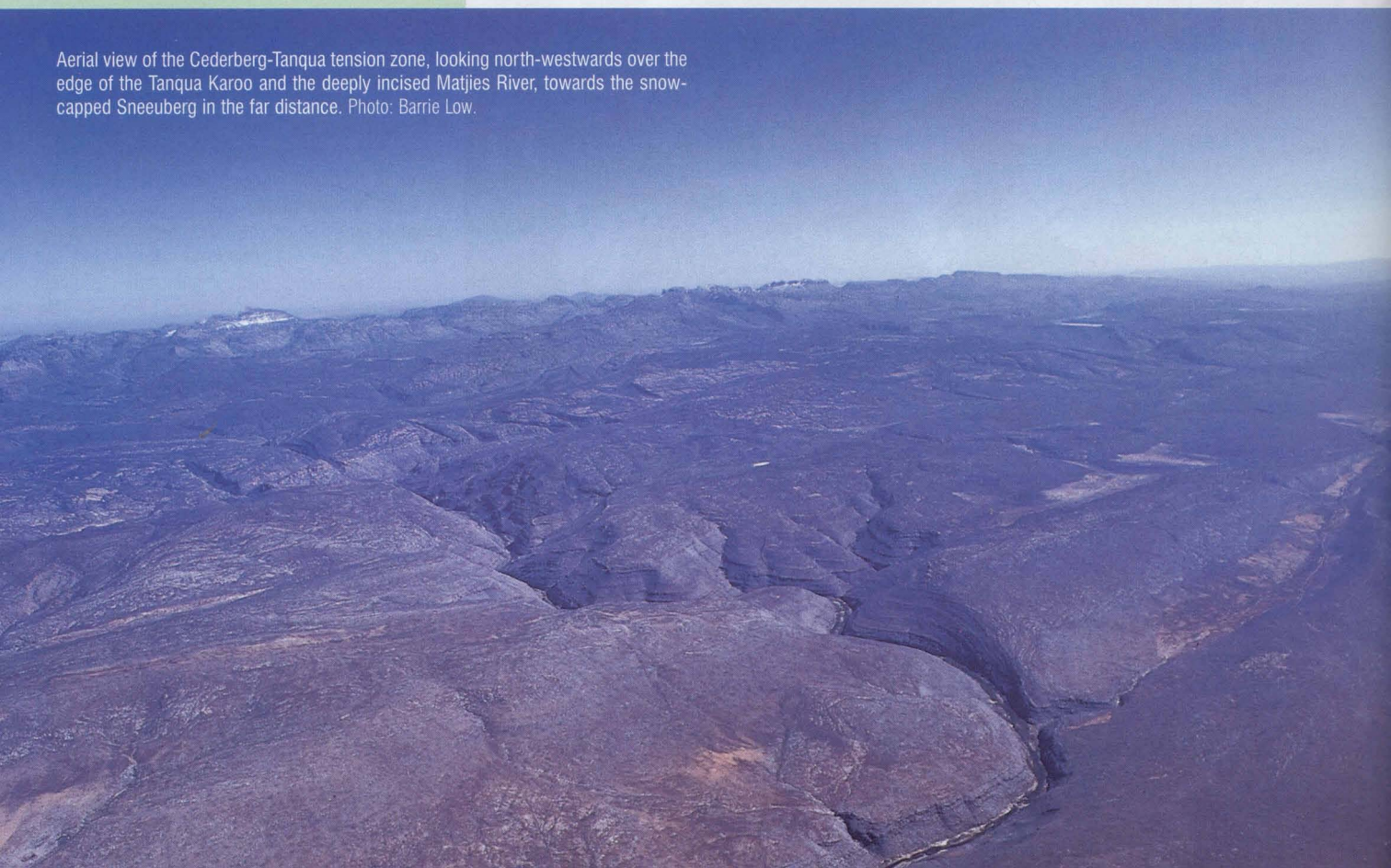
by **Barrie Low** and **Uschi Pond**, Coastec Coastal and Environmental Consultants, Rondebosch

The first article in this series (*Veld & Flora* September 2004) painted a brief geological and palaeontological history of this special 'tension zone', and now we examine the exquisite flora in the ecosystems encountered along the marked ecological gradients between the Cederberg and the Tanqua Karoo

The complex topography of the Witteberg sandstones and quartzites that provide the geological buffer between the Cape Folded Mountains and Tanqua Karoo is as rugged as it is fascinating. It is logical to presuppose that such a varied environment is likely to be reflected in the diversity of the flora and vegetation as one travels along an imaginary gradient between fynbos and Karoo.

