DENDRON

Tydskrif van die Dendrologiese Vereniging, die Boomkunde en Bewaringsvereniging van Suid-Afrika
Magazine of the Dendrological Society, the Tree Science and Conservation Society of South Africa

Dendron Nr / No 55 Januarie / January 2024

PONDOLAND ENDEMICS

Nwambiya SANDVELD

THE SLOW REPRODUCTIVE PROCESS IN Outeniqua YELLOWWOOD

NOTES ON THE CONTROL OF *alien invasives*

Dendrological Society
OF SOUTH AFRICA

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VAN SUID-AFRIKA

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COVER PHOTO:
Boscia foetida subsp. *rehmanniana* – stinkwitgat / stink shepherd's tree
Gerto Prinsloo – winning photo, Manketti-branch Spring 2023 photo competition

Content

“People from a planet without flowers would think we must be mad with joy the whole time to have such things about us.”

Dame Jean Iris Murdoch was an
Irish and British novelist and philosopher

Stop and see the flowers

In spring we usually stop to see and smell the beauty of colorful flowers all over South Africa. Many indigenous trees have a special allure - their spectacular flowers, interesting shapes, and stunning, different colours always give me great pleasure in discovering their inner secrets. Trees grow everywhere, but often you need to be at the right time and place to appreciate their beauty.

Spirostachys africana (tamboti / tambotie) trees are usually single-stemmed trees, easily recognised by the distinctive rough, dark bark, cracking into rectangular blocks. The phenomenon of dense stands of tamboti trees is something that is often seen in nature. The unusual catkin-like appearance of unisexual densely flowered heads of the tamboti is a very distinctive characteristic. The mostly only male flowers (yellow due to pollen) with 1 - 3 female flowers (red) attached at the base of each spiraled axillary spike will develop in early July to August. This happens before the new leaves appear in early spring (September).

One of the reasons contributing to dense stands of tamboti is that the tamboti seeds are often infested with knot-thorn moth (*Emporia melanobasis*) larvae. The moth lays it eggs inside the fruit of the tamboti tree where the larvae develop. During the hot summer months of October to November the larvae inside the three-lobed capsule stretches itself out, jack-knifes inside the segments of the fallen fruit, causing the seed to 'jump', making a popping sound as it does. The more the seed jumps the further it gets away from the parent tree. Hence the popular English common name *jumping bean tree*. In this way the tree disperses the seeds in a small radius close to the parent plant. Obviously, many of the seeds are eaten by birds, but many also germinate and so arises the tamboti woods pheunomen.

The tamboti is one of the so-called 'water trees' usually found near water. It is a protected plant is some areas of South Africa.

Naas Grové
November 2023

PONDOLAND Endemics

Francois du Randt

All photographs by the author, except where mentioned otherwise

Pondoland is very rich in endemic species, and Hartwig von Dürckheim, Ronelle du Randt and myself spent 8 days in this beautiful area during March 2023, especially since our two- year delayed dendrological trip to the Mozambique sandveld, was delayed again, this time due to cyclonic rains in Mozambique and impassable roads and bridges. The best alternative for the sandveld was the poorly known (for me anyway) endemics of Umtamvuna Gorge and Pondoland. We joined up with knowledgeable friends from Pondoland CREW (Custodians of rare and endangered wildflowers and plants) and went on several outings with them – good friends like Dorothy McIntyre, Tracy Taylor, Gail Bowers-Winter, Simon, Uschi, and so forth … all we needed to do is to drive 440 kilometres from Zululand down to Munster and Port Edward (800 kilometres for Hartwig, sorry my friend) and stayed in a house with 95 steps over a dune and a sea-view! Our main purpose – the Pondoland endemics!

The main aim of this document is to introduce the reader to the Pondoland endemics, with an (probably) incomplete list of 78 endemic, or near-endemic trees and shrubs, as well as 48 grassland flowers, with some photographs. I decided to concentrate on just the endemics in this area around Umtamvuna Gorge and closeby, and made the following list:

- *Jubaeopsis caffra* (Mkambati palm)
- *Leucadendron pondoense* (Pondo conebush)
- *Leucadendron spissifolium* subsp. *natalense* & *oribinum*
- *Leucospermum innovans* (Pondoland pincushion)
- *Dahlgrenodendron natalense* (Sandstone quince)
- *Raspalia trigyna* (Pondo ghost-bush)
- *Bauhinia natalensis (*Dainty bauhinia)
- *Dalbergia multijuga* (Glossy glat-bean)
- *Podalyria velutina* (Hairy Blossom-pea)
- *Tephrosia pondoensis* (Pondo poison-pea)
- *Tephrosia bachmannii*
- *Nectaropetalum capense* (Southern false coca-tree)
- *Erythrococca* sp. nov
- *Euphorbia tetragona* (Honey euphorbia)
- *Loxostylis alata* (Tarwood)
- *Searsia acocksii (*Pondo climbing currant)
- *Searsia pondoensis* (Many-veined currant)
- *Gymnosporia bachmannii* (Willow spikethorn)
- *Gymnosporia* sp. nov
- *Gymnosporia vanwykii* (Pondo spikethorn)
- *Lydenburgia abbottii* (Pondo bushmans-tea)
- *Maytenus abbottii* (Pondo silky-bark)
- *Maytenus oleosa* (Pondo koko-tree)
- *Pseudosalacia streyi* (Pondo rock-lemon)
- *Putterlickia retrospinosa* (Pondo false-spikethorn)
- *Apodytes abbottii* (Pondo white-pear)
- *Atalaya natalensis* (Forest krantz-ash)
- *Bersama swinnyi* (Coastal white-ash)
- *Colubrina nicholsonii* (Pondo weeping-thorn)
- *Grewia pondoensis* (Pondo raisin)
- *Ochna chilversii* (Ochna sp. nov) (Pondo ochna)
- *Rinorea domatiosa (*Pondo violet-bush)
- *Pseudoscolopia polyantha* (False red-pear)
- *Struthiola pondoensis*
- *Rhynchocalyx lawsonioides* (False waterberry)
- *Eugenia erythrophylla* (Large-leaf myrtle)
- *Eugenia* sp. A (Rolled-leaf myrtle)
- *Eugenia* sp. B (Krantz myrtle)

- *Eugenia* sp. C (Coast paperbark myrtle)
- *Eugenia umtamvunensis* (Thick-leaf myrtle)
- *Eugenia verdoorniae* (Small-leaf myrtle)
- *Syzygium pondoense* (Pondo umdoni)
- *Memecylon bachmannii* (Pondo rose-apple)
- *Cussonia nicholsonii* (South coast cabbage-tree)
- *Cussonia pondoensis*
- *Manilkara nicholsonii* (Pondo milkberry)
- *Carissa wyliei* (Large-flower forest num-num)
- *Podranea ricasoliana* (Port St Johns creeper)
- *Canthium vanwykii* (Pondo Turkey-berry)
- *Tricalysia africana* (Empogna africana) (Pondo jackal-coffee)
- *Brachylaena glabra* (Malabar silver-oak)
- *Stenoglottis woodii*
- *Syncolostemon rotundifolius*
- *Syncolostemon ramulosus*
- *Raphnia elliptica*
- *Eriosemopsis subanisophylla*
- *Eriosema umtamvunensis*
- *Indigofera abbottii*
- *Indigofera pondoensis*
- *Gasteria croucheri*
- *Brachystelma australe*
- *Brachystelma sp. nov*
- *Brachystelma pulchellum*
- *Lotononis bachmannii*
- *Plectranthus ernstii*
- *Plectranthus hilliardiae*
- *Plectranthus oertendahlii*
- *Plectranthus oribiensis*
- *Streptocarpus porphyrostachys*
- *Crassula streyi*
- *Watsonia bachmannii*
- *Watsonia inclinata*
- *Watsonia mtamvunae*
- *Watsonia pondoensis*
- *Roella glomerata*
- *Bulbine* sp. nov
- *Otholobium stachyerum*
- *Phylica natalensis*
- *Helichrysum populifolium*
- *Erica cubica*
- *Erica aspalathifolia*
- *Indigastrum fastigiatum*

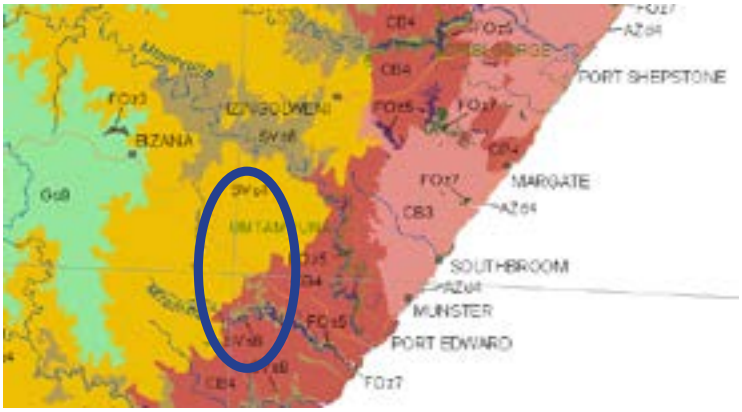
An incredible number of 83 solely endemic species are left.

UMTAMVUNA NATURE RESERVE

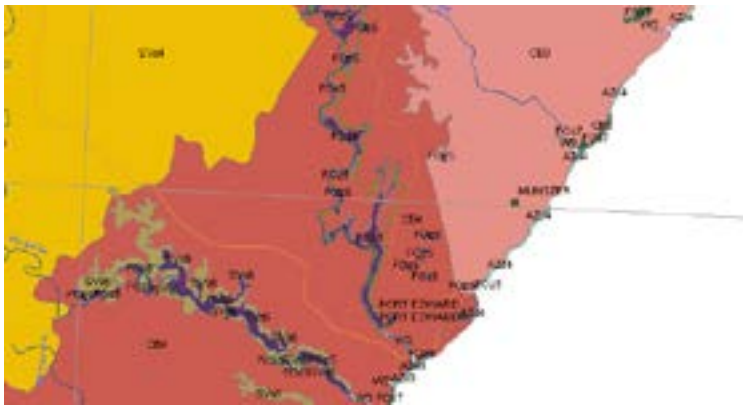
The Mtamvuna River (modern day spelling) originates near Weza and Ingeli Mountain, flowing 80 kilometres south-eastwards to Port Edward, forming the border between KwaZulu-Natal and the Eastern Cape (formerly the Transkei). The Zulu origin of the name means 'the river of people that harvest', referring to the damage when the river is in flood, or the fertile region.

The reserve is 3250 ha in surface area, and consists mostly of Pondoland-Ugu Sandstone sourveld on Msikaba Sandstone. It is one of South Africa's important endemic 'hotspots', a real jewel among botanists.

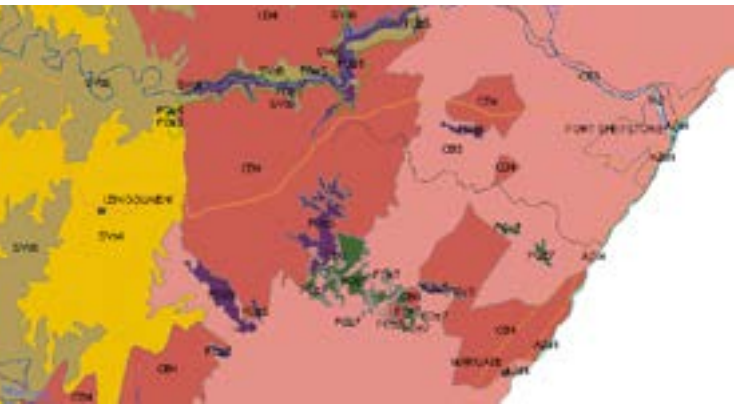
Top lef: Umtamvuna Gorge from the Clearwater Trails viewing platform (2013); Middle: Umtamvuna Nature Reserve. Bottom: Mtamvuna River



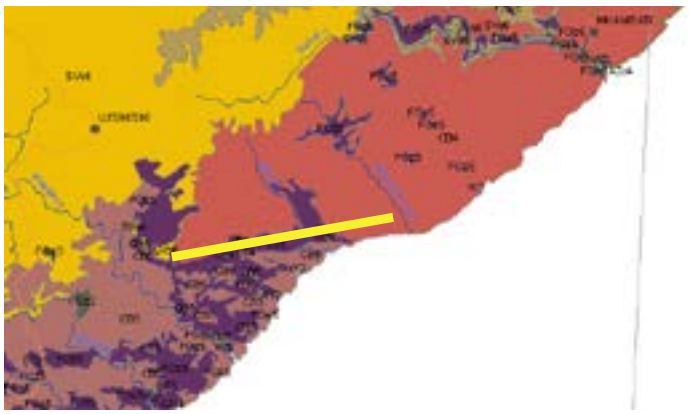
Overview vegetation map of Oribi Gorge and Umtamvuna Nature Reserve (encircled in blue)



Umtamvuna Nature Reserve and Mzamba valley



Oribi Gorge with Pondoland-Ugu Sandstone (CB4)



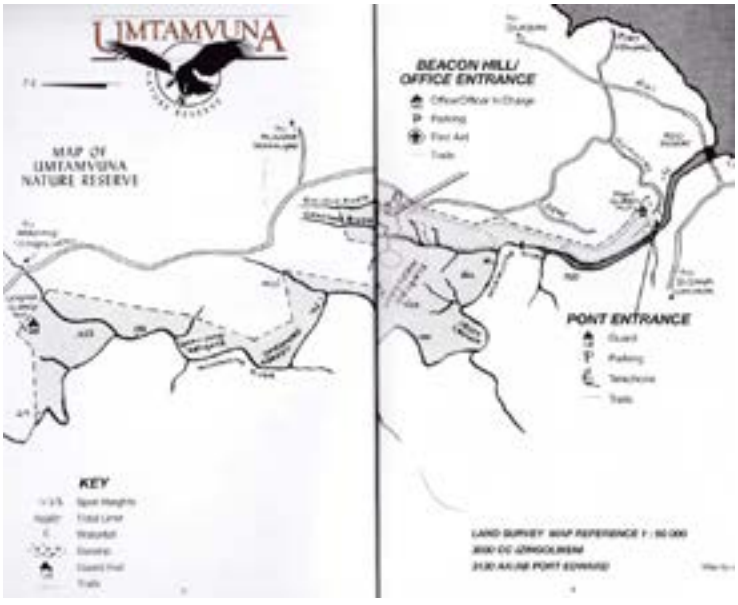
Southern Pondoland-Ugu Sandstone (Mkambati to Mzintlava area)

The main plant habitats in the Oribi Gorge, Umtamvuna Nature Reserve and Transkei-Pondoland, according to Mucina & Rutherford's classification are:

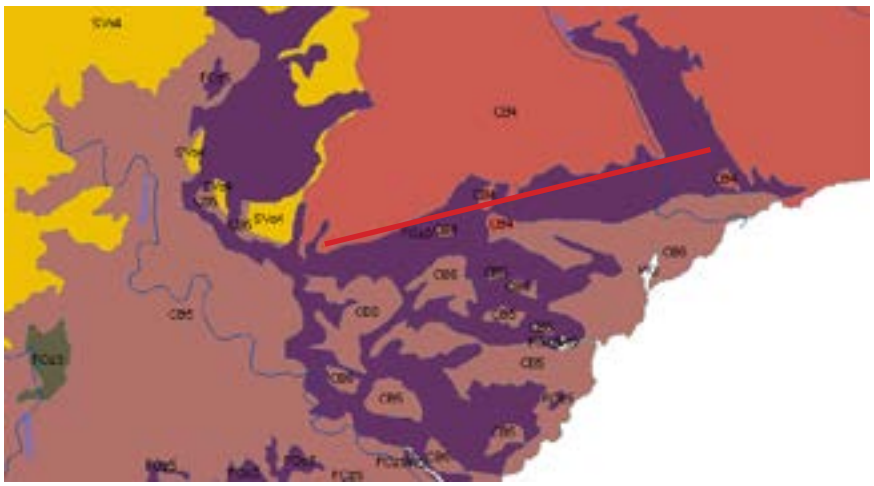
- FOz5 - Scarp Forest
- CB4 - Pondoland-Ugu Sandstone Coastal Sourveld on Msikaba Sandstone
- CB3 - KwaZulu Natal Coastal Belt
- FOz7 - Northern Coastal Forest
- FVs6 - Eastern Valley Bushveld

The Msikaba Sandstone "slab" ends abruptly at the Fraser Gorge and Magwa waterfall, near Mbotyi, in the former Transkei (see inserted red line above and below)

- FOz5 - Scarp Forest
- CB4 - Pondoland-Ugu Sandstone Coastal Sourveld
- CB5 - Transkei Coastal Belt
- SVs4 - Ngongoni veld



A map of the area (Jewels of Mtamvuna)



Mbotyi – Fraser Gorge area

PONDOLAND-UGU SANDSTONE COASTAL SOURVELD (CB4):

The Pondoland-Ugu Sandstone Coastal Sourveld is a very important centre of endemism, stretching from Port Shepstone (Ugu district) and Oribi Gorge, where it borders the KwaZulu Natal Coastal Belt (CB3) in the north and Ngongoni Veld in the west, southwards through Umtamvuna Gorge to the Pondoland Coast, where it borders Transkei Coastal Belt (CB5) at Mbotyi River and Fraser Gorge in the south, with a connecting strip of beautiful Scarp Forest at Ntsubane.

It includes the coastal plains and partly undulating hills with very steep slopes of river gorges, like Oribi Gorge, Umtamvuna Gorge, Mzamba Gorge, Mtentu Gorge and Msikaba Gorge. It supports natural, species-rich

The prominent Egossa Fault (at Magwa Falls) (2013), the southern-end of the Msikaba Sandstone "slab"

grassland punctuated with scattered low shrubs or small trees. Rocky outcrops and krantzes are common and dramatic sea-cliffs occur, like Cathedral Rock, Waterfall Bluff and the Cliffs at the Citadel.