On a regional scale the diversity of both the fynbos and succulent Karoo biomes is well documented, with various authors ascribing this to infertile soils, punting for fire or suggesting topographical gradients. Now researchers at the South African National Biodiversity Institute (SANBI) have claimed that major speciation (the evolution of new species) patterns of both fynbos and succulent Karoo should be attributed to climatic oscillations during the Pleistocene (i.e. over the past two million years). Our assertion is that no one factor would have dominated, however, fire would have been absent in the Karoo and much of this region has low topographic variation. High species turnover is no more evident than in the transition between mountain fynbos and adjacent Karoo and we suggest that whereas climate might have been important in the speciation process, the juxtaposition of different substrates and varied topography in this Cederberg-Tanqua tension zone has

Aerial view of the Cederberg-Tanqua tension zone, looking north-westwards over the edge of the Tanqua Karoo and the deeply incised Matjies River, towards the snow-capped Sneeuberg in the far distance. Photo: Barrie Low.





ABOVE: *Braunsia apiculata* one of the many vygies dotting the rocky slab landscape in the tension zone. Photo: Barrie Low.

accelerated the rate of appearance of new species.

The work of Richard Lechmere-Oertel in the Matjies River Nature Reserve explains the mosaic of succulent Karoo and arid fynbos communities found here. The Cederberg-Tanqua region not only represents a major change-over in biomes (fynbos to Karoo) but also in vegetation types, with an impressive range of seven vegetation types in less than 20 km: from Cederberg Sandstone Fynbos and Northern Shale Band Vegetation, through Agter-Sederberg Shrubland, Swartruggens Quartzite Fynbos, Swartruggens Quartzite Karoo, to Tanqua Wash Riviere and the Tanqua Karoo. This transition takes place along a marked rainfall gradient, with aridity increasing as one travels eastwards into the Tanqua region.

There is a dramatic drop in precipitation from Algeria (910 mm pa) to the Tanqua Karoo National Park that receives less than 100 mm pa. The Matjies River Nature Reserve receives on average 220 mm each year.

Now, with such a varied landscape and diversity in vegetation, one would expect equal surprises from the flora. Fluctuations in climate during the Pleistocene would have ensured con-

stant shifting of the boundary between fynbos and Karoo – a likely place for speciation! Evidence exists for substantial and relatively recent evolution of species within the succulent Karoo flora and it is reasonable to expect that much of this speciation occurred within the Cederberg-Tanqua tension zone.

We would expect marked shifts in species patterns as we journey between the Cederberg mountains and Tanqua plains. And we are not to be disappointed! Thanks to collecting by Richard Lechmere-Oertel in the Matjies River Nature Reserve and Francine Rubin in the Tanqua Karoo National Park, and with major contributions from the Cederberg Conservation Group's forays into the region, we are able to build a reliable picture of species changes between the arid fynbos of the south-eastern Cederberg and the much drier Tanqua Karoo.

Our focus has been on the Matjies River Nature Reserve and adjacent Zuurfontein Farm, where both arid fynbos and succulent Karoo types are found. Analysis of the two adjacent floras provides not a little intrigue! Comparing the floras of the two vegetation types, similarities between arid fynbos and succulent Karoo are low

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(25 %). Even adjacent sites within the same vegetation type show small similarities, with figures of 18.9% for the arid fynbos of the Matjies River Nature Reserve and Zuurfontein Farm, and 33.4% for the succulent Karoo from the same sites. In fact the succulent flora here share only a third of the combined complement of 455 species!

Over great distances one would expect the similarities to decline, and it does this rather dramatically between the central Cederberg and the Tanqua Karoo National Park, which share a mere seventeen species out of a combined total of 1895, a paltry similarity of 3.6%!

If we permit ourselves to stray about 50 km further south to the arid fynbos of the Swartruggens Range (Katbakkies



Pass), then the similarity is of the order of 23.3 % - again a major difference, but this time over a much longer distance.