Proteaceae are fairly common, like the following tree species: *Protea caffra* subsp. *caffra*, *Protea roupelliae* subsp. *roupelliae, Faurea saligna, Leucadendron spissifolium* subsp. *natalense, Leucadendron spissifolium* subsp. *oribinum, Leucadendron pondoense* and *Leucospermum innovans.*

This vegetation unit is strictly delimited by its geology of hard, white, coarse-grained, siliceous quartz arenites (or sandstones) of the Msikaba Formation, giving rise to shallow, nutrient-poor, highly leached, skeletal, acidic sandy soils (very favourable for "Cape fynbos"). Another proof of this are all the commercial macadamia plantations in the region.

The southern border of the Pondoland-Ugu Sandstone is sharply delineated into the Scarp Forest of Ntsubane and Fraser Gorge. It is the most dramatic part of the Transkei Wild Coast. Scarp Forest (Foz5) is also present in Umtamvuna Gorge and a few northern Pondoland river gorgers, like the Mntentu and Msikaba gorges.

Scarp forest is an archipelago of scattered patches of forest on the coastal escarpment, stretching from the Eastern Cape to southern Mpumalanga and Mozambique. A few other large patches include oNgoye

Leucospermum innovans in full flower (Cathedral Rock)

forest, near Mtunzini, Crocodile River Gorge and Oribi Gorge. A number of Msikaba Sandstone Pondoland species also occur in oNgoye Forest, a transitional link with Maputaland.

Scarp Forest occurs at low altitude between 50 and 600 meters and must be distinguished from the higher altitude (southern) mist belt forest (example at Ngome, Ntendeka region). It is species-rich, consisting of tall trees, structurally diverse and multi-layered, but a poorly developed herb layer. It grows on Natal sandstone outcrops, granite of the Lebombo Group and Karoo sedimentary rocks with nutrient poor and shallow soils.

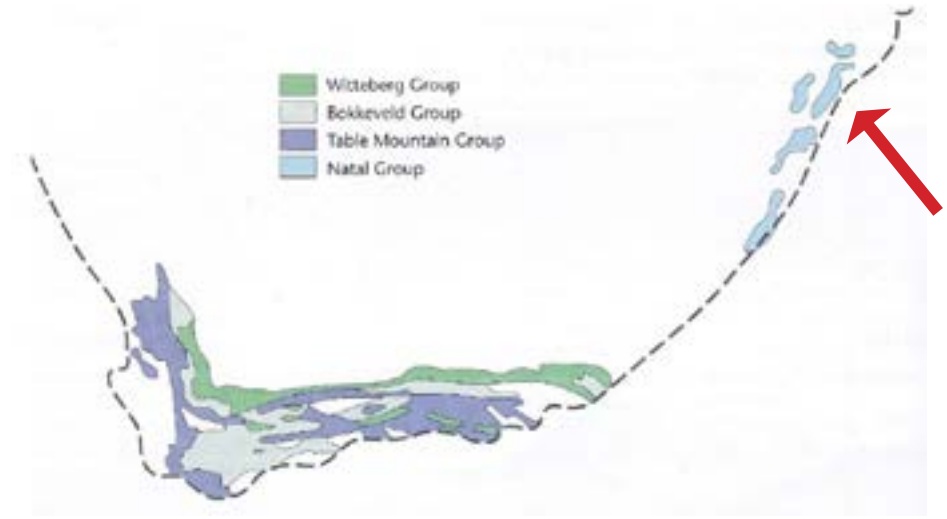
The most conspicuous trees, in general, are *Buxus macowanii, Buxus natalensis, Drypetes gerrardii, Englerophytum natalense, Harpephyllum caffrum, Heywoodia lucens, Memecylon natalense, Millettia grandis, Oricia bachmannii, Philenoptera sutherlandii, Rinorea angustifolia, Rothmannia globosa* and *Umtiza listeriana.*

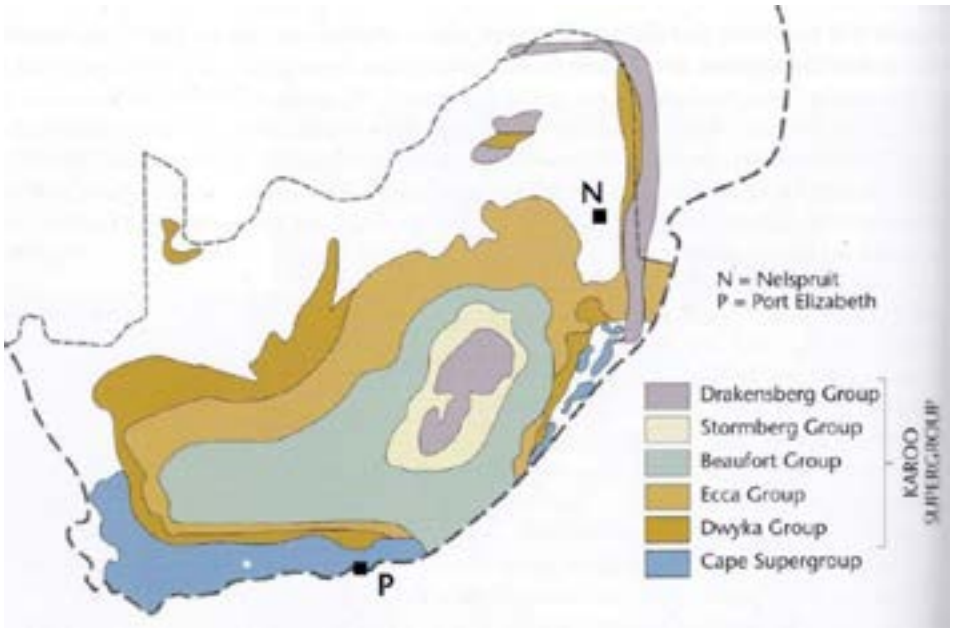
Top: Cape Granites. Bottom: Msikaba Sandstone

These forests are not endangered, but only 20% are formally protected. They are exposed to over-exploitation, like cultivation clearance, muthi stripping, exotic plantations and alien infestation. One of the best preserved forests of this unit is the Ntsubane Forest in and around Fraser Gorge, en route to Mbotyi.

These are probably the most valuable forests in South Africa from a biodiversity point of view. It houses many endemic species, as well as beautiful genera like *Plectranthus* and *Streptocarpus.* (I am not going to discuss Scarp Forests, but rather stay with the Pondoland endemics.)

The geology in Pondoland is the reason behind these fantastic endemism. The sedimentary rocks deposited in the Agulhas Sea are known as the **Cape Super group.** The north-easterly branch received mostly coarse sediments, which today form the strata of the **Natal Group** and may have formed at about the same time





Top: The Cape Super group.
Bottom: and Karoo Super group

as the Klipheuwel Group further west. Rocks of the Natal Group are especially well exposed in road cuttings between Durban and Pietermaritzburg (esp. Marian Hill Toll Plaza), as well as to the west of Melmoth and in the Oribi Gorge area.

Today, the rocks of the Cape Super group show a linear, but in detail, complex distribution (see next Fig), a consequence of the intricate folding of the layers. The crust (and lithosphere) began to sag under the load of this mountain range and a depression or basin developed on its northern flank, in which an island sea formed. This is called the **Karoo Sea.**

The connection between the Table Mountain (Peninsula) Sandstone and Msikaba Sandstone is very clear on the ground. There are many fynbos species in Umtamvuna Nature Reserve. A few examples are *Leucadendron spissifolium* subsp. *natalense*, common on the slope of the gorge east of Beacon Hill. Subspecies *oribinum* is more restricted to a few localities, and rare.

Leucadendron spissifolium

subsp. *natalense*

Isolated patches in grassland (damp sandstone)

Shrub 0.75 m. Multiple stems (from underground rootstock)

Leaves: oblanceolate-linear, tip with fine point, **red**, twisted below; **46 x 8mm** (bigger)
Involucral bracts (leaves) conspicuous (larger than stem leaves), tips pointed, bract-like.

Cone bracts hairy across middle
Male heads round 18 mm.
Female heads oval 18 x 14 mm
(throughout year)
Cones 36 x 26 mm, red, bracts rounded with slight notch

subsp. *oribinum*

Rare, on steep grassy slopes above cliffs. Only 3 localities

Leaves: similar,
31 x 3 mm on male plants but 45 x 4 mm on female plants tips with **pale fine points, sickle-shaped,** twisted, hairless

Male flower heads without leaves (Oct-Nov)

Other subspecies in the Cape:
subsp. *spissifolium* – S.W.Cape (common)
subsp. *fragrans* – S.Cape Langeberg, Outeniqua & Swartberg
subsp. *phillipsii* – Tsitsikamma to Kareedouw mountains

Leucadendron spissifolium subsp. *natalense*

Leucadendron pondoense

Rare, in colonies **along watercourses** (Lupatana coast is good example of habitat); **dense stands**

Shrub up to **6 m tall; single main stem**, pale brownish-grey; branchlets pinkish-red when young

Long & narrow, alternate leaves (**70 x 3 mm**, slightly bigger in females), apex pointed; shiny dark green, leathery, **covered in fine silvery hairs** (hairless when mature); slightly sickle-shaped, **tip with fine red point,** base tapered to a 2 mm stalk

Male flower heads are small (10 mm), with dense silvery hairs; inconspicuous involucral bracts (n=8)
Female flower heads are bigger (15 x 9 mm), becoming reddish at top

Cones dark brown, 35 x 20 mm, persist several years

Brunia trigyna (Raspalia trigyna) (Pondo ghost-bush)

The slope and walk down into the Scarp Forest east of *Raspalia trigyna.*

Gail admires the fynbos and forest

Lydenburgia abbottii (Pondo bushmans-tea)

A typical 'fynbos' element is the very rare Pondoland ghost bush, *Raspalia trigyna* (new name *Brunia trigyna*), of which there are only 30 plants left in nature. A walk down into Umtamvuna gorge from Beacon Hill brings one to these incredible plants.

Top: Leaves of *Lydenburgia abbottii.*
Bottom: The author, Gail & Dorothy at at *Lydenburgia abbottii*

There are not more than a few *Lydenburgia abbottii* (Pondo bushmans-tea) trees in this forest. It is one of the rarest trees in the world. Graham Grieve took me to the tree in 2013, but I did not mark its location on a GPS, so we struggled to find the same tree this time, but while looking for it, the ladies found three others which was a wonderful discovery.

During our exploration we saw quite a number of other tree/plant species: *Stangeria eriopus, Encephalartos villosus, Cnestis polyphylla, Indigofera natalensis, Margaritaria discoidea* subsp. *fagifolia, Gymnosporia rubra, Cryptolepis oblongifolia* versus the endemic *Cryptolepis capensis* and *Tridactyle bicaudata* subsp. *rupestris.*

Dorothy (80 years of age), Tracy and Gail do "botanizing without brakes", so one must keep up with their pace, but with that we saw lovely *Watsonia densiflora, Brunsvigia grandiflora, Aspilia natalensis, Exochenium grande (Sebaea grandis), Exochenium* sp. nov, *Desmodium setigerum, Lasiosiphon (Gnidia) anthylloides, Crassula alba, Senecio erubescens* subsp. *incisus* and *Tephrosia polystachya*, the confetti-bush, to name a few.

The grassland is exceptionally beautiful. There are four species of *Watsonia* present, namely *Watsonia densiflora, Watsonia inclinata, Watsonia pondoensis* and *Watsonia mtamvunae.*

Smedmore Forest is home to *Eugenia erythrophylla, Pavetta galpinii, Stenoglottis fimbriata, Stenoglottis woodii, Brownlea coerulea, Carissa wyliei, Cassipourea gummiflua, Protorhus longifolia, Secamone alpini, Loxostylis alata, Searsia lucida* and *Searsia dentata.*

This page, clockwise from top left: *Syncolostemon rotundifolium, Tephrosia grandiflora. Pachycarpus grandiflorus* and *Moraea elliotii.*
Opposite page: Smedmore Forest (forest margin left, and Simon collecting samples in the forest, right). *Dalbergia multijuga. Philenoptera sutherlandii* in full pods

Rinorea angustifolia subsp. *natalensis* is present in Scarp Forest, and has a characteristic stipular scar, but is joined by *Rinorea domatiosa*, in Umtamvuna Nature Reserve, with its prominent brown domatia in the vein axils on the leaf under surface.

This page: *Otholobium stachyerum* at Mpenjati Nature Reserve. Opposite page, clockwise from top left: Botanizing in the fynbos of Umtamvuna Gorge. The Mpenjati River. *Helichrysum herbaceum. Gymnosporia vanwykii.*




Rinorea angustifolia subsp. *natalensis*

Narrow-leaf / White Violet-bush

- Shrub - often in groves in forest understorey (mist belt to coast)
- Slender branches with lenticels, and slight **zigzag growth pattern**
- **Stipular scar encircle twig**
- Alternate leaves, **held horizontally,** elliptic, with **serrated margin**
- Clear dots visible against sun (with 10x lens)
- Other species in Violaceae family:
  - *Rinorea domatiosa*
    - Often in groves in understorey on **Msikaba Formation sandstone** (Pondoland)
    - **Young stems densely hairy**
    - **Rusty brown, hairy pockets in main vein axils**
  - *Rinorea ilicifolia* subsp. *ilicifolia*
    - Forest understorey in Zululand
    - Stipular scar encircle twig
    - Margin sharply serrated to toothed (like *Rawsonia lucida*)

Tricalysia capensis var *capensis*

Domatia present (hairy, tufted)

Coastal forests
Leaf stalk hairy (to **hairless), 10mm long**

Flowers in parts of 5-6
Fruit red

Also var. galpinii (Swaziland & north)
Var *transvaalensis* (Montane forests Tvl)
Similar to *T.delagoensis* (Sand Forest)

Tricalysia africana

Domatia present (hairy) (both) – both Rubiaceae

Only **Pondoland** forests (Msikaba sandstone)
Leaf stalk hairy, **2-4 mm long**

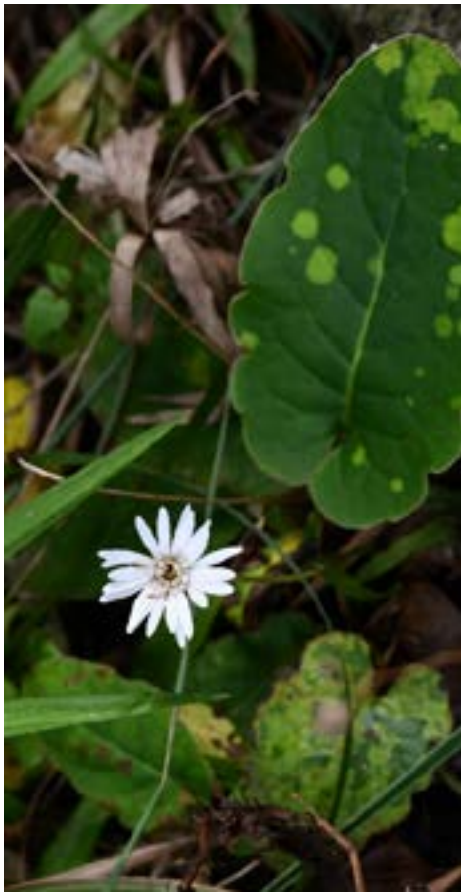
Flowers **in parts of 4** (petal lobes)
Fruit black, **tipped with persistent 4-lobed calyx**

There are a few examples of the endemic *Tricalysia africana* (nowadays *Empogona africana*) in the forest. Some scientific name changes are mind-boggling.

A few more important sights are *Tarchonanthus trilobus* var. *trilobus, Osyris compressa* (again changed its name back to *Colpoon compressum*), *Commiphora woodii* (with fruit), *Psydrax obovata, Homalium dentatum* and *Gerbera sylvicola*.

This page: *Rinorea domatiosa* with its characteristic brown domatia

Opposite page, clockwise from top left: *Brownlea coerulea* (photo: Tracy Taylor). *Cassipourea gummiflua. Loxostylis alata. Cryptocarya nyliei* Bulolo Gorge, a tributary to the Umtamvuna Gorge.



This page: *Gerbera sylvicola* (left) and *Erica cubica* (right) (photo: Tracy Taylor)
Opposite page:, top: *Canthium vanwykii* (left) and *Cryptocarya latifolia* (right).
Middle: *Erythroxylon pictum* with its characteristic leaf under surface
Bottom: *Eugenia erythrophylla*

The main differences between:

Apodytes dimidiata

Very common, forests & bushveld

Young **stems purplish-red**
Alternating, **elliptic leaves**; softly leathery

Shiny dark green, mid-rib pale
Petiole usually pinkish-red, to 20 mm long
Audible sound when leaf cracked
If carefully twist apart, thread connects mid-rib

Kidney-shaped black fruit with red appendage

Apodytes abbottii

Common on **Msikaba Sandstone,**
prefer rocky areas

Branchlets can be reddish at first
Alternating, **roundish, shorter leaves,** shiny blue-green; **more leathery & stiff**

Apex rounded
Longer petiole, usually reddish
Louder audible sound when leaf cracked

Similar fruit

Apodytes abbottii (left), with the differences between the leaves of *Apodytes dimidiata* (left) and *Apodytes abbottii* (right)






There are four species of *Erica* on the Msikaba Sandstone and Umtamvuna Gorge area, namely *Erica natalitia, Erica cubica, Erica abbottii* and *Erica aspalathifolia.*

Hartwig and I had a long discussion about the *Eugeni*a genus, which is so prominent in Umtamvuna Nature Reserve.

Eugenia is named after Prince Francois Eugene of Savoy (1663 to 1736). All the members of the genus have opposite leaves, which are gland-dotted when held up against the light, with a typical aromatic *Eucalyptus* smell when you crush the leaf. It belongs to the Myrtaceae family.

Some difficult trees to identify in the Scarp Forests are *Memecylon, Buxus* and *Garcinia*.

This page, left: *Eugenia erythrophylla* stem below. Bottom: *Eugenia umtamvunensis* (left) and *Eugenia verdoorniae* (right) Opposite page: *Eugenia verdoorniae* (left), *Memecylon bachmannii* (right)

The species in KZN are: *Eugenia albanensis, E.capensis* subsp. *capensis,* subsp. *gueinzii,* subsp. *mossambicensis, E.erythrophylla, E.natalitia, E.simii, Eugenia* sp. A, sp. B, sp. C, *E.umtamvunensis, E.verdoorniae, E.woodii, E.zeyheri* and *E.zuluensis.* An invader species is Eugenia uniflora. Only three of these species occur in Mpumalanga & Kruger National Park (according to Schmidt, Lötter & McCleland), i.e. Eugenia mossambicensis (sandveld Punda Maria), E.natalitia (forests) and E.woodii (mist belt forests). One more rare species is Eugenia pusilla in the rocky grassland of Amsterdam.

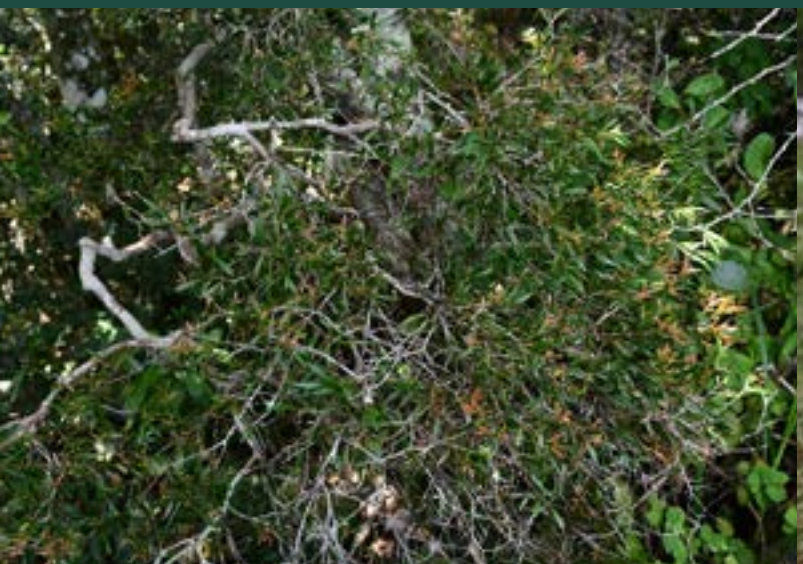
Dave Johnson's Key in KZN is:

Leaves opposite, entire .... stipules absent (not Rubiaceae) .... no latex present .... not mangrove, no succulent leaves and not tiny, scale-like leaves .... erect shrubs (not scramblers) .... not 3-veined from the leaf base .... can be **bicoloured**:

- Broader leaves, pale-green below:
  - Leaf < 60 mm long .... *Eugenia* sp. B (scarp forest, sandstone)
  - Leaf > 60 mm long, twig red-brown .... *Eugenia erythrophylla* (Pondoland, characteristic leaves)

Leaf **not bicoloured** .... spineless, leaves not 3-whorled & midrib not ending with raised dot, and twigs not square in cross-section (e.g. Syzygium & Olea) ... **leaf aromatic**:

- Leaf smells like myrtle (not curry), twigs with NO elongated lenticels or galls .... Leaf round:
  - *Eugenia capensis* subsp. *capensis* (thick leathery leaves, midrib falls short of apex) (round leaves, only on coastal dunes)
  - *Eugenia capensis* subsp. *gueinzii* (leaf base cordate, clasps stem) (suffrutex)
- Leaf **NOT round** .... leaf **at least 3x as long as broad:**
  - Leaf narrowly ovate
    - Leaf < 100 mm long .... *Eugenia* sp. A (only sandstone S.KZN)
  - Leaf not narrowly ovate
    - Twig white .... *Eugenia simii* (Pondoland or watercourses)
    - Not so ....
      - Leaf linear, about 5x as long as broad .... *Eugenia verdoorniae* (only Pondoland Centre)
      - Leaf oval, about 3x as long as broad .... *Eugenia zeyheri,* (mostly dry forest, E.Cape)
- Leaf **broader** ... leaf **obovate, lateral veins obscure** .... *Eugenia albanensis* (suffrutex, with distinct drip tip)
- Not so ...
  - Leaf **ovate** .... *Eugenia uniflora* (exotic, invader)
  - Leaf oval .... **leaf at least 2x as long as broad**
    - Petiole not red ... **bark flaky, yellow-brown** .... *Eugenia zuluensis* (Mistbelt forests)
    - Bark not so ... **lateral veins obscure** .... *Eugenia natalitia* (Forests, smooth bark)
    - Lateral veins not obscure .... leaf apex attenuate (*Syzygium cumini* exotic)
    - Leaf apex tapering .... (*Syzygium guineense*)
  - Leaf broader .... **leaf apex attenuate** .... *Eugenia* sp. C (Peeling bark, scarp forest, Pondoland)
  - Leaf apex not attenuate ....
    - **Leaf thick & leathery** .... *Eugenia umtamvunensis* (Scarp forest, Msikaba sandstone)
    - Not so .....
      - **Large tree** .... *Eugenia woodii* (Bark corky, flaking, forests, bronze new leaves)
      - Small shrub .... *Eugenia capensis* subsp. *mossambicensis* (suffrutex, N.E.Maputaland)



All the following trees with characteristic, opposite leaves:

Garcinia gerrardii

Forest Mangosteen

Large forest tree, scarp forest

Mottled ±yellow bark
White to **yellowish latex**
Green branchlets, **angled**
Leathery, shiny, dark green thick leaves

Apex **sharply pointed, recurved tip**
Thick margin rolled under
Mid-rib raised below
Typical **swollen-like petiole junction**
Yellow-orange large berry-like fruits

Buxus natalensis

Natal Box / Large-leaf Box

Small tree, in colonies, scarp & coastal forest; **understorey**

Light brown, **corky peeling bark**
Horizontal branching
Young stems are green, not angled
Elliptic leaves, bigger than *Buxus macowanii*

Apex blunt drip-tip

Roundish fruit with three horns

Buxus macowanii

Cape Box

Small tree in colonies in scarp forest
Straight, slender stem with grooved, roughish bark;
angled branchlets
Diamond-shaped, **stiffly leathery**, shiny dark green
Short **stalk (petiole) runs into stem**

Memecylon natalense

Small-leaf Rose-apple

Small tree in scarp forest understorey
Branches held horizontally
New growth purplish with **fine, rounded stems**

Bark finely **longitudinally furrowed**
Opposite leaves, arranged **horizontally** on twigs

Leaves broadly-elliptic, **taper to a pointed tip**; fairly stiff
Mid-rib and side veins hardly visible

(slightly **more** 3-veined from base)

Memecylon bachmannii

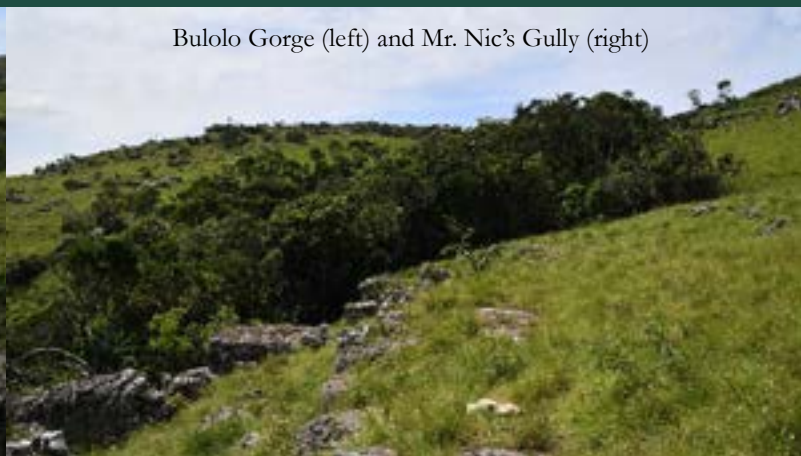
Pondo Rose-apple

Forest understorey (**Pondoland endemic**)
Horizontal branching

Pale grey bark, finely furrowed
Broadly ovate to round leaves

Base round, slightly lobed; apex abruptly pointed
Stiff, leathery, shiny, dark green, paler below
Mid-rib raised
Margin tightly rolled under
(faintly 3-veined from base)

Similar to **Eugenia natalitia**
Bark not furrowed **(smooth)**; forest. **Aromatic leaves** when crushed (Myrtaceae = gums)
Broadly elliptic leaves (decussate); **midrib sunken above**



Bulolo Gorge (left) and Mr. Nic's Gully (right)

The differences between ***Garcinia gerrardii, Voacanga thouarsii*** & ***Tabernaemontana ventricosa*** when only leaves available:

Garcinia gerrardii	*Voacanga thouarsii*	*Tabernaemontana ventricosa*
Forest Mangosteen	Wild Frangipani	Forest Toad-tree
Forest tree	Larger tree	Forest understorey
Green branchlets, angled	Young stems green with raised white dots, fallen stipules form a rim between leaves (leaf stalks joined at base to form a rim around twig)	Bark smooth, light brown, with large, raised lenticels
Mottled pale, yellow bark	Smooth, mottled grey bark	
White to yellowish-brown sap	Milky sap	Milky sap
Opposite leaves	Opposite, decussate leaves, crowded near branch ends; can have domatia	Large, opposite leaves
Elliptic leaves, leathery	Narrowly obovate to elliptic	Oblong leaves (not obovate)
Thick, shiny, leathery & dark green leaves	Shiny, dark green, visible dots against light (not leathery)	Shiny dark green, paler below; margin wavy (not leathery)
Mid-rib raised below	Mid-rib raised below, inconspicuous side veins	Raised mid-rib, many side veins
Thick rolled under leaf margin		
Apex recurved, sharply pointed	Broadly tapering to round apex; base narrowly tapers into leaf stalk	Round to pointed apex
Typical swollen-like opposite petiole junction		
Scarp Forest	Always swamp or riverine forest	Forest understorey
	White frangipani-like flowers	Large white flowers
Yellow-orange berry like large fruits	Paired dark green fruits, white spots, smooth surface	Paired pale green fruits, smooth
Similar to *Buxus natalensis*		Compare with *T. elegans*

Gerrardina foliosa (left) and *Lasiosiphon (Gnidia) anthylloides* (right)

Pseudoscolopia polyantha

Putterlickia retrospina (left) and *Pseudoscolopia polyantha* (right)

Rhynchocalyx lawsonioides (false waterberry) (left and right)

Syncolostemon rotundifolius

Syzygium cordatum x gerrardii hybrid (left),
Syzygium pondoense (right)

Nectaropetalum zuluense (left) & *Nectaropetalum capense* (right)

Clockwise from top left: Hugh Nicholson, abotanical pioneer in Umtamvuna Gorge .The walk down to the gorge. *Brunsvigia grandiflora*. *Manilkara nicholsonii* galls (photo right: Tracy Taylor)

From top to bottom: *Manilkara nicholsonii* leaves. *Maytenus abbottii, Ochna chilversii*

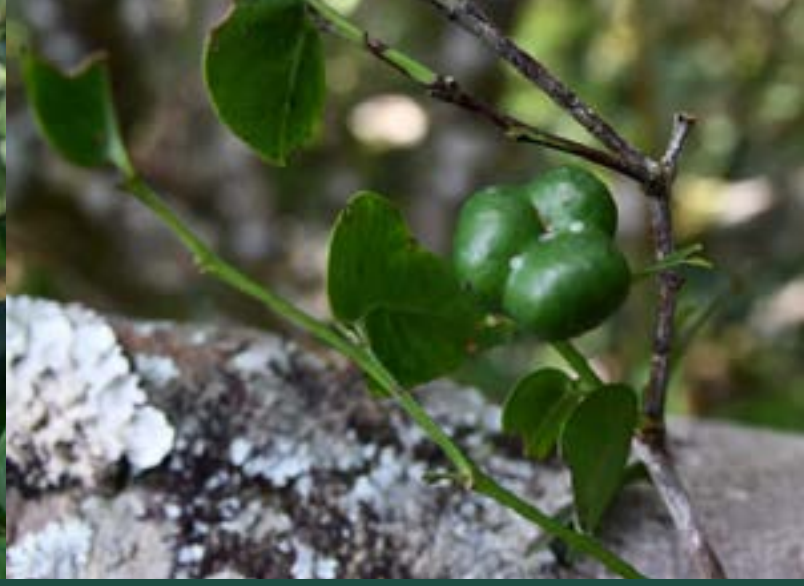
We undertook a day trip to Mr. Nic's Gully, and Hartwig and I redid the trip a few days later, especially to do revision of the difficult Pondoland endemics.

Dorothy, Gail, Tracy and Simon joined us on the first visit in tropical, and humid heat. This gully is named after Hugh Nicholson, also known as "Oom Nic". You walk near the cliff face and see more than 35 species of trees within 20 metres along the forest edge.

We had to walk down the grassland to finally get to the gully and the forest edge, but were rewarded with incredible plants, like *Searsia carnosula, Searsia fastigata, Watsonia densiflora, Setaria grasses, Inulanthera calva, Lotononis viminea, Lasiosiphon anthylloides (Gnidia anthylloides), Thunbergia atriplicifolia* versus *Exochenium grande (Sebaea grandis), Isoglossa ovata, Gladiolus daleni, Watsonia densiflora, Kniphofia parviflora, Senecio albens, Sopubia simplex, Monopsis natalensis, Aspalathus chortophila, Monopsis unidentata, Bulbine* sp. nov, *Helichrysum herbaceum, Drosera natalensis, Pelargonium luridum, Senecio discodregeanus, Desmodium dregeanum* and one of the Pondoland endemics, *Syncolostemon parviflorus.*

The diversity at Mr. Nic's Gully is incredible: *Faurea macnaughtonii, Peddiea africana, Grewia pondoensis, Pseudoscolopia polyantha, Cryptocarya wyliei, Eugenia verdoorniae, Canthium vanwykii,* the impressive *Rhyncocalyx lawsonioides* (false umdoni), E*ugenia erythrophylla, Anastrabe integerrima, Putterlickia retrospinosa, Bersama swinnyi, Dovyalis lucida, Plectranthus saccatus, Clausena anisata, Searsia lucida, Eugenia umtamvunensis, Loxostylis alata, Indigofera natalensis, Lauridia tetragona, Secamone alpini, Podocarpus latifolius, Rothmannia globosa, Diospyros scabrida, Diospyros villosa, Syzygium pondoense, Schlefflera umbellifera, Maytenus abbottii, Robsonodendron eucleiforme, Maytenus cordata, Brachylaena uniflora, Syzygium gerrardii, Olea capensis* subsp. *enervis, Memecylon bachmannii, Halleria lucida, Rhoicissus tridentata, Gymnanthemum tigna* (old name Vernonia tigna), *Gerrardina foliosa, Tarchonanthus trilobus* var. *trilobus, Cassinopsis tinifolia, Euclea natalensis, Dombeya tiliaceae, Allophyllus africanus* and *Grewia pondoensis.*

There are a few trees where you can carefully pull the leaf apart to see fine silky threads: the more common *Maytenus acuminata* and *Robsonodendron eucleiforme*, both fairly widespread. In Pondoland you also get *Maytenus abbottii* and *Maytenus cordata*.



Maytenus cordata with its flowers and cordate leafbases, and fruit

Maytenus abbottii leaf and flower – floral parts in 4s

Leaf Key: Leaves alternate, not entire – spineless – **torn leaf held together by elastic threads**:

- Twig & petiole purple .... *Maytenus acuminata*
- Not so ....
  - Leaf margin **sharply serrate** .... *Maytenus abbottii*
  - Leaf margin **weakly toothed** ....
    - Leaf ovate .... .*Maytenus cordata* (also cordate base)
    - Leaf oval .... *Robsonodendron eucleiforme*

Maytenus acuminata
Leaves **ovate to lanceolate**, often small in canopy, **apex narrow, thinly l**eathery; **midrib of young leaves reddish**; common in forests

Robsonodendron eucleiforme
Leaves **elliptic to oval, more leathery,** with rolled under margins; **young branches 4-angled**; small leaves (but bigger than M.acuminata), **base tapers with short stalk**; in forests, widespread

Maytenus abbottii
Large ovate leaves with prominent midrib; margin sharply serrated; flower parts in 4s (other Maytenus spp flower parts in 5s); often associates with Pseudosalacia streyi (upright stem, horizontal, widely-spaced branches; stiff, thick & leathery leaves, leaves held horizontal, apex rounded or notched) – both only Pondoland

Maytenus cordata
More widespread, coastal and scarp forests; branches held horizontal, purplish-brown, cylindrical, final twigs green but angular; **leaves ovate, shallowly serrated or entire, base usually heart-shaped** (cordate), very short stalk. Differs from *Maytenus acuminata*

The floral parts of most *Maytenus* species are in 5s, but the floral parts of *Maytenus abbottii* are in 4s.

It is interesting how laymen botanists can pronounce the same name in different ways, like *Faurea macnaughtonii.* I pronounce *Faurea* as fô-rea, while my friends in Pondoland talk about foorya. There is no dedicated way to pronounce these scientific names, as long as you can spell them correctly.

Top: *Grewia pondoensis*. Middle: *Grewia occidentalis*. Bottom: The Red Desert and its associated grassland is still on our list.

Dorothy suggested that I walk down the steep gorge slope to see three more Pondoland endemics, *Pseudosalacia streyii, Dahlgrenodendron natalense* and *Erythrococca* sp. nov., but the thought of a cold beer at the vehicle was a lot more tempting.