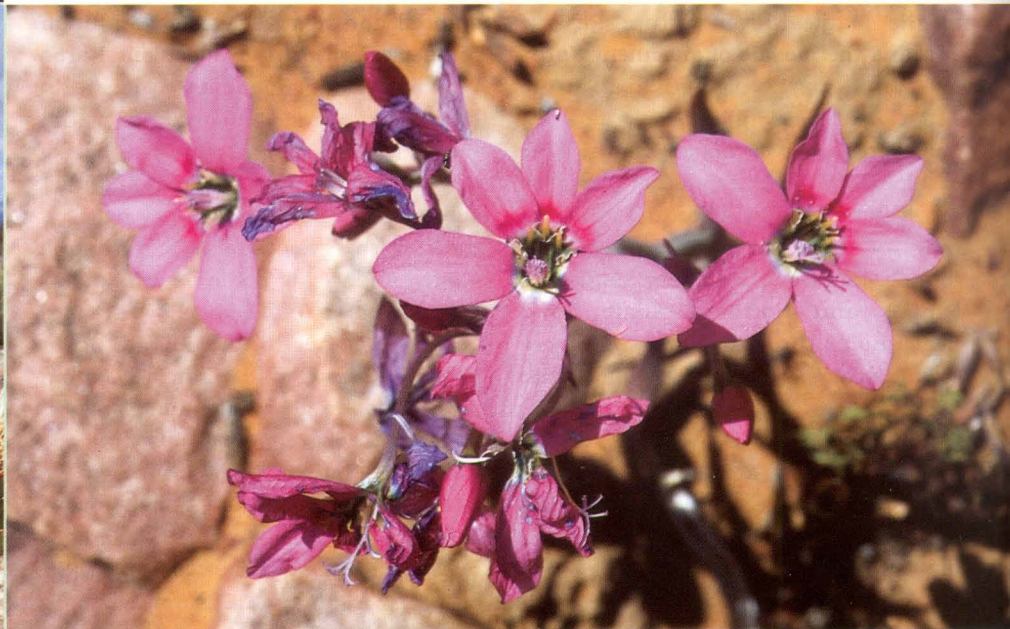
Chief floristic casualties as one moves eastwards along our rainfall gradient are typical fynbos families (proteas, ericas and other ericoid-leaved shrubs, restios and sedges) with concomitant increases in succulents (mesembs, euphorbs, aloes) and the Aizoaceae-Molluginaceae groups. Geophytes also display an interesting pattern, with the Hyacinthaceae increasing towards the Karoo at the expense of the more typical Cape Iridaceae and Orchidaceae families.

And what gems await the expectant botanist? The study has produced numerous new records for both the region as well as for the Cape Flora. Major range extensions include (nearest record, then Red Data status in brackets) *Agathosma elata* (Gifberg, Vulnerable), *Aloe microstigma*, *Oxalis convexula* (Ceres), *Antimima persistens*, bobbejaanarm *Cadaba aphylla*, *Pteronia membranacea*, *Ruschia amicorum* (Montagu, Rare), *Antimima paucifolia* (Bokkeveld Mountains), geelkwassie *Bulbine annua* (Saldanha), *Lampranthus brevistamineus* (Matroosberg), *Othonna retrofracta*, skaapbos *Tripterys aghillana*

(Worcester) and *Thesium capituliflorum* (Cape Peninsula).

Many species are restricted to the Bokkeveld-Karooport region, with several localized endemics such as *Agathosma dentata* (Vulnerable), Sederbergharpuis *Euryops wageneri*, *Helichrysum aureofolium*, *Oncosiphon intermedium*, *Phylica fruticosa* (Rare), *P. levynsiae* (Insufficiently Known), knikknopsuikerbos *Protea pendula* and Swarttruggens vexator *Vexatorella amoena*. The drier quartzite slabs boast several habitat endemics, typical of which are the low, pungent vygies *Braunsia apiculata*, Sederberg dekriet *Cannomois taylorii*, the aptly named klipheide *Erica maximiliani*, klipharpuisbos *Euryops othonnoides*, veterbos *Passerina truncata*, named for its useful stringy bark, *Phiambolia mentiens* and the striking kaaingsuikerbos *Protea glabra*, one of the few species in the area to reach more than 3 m.

Another interesting habitat endemic is the turflelie *Crinum variabile* that occurs along the dry streambeds of Namaqualand, the western Karoo and the Cederberg-Tanqua tension zone. Our sampling in the Doring River extends this species' known distribution southwards from the Biedouw Valley.



LEFT TOP: *Braunsia apiculata*.

LEFT CENTRE: Sederbergharpuis *Euryops wageneri* is a classic rocky sandstone and plateau species, thriving in both arid fynbos and on the edge of the succulent Karoo. A local endemic, it is found only between here and the Biedouw Valley.

ABOVE: The prominence of the Iridaceae tends to decline as one enters the Tanqua Karoo. Kabong *Lapeirousia fabricii* is an exception and this particular specimen was found at the top of one of the Doring River 'side kloofs' on Zuurfontein Farm.

LEFT: Kaaingsuikerbos *Protea glabra* is a standard-bearer for arid fynbos on rocky slabs. Confined to sandstone and quartzite 'pavements', this distinctive species is a regional endemic, with a distribution from the Bokkeveld Plateau to the Kouebokkeveld Mountains.

Photos: Barrie Low.



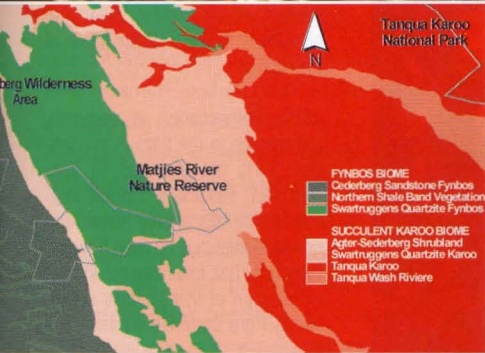
And not to be forgotten, several new taxa have been discovered in the Cederberg-Tanqua tension zone – two Asteraceae (*Senecio* and *Othonna*), two Cyperaceae (both *Ficinia*) and a new *Ixia*. Most of the species in the new vygie genus, *Phiambolia*, have either been collected from this area or in a band stretching southwards to the Ceres Karoo.

But what about other Karoo-fynbos interfaces? Some seventy years ago, Prof. Compton wrote about the Witteberg one of the south-western Karoo mountains (fynbos), and adjacent Whitehill Karoo Garden (Karoo) floras, where only four out of a total of 650 species were shared! Again the sharp line between fynbos and Karoo floras is clear. Abrupt flora transitions are also strongly evident along the inner mountain edges elsewhere in the Cape Floristic Region.

Again low similarities in the order of between 4% and 6% are found for the southern Langeberg-central Karoo and Tsitsikamma-eastern Karoo.

It follows that these areas would each sport their own 'tension zone' with concomitant high species numbers and endemism. The eastern Karoo, although not implicated in the SANBI climatic work, would nevertheless have exhibited a similar tension zone, with a gradient from fynbos to Nama (and not Succulent) Karoo.

Clearly these tension zones represent as much a past as a current opportunity for speciation, except that climate change is likely to cause unnatural acceleration at the hands of global warming. Ecotonal boundaries such as these must be incorporated into protected networks, with the Greater Cederberg Biodiversity Corridor provid-



LEFT TOP: Klipheide *Erica maximiliani* is one of the more typical slab endemics. This spindly dwarf shrub occurs on dry mountain plateaux and inselbergs from the Cederberg to the Little Karoo.

LEFT: Map showing abrupt changes in vegetation types over short distances between the Cederberg and Tanqua Karoo. After L Mucina, M C Rutherford and L W Powrie (eds) *Vegetation map of South Africa, Lesotho and Swaziland**, published by SANBI, Pretoria, 2005.

BELOW: Perennial herbaceous and sub-woody plants find it difficult to survive in the harsh Karoo environment. Species such as the aptly named *Pelargonium magenteum* display a remarkable resilience through their deciduous nature.