Another endemic is *Colubrina nicholsonii*, found more in the Mntentu forests, but luckily I have seen it in Vernon Crookes Nature Reserve, a few years ago.

After a fantastic few days, one tree remained unidentified. Dorothy and I tried to key it out with Dr Dave Johnson's Leaf Key, while all our Crewites attended the session. You must really concentrate with the key, but eventually you will be awarded with the correct identification … *Chionanthus foveolatus* subsp. *tomentellus* – the genus name has not changed to Norhonia.

The Red Desert is the smallest desert in the world, certainly in Africa. It is not more than 20 ha in size. It consists geologically of red Berea sands, probably about 5 million years old. Unfortunately it houses a lot of invader plants, like *Grevillea banksii* and *Hakea sericea*, both Proteaceae invaders, typical of the Cape fynbos.

Hartwig and I attempted to find *Cussonia* sp. nov (*pondoensis*), another endemic, not even in Richard Boon's book! It has not formally been described yet! We had to get our friends to show us the way again ... with grassland specials like *Lobelia tomentosa, Tephrosia grandiflora, Helichrysum auriceps, Raphionacme elliptica, Chamaecrista mimosoides, Crassula alba, Eugenia albanensis* (a geoxylic suffrutex), *Tephrosia macropoda, Tephrosia bachmannii, Relhania pungens, Moraea elliotii* and *Abrus laevigatus.*

Another Pondoland endemic on Msikaba Sandstone is *Phylica natalensis,* another fynbos species is *Helichrysum populifolium.*

From a distance this rare cabbage-tree looks like *Schefflera umbellifera* (nowadays *Neocussonia umbellifera*), but the leaves are different. It is also different from *Cussonia nicholsonii.* Tracy collected some leaves for our collection from the precipitous cliff face. *Cussonia* sp. nov (*pondoensis*) is described in a Ph.D. thesis from Bernard Johann de Villiers (University of Johannesburg), but the tree ihas not formally been described yet.

While spending some time on the cliffs overlooking the Umtamvuna Gorge, thinking of the gloomy future of our Pondoland endemics and the greed of mankind, I even saw a few mangroves, *Bruguiera gymnorrhiza* and *Avicennia marina.*

Tired of botanizing, but very happy with our achievements, we enjoyed bottomless coffee at Beaver Creek, a seafood meal at Dolphin Pub & Grill, rinsed by pure ice-cold Amarula and watched the full moon rising over the sea.

Bottom left: The explorers on one on the Mntentu forest outings: Uschi, Dorothy, Maggie, Sinegugu and Tracy (photo: Tracy Taylor)

Bottom right: Our group at Beacon Hill (fltr): Dorothy, Francois, Simon, the Reserve manager and Hartwig (back row), with Gail and Tracy (in the front) (photo: Craig)

The sad reality of the human explosion at Umtamvuna Gorge (left), and the cliff face, where we found *Cussonia pondoensis* (right)
Bottom: *Phylica natalensis*

Top: *Cussonia pondoensis* leaf (left), and *Ficus burtt-davyi* on the cliff face (right).
Cussonia sp. nov (*pondoensis*) (encircled in red)

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DON`T FIDDLE WITH FYNBOS, OR WHY BITOU IS A GOOD THING

Chris Gow
Outeniqua -2023

Here we are at the end of 2023, six years after the huge fires that swept through the Garden Route in 2017. At this stage of the recovery process the veld around Knysna is too beautiful - a mass of yellow flowering bitou. I was recently horrified to hear someone say that he treats bitou the same as invasive alien species – not what one wants to hear in a conservancy! I had wanted to dive straight in with a discussion of the importance of bitou in the natural scheme of things, but perhaps one should start with listing the more important reference books to those who are sufficiently interested – not just to identify species, but on the broader topic of ecology and the dynamic, ever changing nature of the living world. I have over the last 20 years accumulated about a metre of bookshelf devoted to mostly indigenous plants, and of course some on alien invader plants. And no, I don`t lend them out and only a few are taken into the field – books are not made like they used to be, and they are dreadfully expensive. The Western Heads / Goukamma Conservancy, my stomping ground, is predominantly Knysna Sand Fynbos, but includes quite a bit of thicket and forest.

First off you need the John Manning (2007). *Field Guide to Fynbos*. Here you will find bitou under what older books called *Chrythanthemoides monilifera* is now *Osteospermum moniliferum*, the genus containing ten other similar species. Don`t go straight to the pictures, read the introductory chapters, where you will find this plea; "With so many species surviving

“With so many species surviving precariously on tiny fragments, fynbos needs all the help it can get to survive.”

precariously on tiny fragments, fynbos needs all the help it can get to survive.” One must hasten to add that we are dealing with some 9000 variously interdependent fynbos species (not all of which occur locally of course), so the rule is hands off, except for alien invader eradication, which is a whole can of worms in itself: one doesn`t just clear land once, alien eradication is forever. (I used to think that alien invader plants are the biggest threat to our indigenous plant ecology. Wrong – people are – ignorant, destructive, and uncaring. Shrugging at invaders is part of it).

Then you must have Jan Vlok and Anne Lise Schutte-Vlok (2010). *Plants of the Klein Karoo*. Much of the fynbos flora crosses the mountains to enter the Klein Karoo floral complex. The Vloks` knowledge of the flora is just phenomenal, and again it is the introductory chapters on ecology that need to be appreciated and absorbed as far as possible and returned to time and again.

For trees all you need is Elna Venter (2011). *Trees of the Garden Route, Mossel Bay to Storms River*. Elna included bitou as a tree, which is fortunate as she includes observations found nowhere else.

One must mention Esler, Pierce and De

Villiers (2014). F*ynbos Ecology and Management*. Just so you don`t think I have forgotten it. A bit of a "curate`s egg" perhaps – don`t get carried away by some of it that I consider a bit cavalier. The management part is really for those who farm on fynbos. Most of these lovely books should be readily available e.g. from the bookshop at the George Botanic Garden.

Back to bitou. Bitou is a conspicuous element of the fynbos in our area and a major player in the recovery stage following fire: it is a small, rounded bush really, growing to approximately 2 - 3 metres or more; short-lived, evergreen, it`s falling leaves turn quickly to useful compost. (Evergreen trees do shed copious amounts of leaves, we just don`t notice it.) The rather fleshy leaves are hairy – ideal for catching and holding the dew which is such a feature of our area – if you are a buck, eat those and you don`t need water. Bitou has a long flowering season (the showy yellow flowers brighten the landscape) and it is our only member of the daisy family that has fleshy fruit. "Once a staple of the Khoi people, the purple fruit is still eaten by children, monkeys and birds." Thank you Elna! Then there are the little furry chaps – the rodents that eat (and hoard) seeds, leaving plenty in the seed bed to sprout after the next fire.

Arranging fires periodically is a delicate business in a landscape dotted with urban areas and forestry plantations (which have a responsibility to keep their neighbours` ground clear of invaders), but fire is essential for the health of fynbos (don`t dwell on all the animals killed and maimed; that`s Nature.) Rather pre-empt than have runaway fire disasters. Fynbos is nothing if not sun loving, but perhaps in the early recovery stages too much sun (= hot sand) might not be so welcome – we don`t know, and this could be one ecological service provided by bitou. Think too of the LBJs moving into the area to repopulate it – they need somewhere to nest, before the more robust re-sprouters (proteas and many others) have grown to a respectable size. Think of wind screening, soil water retention, erosion prevention, shading for reptiles, vast quantities of pollen for bees and many other insects. Get into the veld, ask yourself questions, wonder why things are as they are, have respect for what we don`t understand – don`t even think to second guess Nature.

Bitou is an opportunist of note, popping up all over the place. I have experience of this in a small urban patch of thicket which I have tried to thin (to discourage its use as a lavatory), leaving the better specimen tree species. There is an old truism that Nature abhors a vacuum. Bitou does its best to thwart my efforts. I was horrified the other day to see Port Jackson wattle thriving and flowering in exactly the same way! It has been present there unnoticed for years. Out it came! Contrast the long-term effects of these similar behaviours. The bitou would in time be supressed by the trees around them, but the wattle will take over completely. That is the difference.

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Gonioma kamassi (kamasie) - Naas Grove

THE SLOW REPRODUCTIVE PROCESS IN *Outeniqua* YELLOWWOOD *Afrocarpus [Podocarpus] falcatus*

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Reproductive biological processes (flowering, pollination and fertilization, seed development, fruit/seed dispersal, and seed germination) of a tree species are critical in its early development. This formed part of the studies on the ecology of the BIG tree of our evergreen forests, the gymnosperm Outeniqua yellowwood (*Afrocarpus [Podocarpus] falcatus*) (Geldenhuys, 1975). This dioecious (with separate male and female trees), wind-pollinated podocarp is the only gymnosperm we know of that is dispersed by fruit bats. Seed dispersal by bats contribute to delayed germination of the seeds when compared to upright yellowwood (*Podocarpus latifolius*) (Geldenhuys, 1993). This article briefly covers the flowering, pollination and early seed development, with more detailed coverage of the germination process of Outeniqua yellowwood, as described by Geldenhuys (1975) and uses photographs taken at that time.

Flowering, pollination, fertilization and seed development

The male cones develop near the end of the twigs that developed the previous growing season (year 1), in groups of 1 to 3 cones (Figure 1). Their development starts around November (early summer), proceeding slowly until after winter. They then enlarge rapidly, attaining a creamy green color. After releasing the pollen between August and mid-December (year 2), they become brown, dry and fall to the ground. Sometimes people think

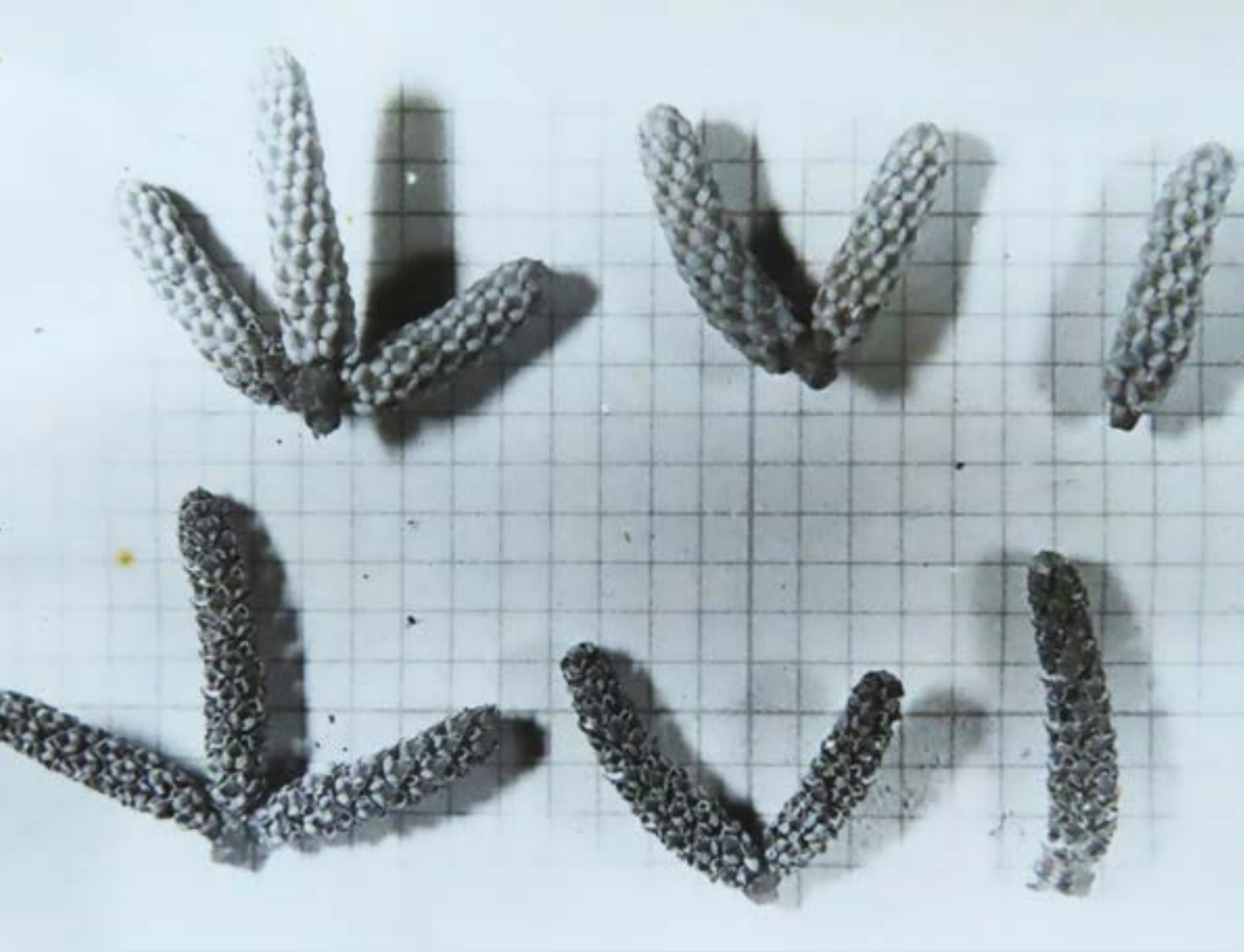
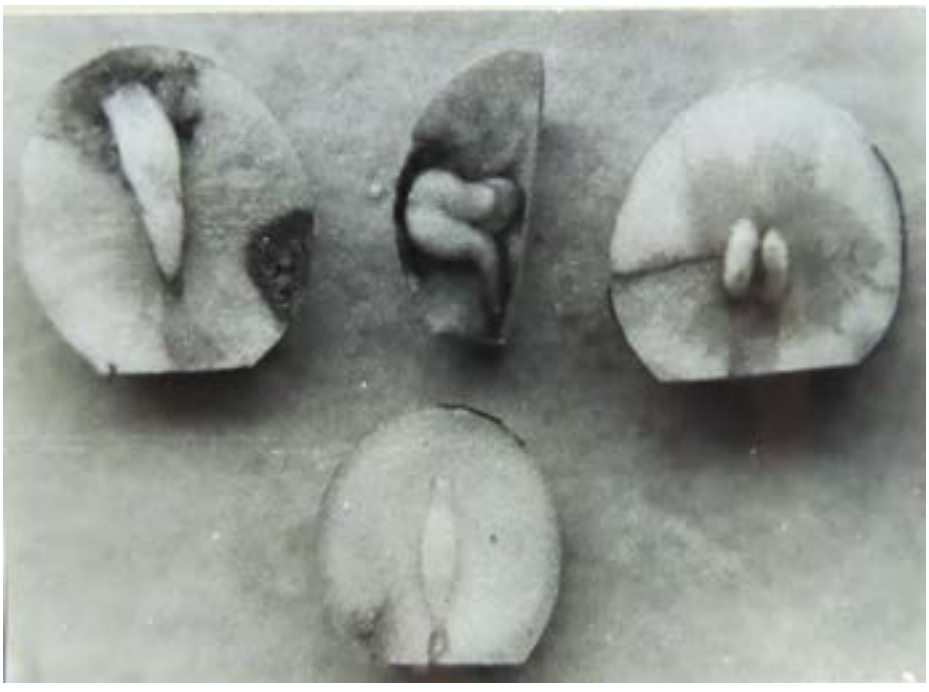


Figure 1. Male cones of Afrocarpus falcatus, generally with three cones in a cluster but also with one or two cones per cluster. The upper row shows cones before release of the pollen and the bottom row shows them after release of the pollen.

Figure 2. Development of abnormal embryos and seedlings in Afrocarpus falcatus: a) Left, with three seedlings developing from one seed. b) Three abnormal embryos (upper row) compared to a normal embryo (below).



such browning appearance is indicative of the tree dying. Most of the pollen on a tree is dropped during a period of one to two weeks, but the period of pollen release may vary between trees. A single female cone, occasionally two, with a blueish-green color and covered with a waxy layer, develops on short shoots (year 2) in the axel of a leaf on a twig of the previous season. The female cone immediately develops further after pollination. Occasionally poly-embryony occurs, with an example of three embryos in one seed developing into seedlings (Figure 2a). Some deformed embryos were also observed during cutting tests of seed viability (Figure 2b).

The 'fruit' structure of the seed of Outeniqua yellowwood has several components that are of ecological importance (Figures 3). The initial thin, green, leathery epimatium becomes fleshy, yellow and up to 5 mm thick. Between the epimatium and the endosperm with embryo, the hard, woody sclerotesta develops about 4 months after pollination. The seed takes about one year to mature and ripen, between August and December (year 3).

Several factors influence successful pollination and fertilization of Outeniqua yellowwood towards seed production (Geldenhuys, 1975):

(i) The ratio in numbers between male and female trees in a forest, such as a few widely scattered male or female trees relative to the number of trees of the opposite sex.
(ii) The reproductive state of individual trees when few trees are present, when male trees may produce pollen when the female cones are not yet in a state to receive pollen, or vice versa.
(iii) Outside the forest the trees may be in a reproductive state when still relatively young, but inside the forest the younger trees may first have to reach better light conditions before it can produce male or female cones.
(iv) Climatic conditions during a particular season may affect the development of male cones differently to when female cones develop during the next year.

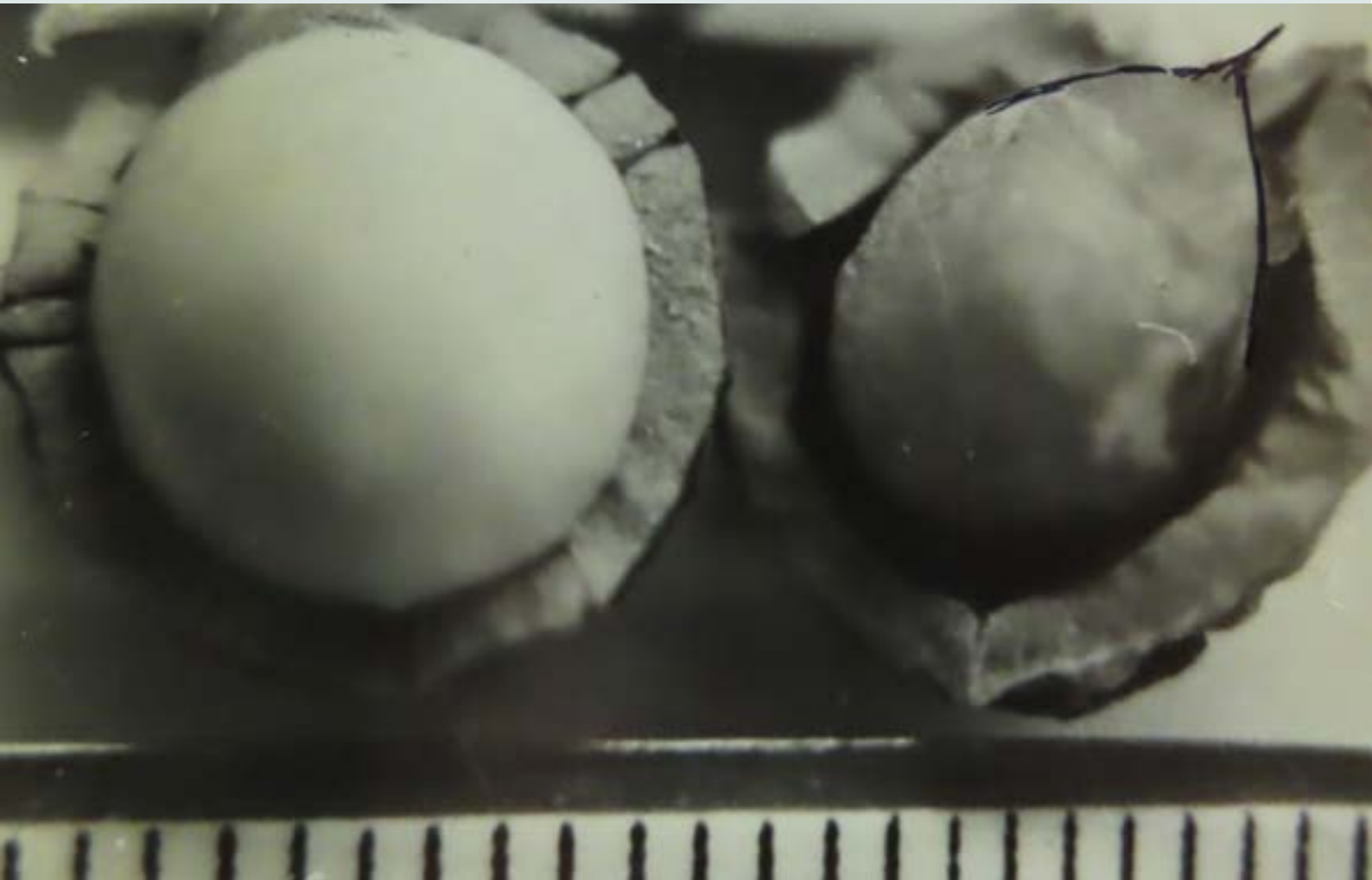
Figure 3. The seed of *Afrocarpus falcatus* developing from a single female cone: a) Left – a schematic view of the mature seed structure; b) Right – the seed with the fleshy, yellow covering (left) and the covering removed showing the bulged sclerotesta (right) after removal of the epimatium by bats.

Seed germination and duration of germination stages

Water uptake by the ripe seed causes the endosperm to swell until it totally fills the inner space formed by the sclerotesta and causes the sclerotesta to crack (Figures 4 and 5), the first external sign of the start of germination. The endosperm continues to swell and pushes the two parts of the sclerotesta further apart. The stem of the developing seedling (hypocotyl) pushes the tip of the root (radicle) through the tip of the endosperm. The hypocotyl becomes green. When the radicle is pushed to about 2-3 mm outside the endosperm, it starts to develop downwards into the soil. The point of transition between the radicle and hypocotyl shows the depth at which germination occurred. At the same time, the hypocotyl lengthens and grows with a bow upwards through the soil profile. It then eventually pulls the two cotyledons (first leaves of the embryonic seedling) above the soil surface, to eventually grow upwards.

The total germination process is very slow. Several experimental observations were done to determine the length of the period a seedling takes to develop through the stages. Many seeds were placed on top of the soil in a large nursery box (Box 1) in the shady part of the nursery. The yellow, soft, fleshy epimatium was not removed, and the seeds were not covered with soil, but the seeds were watered twice a week. These seeds were used to determine the length of germination Stages 1 and 2, when they started to germinate by August (year 4).

Figure 4. Swelling of the endosperm of *Afrocarpus falcatus* from the size on the right to the size on the left, eventually filling the inner space formed by the hard sclerotesta until the sclerotesta cracks and breaks in two parts.



Stage 1 starts when the hard sclerotesta cracks and ends when the tip of the radicle appears (Figure 5). Twenty-five seeds in Stage 1 were placed in nursery Box 2, on top of the soil, to observe and determine the length of Stage 1. The duration of Stage 1 was up to 5 days, but generally 3 to 4 days.

Stage 2 starts when the radicle appears and ends when the bow of the hypocotyl reaches the soil surface (Figure 6a). Seeds developing into Stage 2 were removed to nursery Box 3 and covered with a soil layer of 1 to 2 cm thick, and slightly compressed. The period until the hypocotyl appeared was recorded for each seed. The duration of Stage 2 was between 7 and 27 days, with a mean of 19 days. This period depended on the depth of the soil cover.

Stage 3 starts when the bow of the hypocotyl breaks the soil surface until the tip of the cotyledonary leaves appears above the soil surface (Figure 6b). The duration of Stage 3 was 2 to 23 days with a mean of 9.5 days.

Figure 5. Stage 1 in the germination of the seed of *Afrocarpus falcatus*. a) Left – development of the embryo with the swelling endosperm as observed in cut seeds, and b) Right – the external view of such a seed until the new root (radicle) appears.

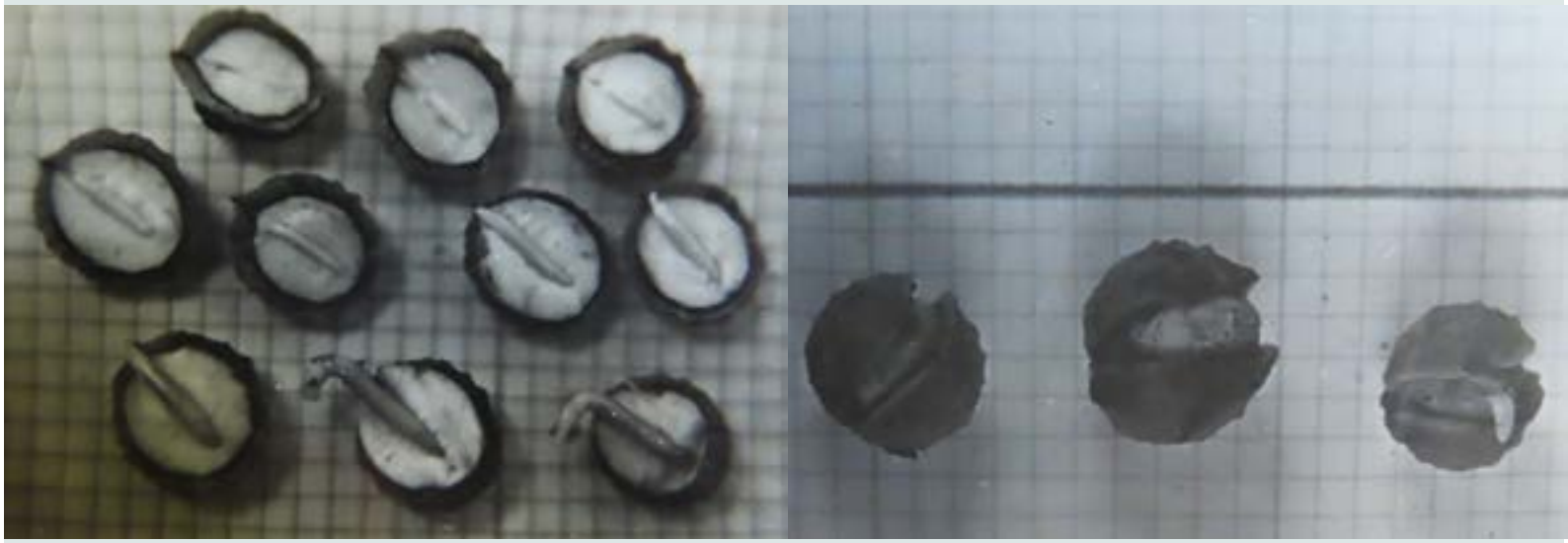
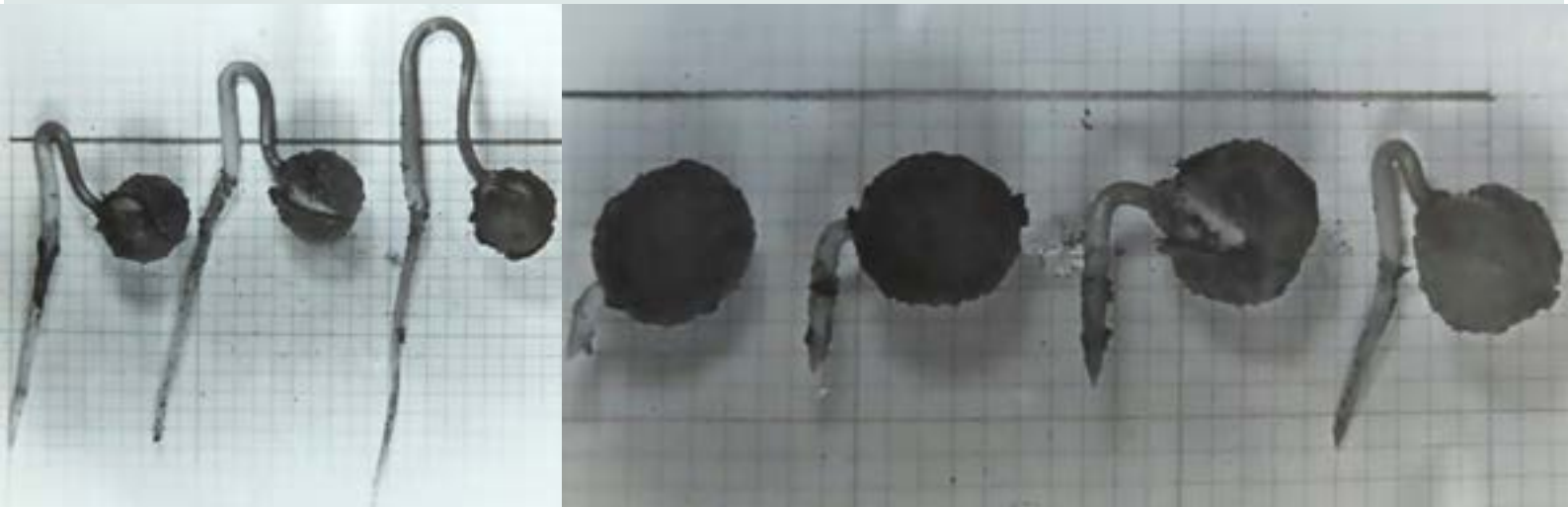


Figure 6. Stages 2 (a, row on left) and 3 (b, row on right) in the germination of the seed of *Afrocarpus falcatus.*

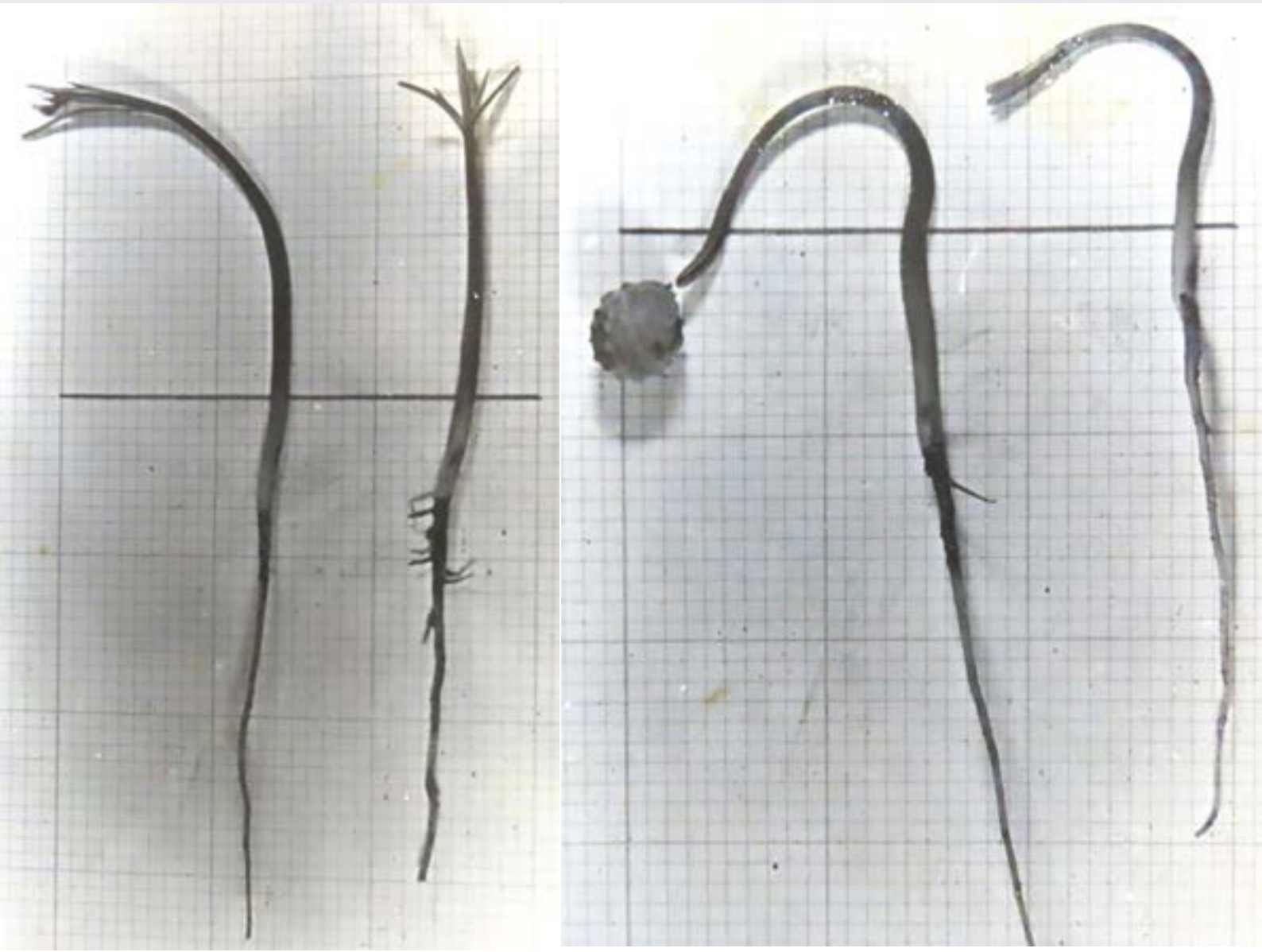


Seeds at the start of germination Stage 2 were sown at different depths (soil surface and 1 cm, 2 cm and 3 cm below the soil surface) to assess the effect of depth of sowing on the total period up to the end of germination Stage 3 (Table 1). The total period for each seed depth is not necessarily the sums of the shortest and the longest periods because the periods differed per seed. The total period from the start of Stage 2 to the end of Stage 3 did not differ much up to 2 cm depth but was longer at 3 cm depth. Stage 2 seemed to be longer with the deeper sowing depth, but the longer Stage 2 caused Stage 3 to complete faster.

Table 1. Length of period of seedling development of Afrocarpus falcatus during germination Stage 2 and 3 sown at different depths.

Seed depth, cm	Period. days		
	Germination Stage 2	Germination Stage 3	Total period
0	04 - 11	12 - 25	16 - 32
1	10 - 18	06 - 19	18 - 32
2	11 - 26	07 - 21	25 - 32
3	18 - 35	02 - 12	27 - 42

Figure 7. tage 4 in the germination of the seed of Afrocarpus falcatus, in which the cotyledonary leaves lift above the soil surface and the seedling pulls up straight.



Stage 4 starts when the cotyledonary leaves lifts above the soil surface until the seedling appears straight upwards (Figure 7). Sometimes the sclerotesta is pulled above the soil with the cotyledonary leaves. The duration of Stage 4 is 1 to 5 days, with a mean of 1.9 days.

In summary, the mean and range in the duration of each stage vary a lot (Table 2). However, this has already started 3 years earlier when the male cones were formed. The critical period for the developing seedling is during Stage 3, when the bent hypocotyl appears above the ground. The hypocotyl hardens when exposed to sun and cannot then be pulled up straight. It is eaten by insects and sometimes damaged by fallen twigs or branches.

Table 2. The mean and range in the duration of the germination stages of *Afrocarpus falcatus*.

Germination stage	Period (days)	
	Mean	Range
1	3.5	02 – 05
2	19.0	07 - 27
3	9.5	02 - 23
4	1.9	01 - 04
Total	5 to 7 weeks	

The mean seedling height at the end of Stage 4 was 5.3 cm and developed to 7.1 cm height after two weeks. The development in the nursery under optimum conditions is much faster in both the roots and the shoot, than in the forest understorey (Figure 8a). However, the seedlings can develop over time, from the shady environment of the forest understorey to the sub-exposed conditions above the canopy, into the big trees of the forests (Figure 8b). Next time when visiting such a big tree, look for some seedlings and imagine the challenges it faces to reach the canopy.