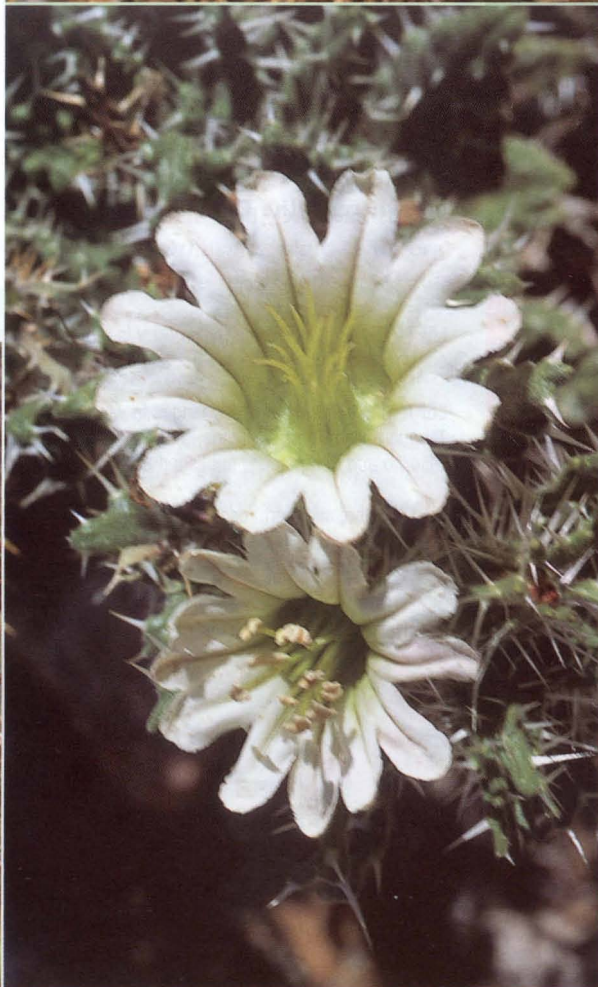
Photos: Barrie Low.



ing a framework for such a network. However, as much of the Cederberg-Swartruggens-Tanqua tension zone is found on privately owned land, conservancies (Biedouw, Wupperthal, Cederberg and Swartruggens) form the backbone of the ecotone of 310 000 ha. Their role in effectively conserving the tension zone cannot be underestimated, but formal resourcing is needed for management as well as an eastwards extension of the Conservancy boundaries to include a more representative proportion of the Tanqua Karoo. 🗺

For more on the Matjies River Nature Reserve and its unique flora, read our earlier article in *Veld & Flora* June 2001.

*An electronic (ArcView) copy of the new vegetation map of South Africa can be obtained from Les Powrie at the South African National Biodiversity Institute (powrie@sanbi.org). The map is also available as a four-sheet 1:1000 000 hard copy.



ABOVE: Turfvelie *Crinum variabile* occupies a special niche along sandy banks of seasonal rivers in the Karoo. Although a rare habitat preference in the area, this trait is partially shared with rooikanolpypie *Watsonia angusta*, a normally terrestrial irid occurring sporadically along the middle section of the Matjies River and elsewhere in the moister parts of the region.

LEFT: Spinescence is generally uncommon in the flora of the tension zone but emerges in species like suikerkelk *Codon royenii*, which has prickly leaves and unmistakable cup-shaped flowers. Our study has extended the known distribution of this species southwards from Botterkloof Pass.

FAR LEFT: Sederberg dekriet *Cannomois taylorii* is named after Hugh Taylor, with whom the author, Barrie Low spent several memorable collecting trips in the Cederberg. It occurs from Moedverloor to Karooport, confined to arid fynbos. One of the few tall restios in the area, it is still used extensively for thatching and construction of dwellings. Photos: Barrie Low.

Acknowledgements

To Tony Kings, owner of Zuurfontein, for accommodation during two of our collecting trips in the area, and for permission to conduct botanical research on his land. Rika du Plessis of Cape Nature Conservation - manager of the Cederberg Wilderness and Matjies River Nature Reserve - and her staff have provided invaluable support over the years, and supplied the rainfall data. Our botanical exploration in the area was greatly assisted by the involvement of Marinda Koekemoer, Hester Steyn, Priscilla Burgoyne (South African National Biodiversity Institute), Cornelia Klak (Bolus Herbarium, University of Cape Town) and Peter Bruyns (University of Cape Town).

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References have been omitted but a comprehensive list is available on request from the editor at voget@kingsley.co.za or through the Botanical Society (see title page for contact numbers).