Figure 8. Left and first image of article
Development of *Afrocarpus falcatus* from seedlings to mature trees. a) Left – Nursery-grown (left) versus forest-grown seedlings of similar age. b) Right – a mature tree with stem diameter of 164 cm and estimated age of 720 years.

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NOTES ON THE CONTROL OF alien invasives

Lantana camara, *Chromolaena odorata* and *Jacaranda mimosifolia*

ISAK LOMBARD

Theory component prepared in partial completion of
Dendrologist Level III Examination, Magaliesberg Branch

Photo by Feyzanur SOYYİĞİT on Unsplash

This article describes the process followed to eradicate and control invasive species of plants on my farm in the Tzaneen area. I discuss the types of invaders and especially the three main invaders that posed the biggest problem on the farm. I furthermore provide information on the equipment used and some general information on labour issues and logistic challenges.

BACKGROUND

I own a small farm of about 100 hectares 10 km east of Tzaneen which I bought in 2006. Of the 100 hectares, 70 are uncultivated. My tenant and neighbours grow bananas, mangoes, litchis, lemon and the occasional cash crops such as cabbage and green peppers. These crops are irrigated from the Letaba River 3 km to the south. This report concerns the 70 ha of uncultivated land, referred to as "the area".

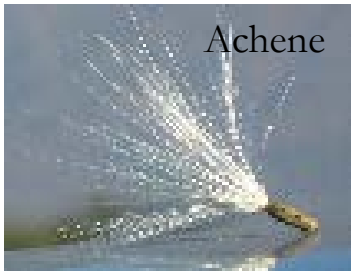
We only started to visit the area regularly in 2010. Veld fires would turn impenetrable bush patches into open black spaces, just to be repeated the following year. The fire kills young trees and dries out the bark of older trees. In many cases termite ants feed on the damaged bark endangering its host. I became interested in the types of vegetation and got to know the main invader, the "paraffienbos/triffid weed" or *Chromolaena odorata*.

The area is shown in the following map (Google Earth):

THE INVADERS

Chromolaena odorata

Chromolaena odorata is a rapid growing perennial weed in the Asteraceae family. It originates from the Americas but has spread to many sub-tropical to tropical areas in Asia, Australia and Africa. I have encountered it next to the Nile, in Uganda and in Thailand. Under favourable conditions it can grow as much as 3 cm per day, smothering surrounding plants. Of all the indigenous shrub-like plants it was only the *Bauhinia galpinii* that stood its ground. A single *Chromolaena odorata* plant can produce up to 90,000 achenes that spread with the wind. Seeds need sun to germinate. By removing older plants, the seeds that may have been dormant in the soil for a long time, germinates in proliferation. It is called 'paraffienbos' as it burns easily, even when green. *Chromolaena odorata* is listed as a Category 1b invasive species in South Africa in terms of the Biodiversity Act of 2004 (NEMBA). The Act requires compulsory control and eradication (remove and destroy).


Achene

It has simple, unlobed and opposite leaves that are decussately arranged (successive opposite pairs of leaves are at 90° to each other). Three main veins arise from near the base. Margin is toothed.

Lantana camara

The evergreen *Lantana camara* is well known with its attractive pink, orange and red flowers. The flowers were the main reason for its introduction from its native tropical regions in the Americas and Africa to South Africa as a garden plant. Lantana camara is part of the Verbenaceae or verbena family. Our own *Lippia javanica* belongs to the same family and the crushed leaves of both species smell remarkably similar. *Clerodendron* and *Volkameria* also belonged to Verbenaceae but were moved to Lamiaceae following phylogenetic studies which included DNA sequencing. The *Lantana camara*'s fleshy black seeds are spread by birds. It is also listed as a Cat. 1b invasive species.

Branchlets are hairy and have scattered hooked prickles. Leaves are simple, opposite and have 4 – 6 pairs of main lateral veins which are sunken above.

Lantana camara leaf extracts have been proven to be effective as a bionematicide against pathogenic nematodes in bananas. Nematodes ('aalwurm' in Afrikaans) attacking banana roots are microscopic roundworms. The *Lantana* extract paralyses the mouth parts of the nematodes. My brother, farming on adjacent land, has been using 60 kg of fermented chopped lantana leaves and branches with every 1000 l of water as an additive to the organic fertilizer for the bananas. The plants appeared healthier with a marked increase in production. The leaf extracts are also effective against certain aphids feeding on cabbage.

Jacaranda mimosifolia

Jacaranda mimosifolia, a native of South America (Argentina, Bolivia), with its beautiful and long-lasting flowers in October needs little introduction. It belongs to the Bignoniaceae family, which includes our *Kigelia africana* (sausage tree/worsboom). Jacaranda wood is light (550 kg/m3), relatively soft and pale grey to whitish. Carpenters find it easy to work with – it is fine-grained, turns easily and does not warp. Even though it does not make hard coals, I have used the wood for braais on many occasions. It is also listed as a Cat. 1b invasive species in Limpopo.

Photo by Eric Hong on Unsplash

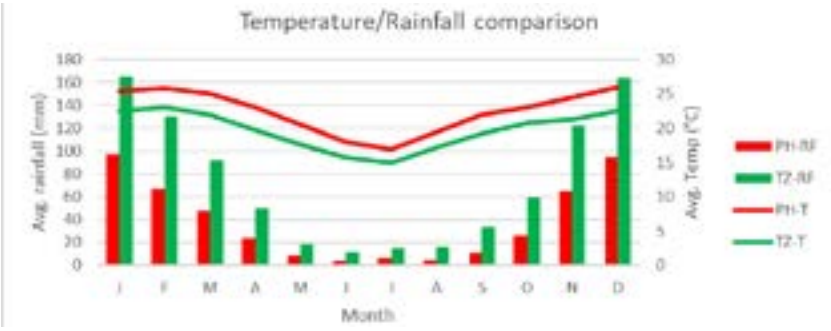
Apart from the above three main invaders there were isolated plants of *Duranta erecta* (duranta/vergeet-my-nie-boom), *Solanum mauritianum* (bugweed/luisboom), *Melia azedarach* (syringa/maksering) and *Psidium guajava* (guava). After sufficient rain (100 mm), the *Solanum* is easy to pull out. I will remove the *Duranta erecta* during a follow-up in its flowering season. I am waiting for my brother's permission to remove a few large *Melia* specimens and the few seedlings in the area.

I initially misidentified *Pterolobium stellatum* (redwing/rooivlerk) as *Caesalpinia decapetala* (Mauritius thorn). Fortunately, I realized my mistake early in the control program. The *Pterolobium* has strong prickles on branches and on the leaf rachis. It is extremely difficult (almost impossible) to remove *Lantana* and *Chromolaena* that grow between the *Pterolobium.*

THE LOCATION

As mentioned above the area is roughly 10 km east of Tzaneen. A steep hill at 785 m AMSL in the east is 146 m higher than the lowest point. The terrain consists of several steep slopes. The above shows the cross section of the eastern border of the area:

The soil is rich in minerals due to weathered granitic rocks. It is covered with a fertile compost layer of leaf litter. The average annual rainfall is about 900 mm and the average annual temperature about 19.7°C. Phalaborwa, a mere 100 km to the east, has an average rainfall of 463 mm and an average temperature of 22.7°C. The average rainfall drops rapidly to the east. The following diagram compares the temperature (T) and rainfall (RF) between PH (Phalaborwa - red) and TZ (Tzaneen - green).

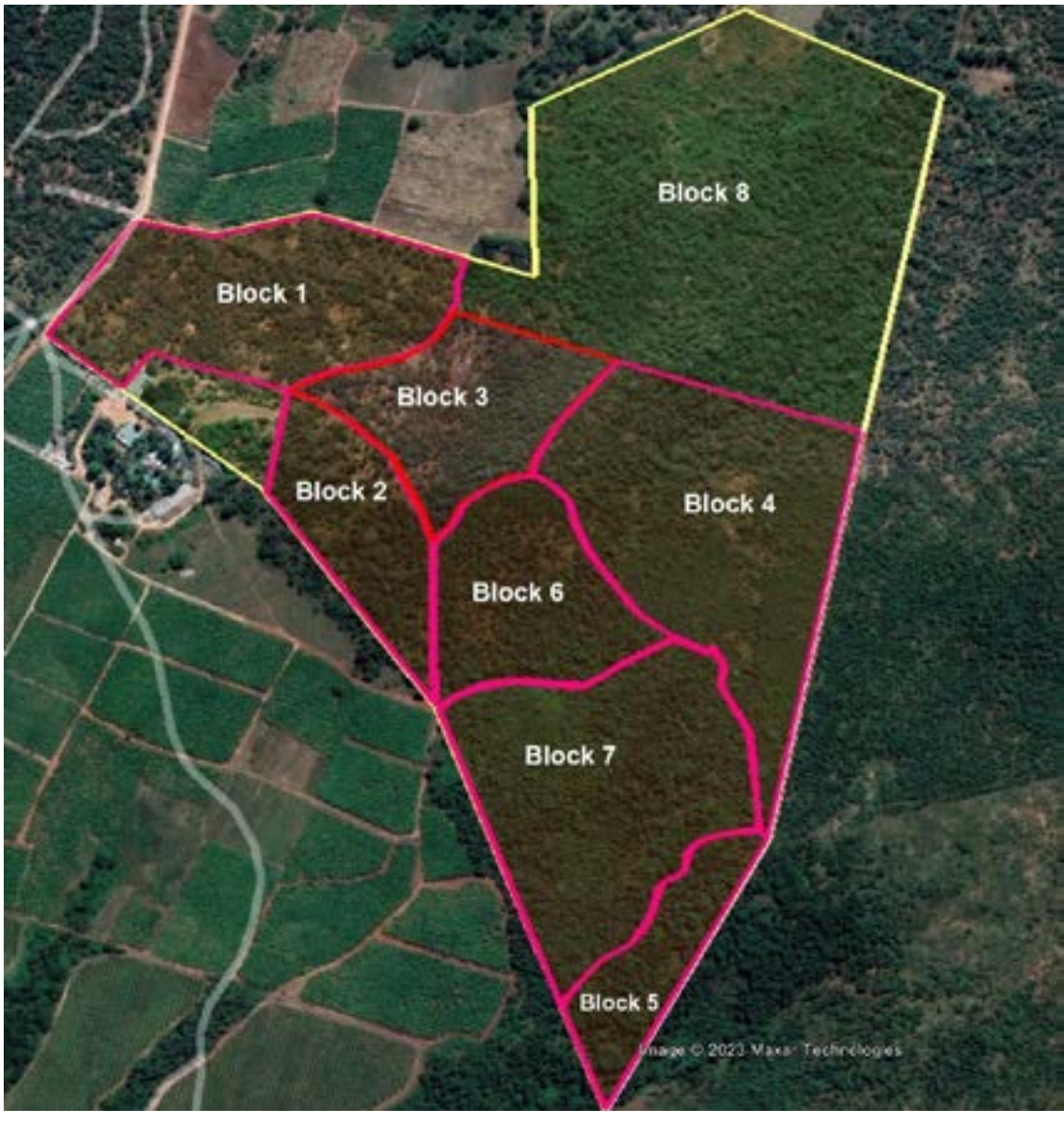


I have compiled a list of 82 "Pocket List" endemic tree species in the area. The predominant indigenous species are: *Combretum collinum* subsp. *suluense* (weeping buswillow/treurboswilg) and *gazense* (hairy bushwillow/harige boswilg), *Pterocarpus rotundifolius* subsp. *rotundifolius* (round-leaved bloodwoord/dopperkiaat) and *Xylopia parviflora* (forest redfingers/bosrooivingers). *Pterocarpus angolensis* (kiaat), *Sclerocarea birrea* subsp. *caffra* (marula/maroela), *Lannea discolor* (live-long/dikbas), the odd *Phyllogeiton zeyheri* (red ivory/ rooi-ivoor) and *Ziziphus mucronata* (buffalo-thorn/blinkblaar-wag-'n-bietjie) are scattered throughout the area. Surprisingly there are no *Combretum imberbe* (leadwood/hardekool) or *Colosperma mopane* (mopane/mopanie) in the area neither to the west of it towards the escarpment. East from the area the first *Colosperma mopane* is about 1 km from the farm and the first *Combretum imberbe* 3 km.

The following map shows a subdivision of the area. I subdivided the area into blocks, considering a maximum size of 10 ha per block, taking the existing slopes into account and using existing tracks as delineation where possible. I also decided to use the term “Block” instead of “Area” for the sub-areas – it is easier to communicate.

Blocks 1, 3 and 4 are northerly sloping with a warmer and drier microclimate where one would get species like C*ombretum apiculatum* subsp. *apiculatum* (red bushwillow/rooiboswilg) and *Dalbergia melanoxylon* (zebrawood/sebrahout). On the southern and westerly sloping areas (Blocks 6 and 7) one finds species such as *Faurea rochetiana* (broad-leaved boekenhout/ breëblaarboekenhout), *Catha edulis* (khat/boesmanstee) and *Vachellia davyi* (corky-barked thorn/kurbasdoring).

Block 2 was previously cultivated and has fewer large trees but there are several *Vachellia sieberiana* var. *woodii* (paperbark thorn/ papierbasdoring) and *Dichrostachys cinerea* (sicklebush/sekelbos) trees. Block 8 does not form part of this study as it still needs to be “cleaned” in future.



EXTENT OF INVASION

Chromolaena odorata is widespread across all areas. With the *Lantana* it forms almost impenetrable dense thickets. It is slightly less prevalent on the drier slopes. *Lantana camara* are well established in rocky areas and under larger trees where birds spread their seeds. It was especially abundant along the ephemeral tributaries (steep gullies) between the slopes. In many cases the *Lantana* and *Chromolaena* grow together. The *Lantana*, with its thorns and strong branches "protecting" the *Chromolaena*. The *Chromoleana*, however, outgrows the *Lantana* robbing it of sunlight during summer. The *Jacaranda* was mostly confined to Block 6 with a few larger trees in other areas.

The following map indicates approximate distribution of the invaders. The purple dots represent approximate positions of *Jacaranda* trees, the red shades the *Lantana* and the lighter green the *Chromolaena.*

The eastern side of Block 4 had relatively few invaders. It was especially surprising that there were very few *Chromolaena* plants. The reason is that the abundance of *Pterocarpus rotundifolius* leaves covering the soil prevents the *Chromolaena* seeds from germinating.

METHOD OF CONTROL

The task seemed immense, but one must start somewhere, or nothing will happen. Using the Block subdivision as explained earlier, the main control measures that were implemented were:

- Mechanical removal
- Cut/saw and apply herbicide
- Spray with herbicide

I also read in a publication of the ARC's Plant Protection Research Institute about the *Pareuchaets insulata* and *Pareuchaetespseudo insulata* (*Chromolaena* leaf-feeding moths) that defoliates dense vegetation resulting in reduced costs for clearing the *Chromolaena* infested areas. I did not further explore that method.

MECHANICAL REMOVAL

Mechanical removal implies the removal of the plant with roots from the soil. This can be done by hand pulling or using the tree popper.

Removal of the *Chromolaena* is relatively easy for a couple of weeks after good rains. The *Chromolaena* has a weak fibrous root system with soil penetration of less than 40 cm. Even the large plants can be pulled out in wet soil. Larger *Chromolaena* may require two persons to pull. It can have a stem diameter of up to 20 mm. In the understorey the stems can easily be recognized by its evenly spaced nodes.

The other species had deeper and more extended root systems. It is impossible to hand-pull even the smallest jacaranda or guava trees. Only small *Lantana* can be hand-pulled in wetter conditions. Even then one needs to take care against the scattered thorns on the stems. The first step was to get workers, train and equip them with the necessary tools. The strategy was to remove as much as possible by pulling. This was possible for smaller plants but not for the larger *Lantana*. I purchased the large tree popper for the larger *Lantanas*. With a weight of 8 kg and a long lever it can pull

plants with a stem diameter up to 50 mm, depending on the soil conditions. Although the tree popper can do larger specimens, it is still difficult to get to the plants and to grasp the stems under a dense plant. The tree popper is operated by putting the jaws on either side of the stem, with the support plate on the ground. When the long lever is lowered down the jaws tightens its grip. As the operator presses the lever down, the jaws pull the stem with roots from the ground. The jaws have steel teeth that easily clogs up with plant material and must be cleaned to keep its grip.

I found the tree popper to be impractical given the extent of the invasion. It was heavy, difficult to manoeuvre in dense vegetation and soon I abandoned the use of the tree popper.

The first problem posed by the removal is what to do with the remains. We collected the remains and piled it in open areas to dry, to be burnt later. Piles were added in open areas to limit the damage from the heat to surrounding trees.

The timing and method used to burn the piles are important to prevent the fires from raging out of control. Care must be taken to

avoid windy days. Mornings are cooler with less wind. The piles must be completely dry and the area around the piles cleared from dry material that can spread the fire (rakes work well for cleaning around the piles). Other safety measures taken were to alert the neighbours and local fire society of the intent to burn and taking local and national fire regulations into account (fires may only be started during certain months and conditions). In the presence of a light breeze the pile was lighted from the downwind side. Care was taken to have enough workers on site, equipped with fire-beaters, to contain the fires.

The burnt patches triggered the germination of the perennial *Abutilon angulatum* var. *angulatum* with its soft velvety leaves. It is also known as the toilet paper bush, found in Botswana and Zimbabwe. The *Abutilon* grew fast and within one season all the burnt patches were filled with clusters up to 2 meters in height. Nothing else grew on the patches.

This changed, perhaps prematurely, my strategy and I stopped the burning practice. I left the dry piles and after a season chopped the dry branches into smaller pieces by hitting it with pangas. I also noticed that termites never fed on the dry *Chromolaena* piles. Research on the repellent and insecticidal activities of the root extracts of *Chromolaena odorata* on *Macrotermes* (termites) indicated that it kills 100% of the termites after a 36 h exposure. It could also be that the basidiomycete fungus cultivated by the termites do not grow on the dead wood material of the *Chromolaena.*

CUT, SAW AND THE APPLICATION OF HERBICIDE

Where the mechanical removal failed, I opted for herbicide on cut plants. I used the excellent summary found at https://www.dws.gov.za/wfw/Control/docs/AIPtreatmenttablesterrestrial.xls to decide what herbicides to use for the different alien species. The web site https://www.dws.gov.za/wfw/Control/ also contains practical guidelines on the mechanical and chemical method, for example *"Cut stump treatment: Stems should be cut as low as practical as stipulated on the label. Herbicides are applied in diesel or water as recommended for the herbicide. Applications in diesel should be to the whole stump and exposed roots and in water to the cut area as recommended on the label."*

The following herbicides were used as stump/stem treatment for the various plant species:

Plant	Active ingredient and Strength	Trade name	Mix
Lantana	imazapyr 100 g/L SL	Hatchet 100 SL	100 ml per 5 l water (mix 1)
	picloram 50 g/kg + triclopyr 50 g/kg	Kaput	Apply gel with old toothbrush
Jacaranda	imazapyr 100 g/L SL	Hatchet 100 SL	500 ml per 5 l water (mix 2)
Guava	imazapyr 100 g/L SL	Hatchet 100 SL	625 ml per 5 l water (mix 3)

I bought the Hatchet from Noordchem in Tzaneen and the Kaput from Obaro Silver Lakes. I used different bottles for the different Hatchet concentration mixes and clearly indicated its target species.

We cut the *Lantana* with bow saws and immediately painted it with the Hatchet solution by covering the entire cut surface area. This was replaced by Kaput at a later stage, as it was easier to apply with less spillage. The deep dark blue colour remains for considerable time (at least 6 months) on the cut stems as an indication that the herbicide was applied.

Most of the *Jacaranda* were small to medium trees. A few years ago, I cut the *Jacaranda* trees but made the mistake of not applying herbicides. Fast growing shoots becoming sizable trees took off with a vengeance. Herbicides are important for a lasting solution. Mature trees are easily spotted during its flowering season in October. I used a Stihl chain saw to fell the *Jacaranda* trees, after which we immediately applied the Hatchet mix to cover the entire surface, especially the bark edges. It you wait more than a few hours before applying the herbicide – you waste your money. The guava trees were generally small but were given the same cut and Hatchet treatment, if "treatment" is the right word. The red colour of the Hatchet does not last long on the stumps and therefore a colour dye is required if you need an indication of the application.

SPRAY WITH HERBICIDE

Spraying herbicides was my last option, primarily because there is always collateral damage to indigenous plants in the vicinity. I only used the spray solution in cases of mass germination of *Chromolaena* seedlings. Disturbed soil, rain and sunlight in open areas trigger these mass germinations.

There is no way one can control these by mechanical removal – it is extremely time consuming and expensive. I opted for triclopyr (butoxy ethyl ester) 480 g/L EC, i.e. Garlon 4 EC with a mix of 75 ml/15 l solution with a blue dye. I bought the Coopers Pegler CP15 quality sprayer in Letsitele. It is fitted with a coarse spray nozzle and has a volume of 15 l. The sprayer is durable and spares are readily available. It is especially effective when the plants flourish. Two weeks after spraying the leaves become yellow. Patience is needed and one must resist the temptation to increase the herbicide's strength to get faster results. It is helpful to use markers to know what has been sprayed. After two weeks, a follow-up is needed to treat plants that were missed the first round.

OPERATIONAL ISSUES

LABOUR

The control program needed manual labour for the various tasks: pulling of plants, cutting, cleaning, applying herbicides and managing the program. I took responsibility for managing the program. By word of mouth, I initially acquired and hired three acquaintances of an existing employee, all Tsonga speaking from the Bushbuck Ridge area. The first step was to train and show them:

- Their temporary residence and its rules
- Weed identification to ensure the correct plants are removed
- Layout of the farm
- How to use the tools – tree popper, the CPL15 sprayer, application and mix of herbicides, replacing the bow saw blades

I opted for a daily salary instead of contract work. The main reason

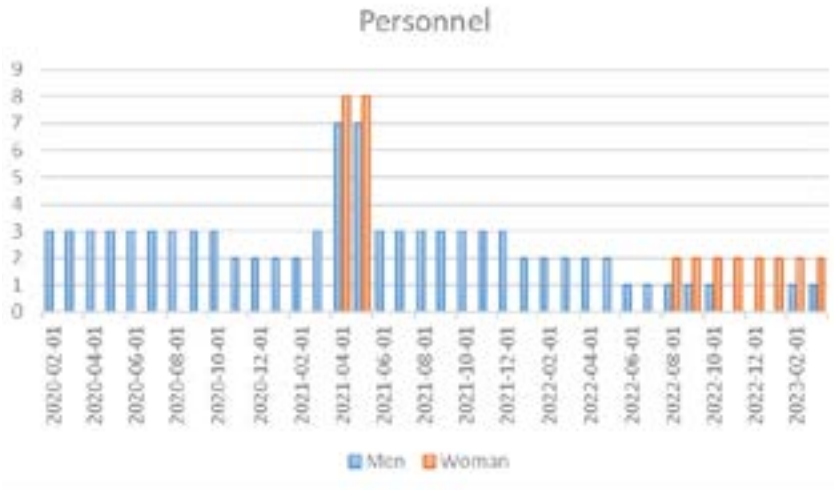
was that I wanted to ensure that a proper and thorough job is done, instead of a fast half-done job.

The management challenges I had were:

- Supervision – I was not living on the farm but tried to visit once a month. I needed to trust the workers. It was challenging to monitor progress in those blocks that I have not even ever set foot on. I gave one of the workers additional supervision responsibilities to keep time sheets and direct the team. It appeared that the supervisor was not as productive as I had hoped, basically hampering the progress.
- Motivation – the task is immense, and I found it difficult to keep the workers for more than 6 months. They were away from home, only visited their family occasionally and the work seemed never-ending.
- Personality clashes – personalities were not always compatible and staying together required discipline. One strong worker could influence the more silent ones and I had to be a judge in many cases.
- Dishonesty – the supervisor overstated the number of working days and he ended up pocketing the difference – I dismissed him and then paid each worker individually.
- Language – most of the workers only speak Tsonga and even though I am semi-Tsonga speaking it remains a challenge to communicate clearly.
- Cash handling – most of the workers did not have bank accounts which forced me to handle cash – not the ideal situation.

There was some staff turnover – also not ideal. One needs to re-train and buy and supply new clothes. The following is a rough timeline with the number of workers:

In April 2021 my brother offered 12 of his workers to clear the heavily overgrown Block 5. They completed the block in 2 months. Apart from Block 8, the entire area was cleared by April 2022. I have employed two women since August 2022 to do follow-up clearing on already cleared blocks.



TOOLS AND ASSISTANCE

I provided the following tools and goods to make the work progress as smooth as possible:

- Bow saws (Lasher) with enough spare blades (600 mm).
- Short cane knife hook (Lasher) for clearing thicker stems.
- Hand slashers for grass (Lasher) to clear long grass.
- Double edge slasher (Lasher) to dig under the plants.
- Tough gloves to protect their hands (I found that the leather welding-type gloves worked the best).
- I bought a small Alva gas stove in a carry case from Build-It. They took it with them when the work was more than 500 m away to save time and effort during lunchtime. It appears to be very reliable.
- The CPL15 sprayer.
- Strong shoes or gumboots, socks, trousers, and shirts.
- Raincoats.
- Doom to use in case they upset wasp nests between the leaves.
- Antihistamine to reduce allergic reactions, plaster, bandage, antiseptics.
- Old toothbrushes to apply the Kaput on cut stumps and stems.

Siphonochilus aethiopicus

I regularly dropped filled 20 l containers with water for drinking and spraying purposes. This saved the workers from having to carry the heavy water on the steep inclines.

EVALUATION

After 3 years of constant effort the results are clear – areas are accessible, many new indigenous seedlings and plants appear, animals (bushbuck, monkeys, bushpig) can move more freely, it is almost impossible for poachers to set snares and I noticed an increase in birdlife. There is a notable increase in biodiversity. After the clearing I noticed, for the first time on the farm, many *Siphonochilus aethiopicus* (wild ginger) plants. They flower from October to February after the first rains.

The above shows two sides of the access road. The block on the right was first cleaned in 2021, whilst the left side, where you can see the *Chromolaena* thicket, belongs to my neighbour.

The picture below shows an area that was overgrown and impenetrable with *Chromolaena* a few years ago.

COSTS

The following is a summary of costs, excluding my own time and travel expenses, for the past 38 months ending 2023-02-28:

Item	Cost
Labour	478,800
Other personnel costs	13,560
Herbecide	44,455
Tools	40,101
Total	R576,916

As after-tax expense it is a huge burden to carry. I hope that the costs for "maintaining" the current state reduce drastically. The Working for Water (WfW) program of the Department of Forestry, Fisheries and Environment used to have teams that assisted qualifying farmers, but these teams have been abandoned during Covid. I only hope that the assistance is reinstated in future to help me with the first pass clearing of Block 8, whilst I focus on maintenance.

CONCLUSION AND FUTURE PLANS

I plan to fence the entire area and thereafter buy some livestock (cattle or modjadji-sheep) or game (zebras) to utilize the grass. Livestock, feeding on smaller areas on a rotational basis, will also make the area more accessible on a permanent basis. Livestock will create income and hopefully will be enough to sustain the expense to control the alien weeds. When I tackle a similar project in future, I will create much smaller blocks of two or three hectares, and clearly number them for better control and easier instructions.

I hope that my experience will give some insight into the problem of controlling these species and that the information I provided will be helpful for someone facing a similar challenge.

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Vachellia robiuta subsp *robusta* – Danie du Plessis

TWEE IKONIESE Bosveldbome

Pieter Wynand van Niekerk

Vanjaar in matriek, bespreek sy twee gunsteling Bosveldbome, wat deel uitmaak van die teorie ter voltooiing van die Dendroloog Vlak II eksamen. Waterbergtak.

Albizia tanganyicensis subsp. *tanganyicensis.*

SA boomnommer: 157
Familie: Fabaceae (peulplantfamilie)
Ander name: Engels: paper-bark albizia, paper-barked false-thorn, paperbark false-thorn; Afrikaans: papierbasvalsdoring; Tsonga: dzuvudzuvu.
Herkoms van naam: *Albizia*: Vernoem na F. de Albizzi. Hy was `n edelman van Florence wat in Europa die aankweking van die Asiatiese spesie, Albizia julibrissin, begin het in 1749. *tanganyicensis*: Van Tanzanië.

Albizia tanganyicensis subsp. *tanganyicensis* is een van die twee subspesies van *Albizia tanganyicensis*, die ander is die *Albizia tanganyicensis* subsp. *adamsoniorum* wat inheems aan Kenia is. Die *Albizia tanganyicensis* subsp. *tanganyicensis* is `n klein tot medium grootte boom wat tussen 10 tot 20 m hoog kan groei in die Waterberg en in ander dele van die land. Die deursnee van die stam kan tot 120 cm wees. Die boom het gewoonlik `n lang, krommerige groeiwyse met `n yl, min vertakte kroon wat plat of spreidend kan wees. Die boom het gewoonlik `n enkele hoofstam of dit het twee of meer vertakkings van naby die grondvlak. Dit is bladwisselend. Die *Albizia tanganyicensis* subsp. *tanganyicensis* het `n baie unieke stam. Die bas skilfer af en ontbloot `n wit of liggroen, gladde stam. Die baie dun, amper deurskynende, lae of vlokke wat afskilfer is gewoonlik oranje-geel tot rooibruin. Die afgeskilferde lae veroorsaak dat `n dik, romerige poeier agterbly. Die bas van die jong takke is glad en roomgroen.

Albizia tanganyicensis subsp. *tanganyicensis*

Die boom het saamgestelde blare wat dubbelveervormig is. Die blare kom voor in pare van 5 tot 13 (15 op die meeste) per veerblare en daar is gewoonlik 4 pare veerblare op `n takkie. Die klein blaartjies is liggroen of donker vaalgroen, maar jong blare is rooibruin. Die blare het stomp punte (tot effens gepunt). Die blare se basis is asimmetries met gladde rande en `n prominente klier by die basis van die blaarsteel, net bokant die dik blaarvoet. Die boom bot baie vroeg in die lente.

Die *Albizia tanganyicensis* subsp. *tanganyicensis* se bloeiwyse kan beskryf word as poeierkwassies. Die blomme verskyn voor die blare en is roomwit of geel, soetgeurig en word gedra in halfsferiese hoefies. Die blomme het baie lang, prominente meeldrade. Die koppe van die blomme, voor dit blom, is roesbruin. Blomtyd begin in September en duur tot November.

Die *Albizia tanganyicensis* subsp. *tanganyicensis* dra oopspringende, breë, plat peule. Die peule is glad en hard, rooibruin of donkerbruin en kan tot 30 cm lank wees en 5 cm breed. Die peule bars maklik oop tydens die somermaande.

Die boom kom in die noorde van die land voor tussen Bela Bela (Warmbad) en die Soutpansberg. Dis veral volop in die Waterberge. Dit aard ook rondom Punda Maria in die Nasionale Kruger Wildtuin. In sy natuurlike habitat groei dit teen rotsriwwe en op berghange in granitiese en kwartsitiese sandgrond.

Die hout is wit (vuilwit), sag en lig. Die gelugdroogte hout= 460 kg/m^3. Daar is geen verskil tussen die spinthout en kernhout van die boom nie en daar is geen pithout nie. Die hout kan rooibruin verkleur as gevolg van insekbeskadiging. Die takke van die *Albizia tanganyicensis* subsp. *tanganyicensis* is baie bros. As die hout gesaag word kan dit `n irritasie van slymvliese veroorsaak as gevolg van die chemiese stof wat die hout bevat.

Die *Albizia tanganyicensis* subsp. *tanganyicensis* speel `n baie belangrike rol in sy eie habitat en ekosisteme waarin dit voorkom. Die boom is `n bron van voedsel vir baie diere. *Loxodonta africana* (olifante) eet die blare en jong takke. *Loxodonta Africana* (olifante) kan ook groot skade aanrig en baie bome van die spesie was al deur die dier beskadig. *Tragelaphus strepsiceros* (koedoes) en *Aepyceros melampus* (rooibokke) eet die blare en blomme. In die vroë lente en laat winter is die peule van *Albizia tanganyicensis* subsp. *tanganyicensis* giftig, die jong peule is die giftigste. Dit kan veroorsaak dat beeste siek raak as hulle die peule van die grond af eet. Diere wat die peule eet sal steier as hulle loop, stuiptrekkings kry en na die grond val voordat hulle van hartversaking vrek. In hierdie tydperk moet diere in kampe gehou word, weg van die peule af. As die peule uitdroog, word dit minder giftig. *Charaxes ethalion* (kusdubbelstert) se larwes vreet die blare van die bome en *Poicephalus cryptoxanthus* (bruinkoppapegaaie) vreet die groen sade.

Afkooksel van die *Albizia tanganyicensis* subsp. *tanganyicensis* se bas word gebruik as hoesmiddel.

Sclerocarya birrea subsp. *caffra.*

SA Boomnommer: 360
Familie: Anacardiaceae (mangofamilie)
Ander name: Engels: marula; Afrikaans: maroela; Herero: omungongo; Noord Sotho: morula; Zulu: umganu.
Herkoms van die naam: *Sclerocarya*: harde neut; *birrea:* birr (volksnaam van die boom in Senegal); caffra: van Kaffraria (Oos-Kaap)

Sclerocarya birrea subsp. *caffra* is een van Suid-Afrika se bekendste en belangrikste bome. Die spesie kom reg deur Afrika voor vanaf Ethiopië tot in KwaZulu-Natal in `n verskeidenheid habitatte. Die boom groei in verskeie soorte Bosveld op sand tot sanderige leem. Die boom is nie kouebestand nie, dus kan hulle maklik in die rypvrye Laeveld gevind word.

Sclerocarya birrea subsp. *caffra* is `n medium groot boom wat tot tussen 10 tot 18 meter hoog kan word. Dit is `n bladwisselende boom met `n hoogvertakkende stam en maak `n digte, wye, spreidende kroon wat goeie koelte verskaf. Die boom se stam kan tot 1 meter in diameter groei. Die bas is grys met kolle waar bas sporadies afdop. Jong takke is glad en liggrys met prominente litmerke wat deur blare agtergelaat word. As die boom ouer raak begin die bas afskilfer.

Die blare is saamgedronge aan die punt van `n tak. Die blare is onewegeveer saamgestel meestal met drie pare teenoorstaande laterales en `n endstandige blaar. Die blare is gewoonlik 6 x 3 cm in grootte en lansetvormig of ellipties. Die blare is groen en blink bo, haarloos en gaafrandig, maar jong blare is meestal getand.

Die maroela is eenslagtig en dra manlike en vroulike blomme aan aparte bome . Daar is voorbeelde, alhoewel skaars, van manlike bome wat vroulike blomme produseer en vrugte dra. Manlike blomme groei in lang, yl, neerhangende are van 15 cm. Hulle is ligrooi met wit wanneer oop en het `n donkerrooi knop. Die vroulike blomme groei in groepe onder die blare. Hul stele is gewoonlik 3 cm lank. Hulle het bloedrooi knoppe en is pers tot rooi met wit wanneer oop. Die *Sclerocarya birrea* subsp. *caffra* blom gewoonlik in Augustus of September. Hulle kan ook vroeër, in Junie, of heelwat later, in Februarie, blom.

Die vrugte is rond tot ovaal en sowat 3-4 cm in deursnee. Die skil is dik, glad, haarloos en blink van buite af. Die vleis is wit, klewerig

en slymerig. Dit bevat `n enkele groot, harde, houtagtige pit met 'n neut binne. Die boom dra in Februarie die vrugte wat geel is wanneer ryp.

Die hout is pitloos, baie taai en grof. Dis nie vanself bestand teen boorwurms nie. Die hout is vuilwit met `n rooierige skynsel en baie lig. Lugdroog = 560 kg/m^3.
Maroelabome speel `n baie belangrike ekologiese rol. Dit voorsien koelte en voedsel aan baie verskillende soorte diere. Die blare, bas en vrugte word deur beeste en wild geëet. Voorbeelde van diere wat van maroelas afhanklik is sluit in: *Loxodonta africana* (olifante), *Tragelaphus strepsiceros* (koedoes), *Giraffa camelopardalis* (kameelperde), *Taurotragus oryx* (elande), *Kobus ellipsiprymnus* (waterbokke), *Phacochoerus africanus* (vlakvarke) en *Papio ursinus* (bobbejane). *Poicephalus meyeri* (Bosveldpappagaaie) en ander voëls vreet die pitte van groen vrugte. *Loxodonta Africana* (olifante) beskadig die bome, veral in areas soos die Nasionale Kruger Wildtuin waar olifante oorbevolk is. Mense eet ook die vrugte wat baie ryk is aan vitamiene C. Dit bevat verskillende elemente en bronne van energie soos aangedui in die ontleding van die vrug volgens Quinn, 1959 en Wehmeyer, 1967 hieronder.

Ontleding van die vrug (volgens Quinn, 1959 & Wehmeyer, 1967):

Gemiddelde massa	17.99 g
Skil	41%
Saad	52.51%
Eetbare vrugvleis	6.47%
Vitamien C	67.9 mg/100 g
Kalsium	6.2 mg/100 g
Magnesium	10.5 mg/100 g
Fosfor	8.7 mg/100 g
Kalium	54.8 mg/100 g
Fruktose	0.97 g/100 ml
Glukose	0.75 g/100 ml
Sukrose	5.95 g/100 ml

Sclerocarya birrea subsp. *caffra* speel ook `n baie belangrike rol ekonomies, veral in plattelandse nedersettings. Die hout is moeilik om te bewerk en word nie kommersieël gebruik nie as gevolg van die boom se status as `n beskermde boomspesie, maar die hout word in `n mindere mate vir meubels en paneelwerk

gebruik, dis ook gewild vir houtsneewerk. Mense eet die vrugte en verwerk dit in baie ander produkte soos vir die kook van jellies en konfyte en vir `n verskeidenheid alkoholiese drankies. Soetwyn, port, bier, mampoer en die bekende Amarula likeur word van die vrugte gemaak. Die neute kan gerooster en geëet word, hulle is ryk aan proteïen. Die neute kan ook gepars word vir die ekstraksie van olie. Hierdie olie (maroelaolie) word in skoonheidsmidddels, kosmaak, vleispreservering en behandeling van leer gebruik. Baie boere het al begin om met *Sclerocarya birrea* subsp. *caffra* te boer. Die bome moet in boorde aangeplant word om kommersieël met die spesie te boer. Die bome is bestand teen droogte, maar nie teen koue nie.

In verskeie Afrikakulture is *Sclerocarya birrea* subsp. *caffra* is `n baie belangrike boom. Die Tsongas vier jaarliks die Fees van die Eerste Vrugte. Tydens hierdie fees gooi hulle die sap van die vrugte op die grafte van afgestorwe stamhoofde. Die Tsongas gebruik ook maroelatakke in hul begrafnis rituele. Die Zoeloes voeg die neute by hul pap en gebruik die olie van die neute om hulself mee te smeer. Shangaan sangomas beskou die neute as medisyne en gebruik dit in waarsêery as dobbelstene. Vendas glo die tipe bas wat die ma eet bepaal wat `n baba se geslag gaan wees. As die swanger ma die poeier van `n manlike boom se bas eet sal die baba `n seuntjie wees en as sy die bas van `n vroulike boom eet sal die baba `n dogtertjie wees.

Tot vandag word die bas, vrugte en blare van *Sclerocarya birrea* subsp. *caffra* gebruik vir medisinale doeleindes. ‘n Afkooksel van die bas word gebruik om buikloop en diarree te behandel en dit word profilakties teen malaria gebruik. Die binnebas toon dat dit antihistaminiese aksie teen insekbyte verskaf. Die blare word gebruik om `n ekstrak te maak wat gebruik kan word om brandwonde en swere te behandel.

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Ehretia rigida subsp. *nervifolia* - Richard Gill

Bivane Dam
NATURE RESERVE

Francois du Randt

The Zululand Branch of the Dendrological Society visited this beautiful nature reserve at Bivane Dam in February 2023, with previous visits in January 2015 and 2016. We compiled a tree and shrub list, with over 120 species, which is not complete, as we did not travel extensively through the whole reserve. According to the manager of Bivane Dam camp, Dawie Cronje, in total there are more than 800 species of plants. We appreciated the assistance of Dr. Johan Boonzaaier and promised to assist the reserve in tree tagging and more information.

A GPS map of the route west from Louwsburg to Bivane dam

Bivane Dam is about 3 hours' drive from Hluhluwe on the N2 north, with a turn-off at Candover (Rooi Rante gravel road) to Magudu, or a bit longer drive on tar via Pongola, to Magudu and Louwsburg. The reserve is west of Ithala Nature Reserve.

The turn-off to Bivane Dam is 26 kilometre west from the turn-off to Louwsburg. The gate is 12 kilometre further on a good gravel road through the local villages and black wattle 'plantations'. From the entrance gate it is 6.8 kilometre to the reception office and camp (chalets and campsite). The camp is just more than 44 kilometre past the Louwsburg turn-off.

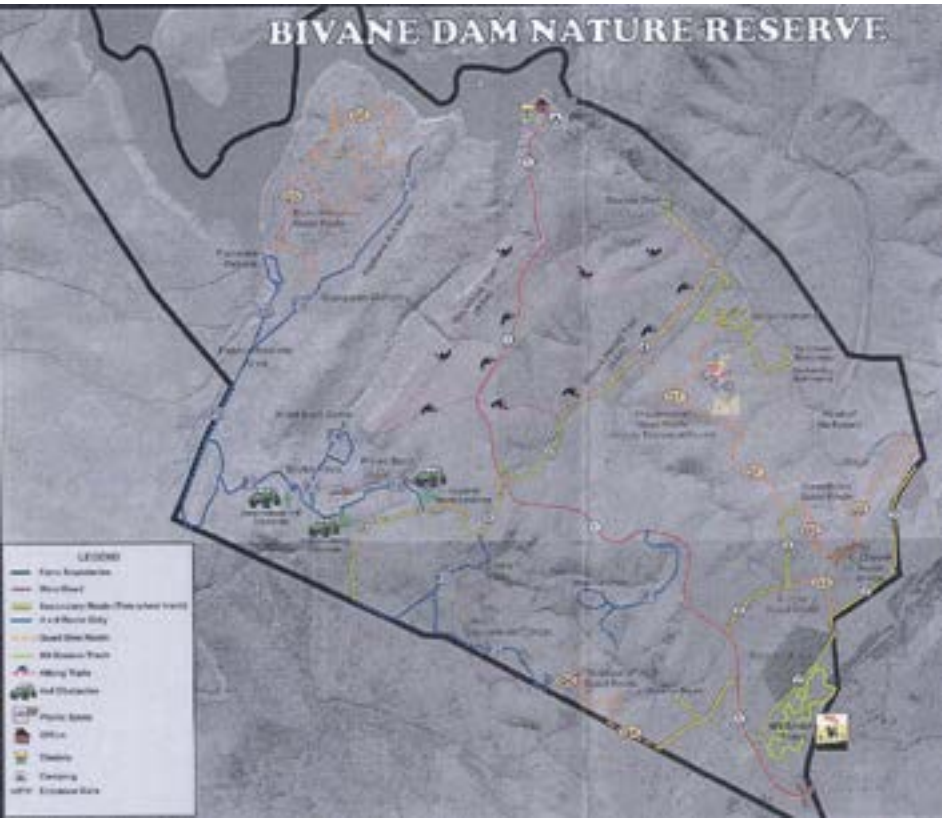
Bivane Dam Nature Reserve is beautiful with many indigenous bushveld trees, very similar to Ithala Game Reserve. There are 14 chalets, 20 camp sites, a guesthouse and a wilderness camp.

A view of the nature reserve (right)

The reception area has a small shop selling firewood, ice and a few refreshments. It is advisable to bring all supplies from home as there are no shops or fuel in the vicinity. The reserve belongs to private farmers from the Pongola-area. Water sport and fishing are allowed. Nature lovers, tree huggers and keen birders are overwhelmed by the diversity and sheer numbers.

Bivane Dam is located in the Bivane River. The dam was built by the farmers and the Impala Water Users Association from Pongola. The dam wall is similar to Gariep Dam and was completed in 2000. The water catchment area is 1600 km^2, and the dam covers 700 ha when 100% full. To the south of the dam is an idyllic nature reserve, with beautiful bushveld on mountains, in valleys and along rivers. There are many roads, including 4x4 routes, quad routes, MTN bicycle routes and hiking routes.

The map of Bivane nature reserve



The area south of the dam consists of quartzite and ferricrete hills with beautiful riverine forests and thick

The reception (left) and view of the camp (right) at Bivane dam

sub-tropical bushveld and mist belt forests. There are a few *Protea* species, like *Protea caffra, Protea gaguedi* and the rare *Protea comptonii*. There are rare cycad species, like *Encephalartos aemulans,* and beautiful and rare aloe species.

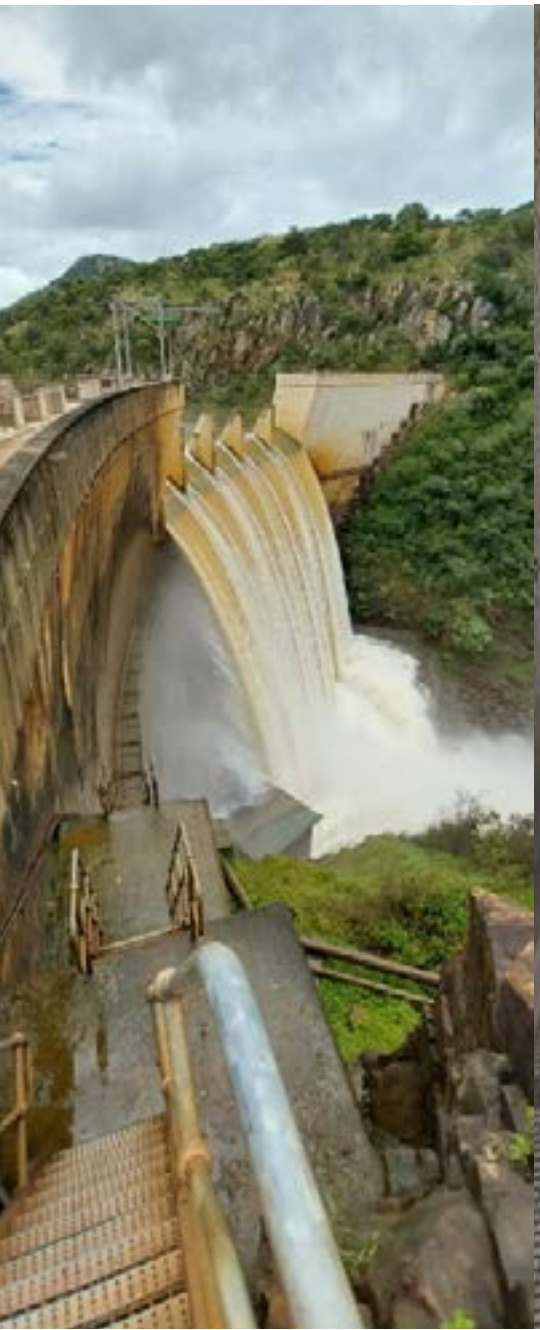
The vegetation is classified as Sub-Escarpment Grassland (Grassland Biome), according to Mucina & Rutherford (2006), with two vegetation units, namely Swaziland Sour Bushveld (SVI14) and Ithala Quartzite Sourveld (Gs2).

SVI 14 (Swaziland Sour Bushveld)
Mostly Mpumalanga (Badplaas to Piggs Peak), Swaziland and Northern KZN (Ithala & Bivane). Altitude 400 - 1100 m. Open to closed medium to tall tree layer with closed, well-developed grass layer. Very hilly with moderate to steep slopes, positioned at higher altitude than the adjacent (SVI 3) Granite Lowveld to the east. Mostly grey soils, very clayey and dark. Summer rainfall with dry winters. MAP 700 – 1350 mm. Frost infrequent to occasional at higher altitudes. Expect *Philenoptera violacea* as a tall tree – not seen previously. Endemic taxa: *Hemizygia gerrardii* [e]. Similar habitat in Songimvelo Nature Reserve (Barberton), Ithala Game Reserve and Malalotja Nature Reserve in Swaziland. Higher classification: Lowveld Bioregion (Savanna Biome)

Part of the jetty (left), with the dam and camp (2023) (right).

Bivane Dam in 2023 (overflowing) (top), versus 2015 (bottom)

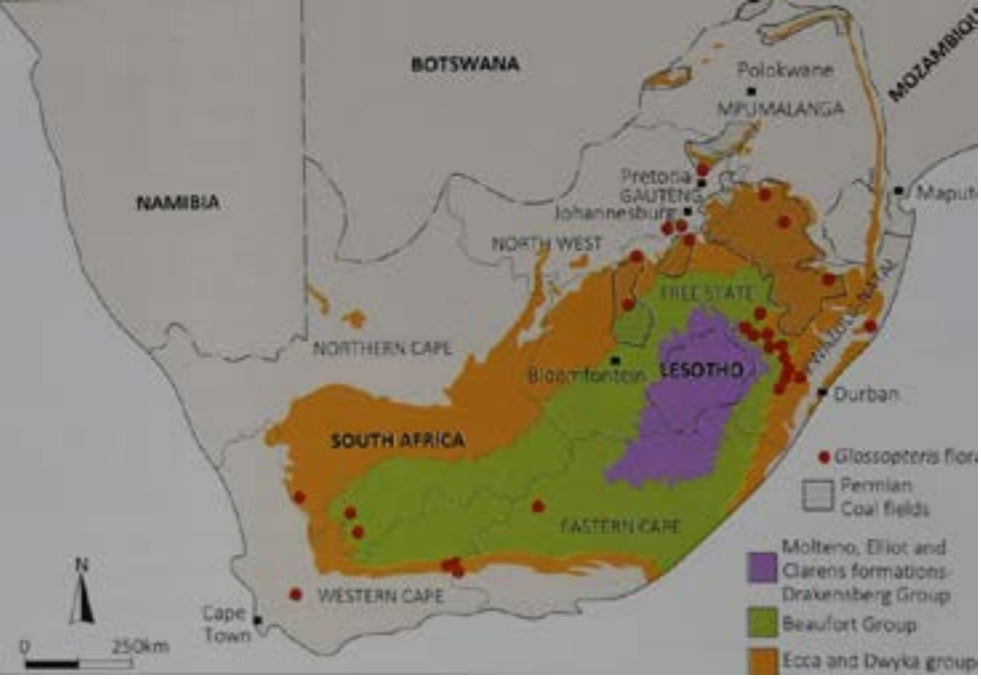
Bivane Dam wall in overflowing in 2023



Some excitement to walk below the dam wall, lead by Johan Boonzaaier

Gs2 (Ithala Quartzite Sourveld)
Confined to large quartzite patches around Amsterdam, Piet Retief, Mahamba, Paris Dam and Ithala Game Reserve, with isolated outcrops at Magudu. Altitude 440 – 1360 m. Low mountain ranges and undulating hills with rocky lowlands. Generally a mosaic of woody shrubs and small trees in rocky areas, interspersed in the grass layer. It occurs in the zone between Grassland and Savanna, where the dominant grassland gives way to woodland as elevation decreases. It is species-rich unique to the dystrophic quartzite geology. Infrequent frost. MAP 1200 mm in the west. Nutrient poor soils, only protected in Ithala Game Reserve. Important species are *Protea comptonii* (only from Songimvelo and Ithala area), *Tricalysia capensis* var. *galpinii, Hemizygia macrophylla, Aloe suprafoliata, Melanospermum italae, Thorncroftia longiflora, Gladiolus vernus, Euclea natalensis* subsp. *magutensis* [e], *Aloe dewetii* [e], *Danthoniopsis scopulorum* [e] (graminoid) and *Gladiolus scabridus* [e] ([e] endemic).

Geologically most of Bivane Dam consists of Ecca Shales and Beaufort Sediments, part of the Karoo Sequence. In very short summary, Gondwana continued its northward drift, moving out of the polar region. Glaciers, which covered most of South Africa, finally all melted, leaving a vast inland water body extending across South Africa and



Glossopteris distribution in South Africa

neighbouring regions of Gondwana, called the Karoo Sea. The Cargonian Highlands formed the high ground to the north of the sea, and rivers draining this region deposited their sediment along the northern shoreline, forming large, Mississippi-like deltas. Rivers also flowing into the sea from the Cape Mountains in the south deposited sediment. These deposits are known as the Ecca Group of rocks. They were deposited on top of Dwyka sediments, caused by glacier retrieval.

By the time that southern Gondwana emerged from beneath the ice, several large, tree-like plants had already evolved. These plants, dominated by a genus known as *Glossopteris*, rapidly colonised the large (Mississippi-like) deltas along the northern margin of the Karoo Sea, where they grew in the extensive swamps that flanked the delta distributary channels. In these swamps, dead vegetation accumulated faster than it could decay, and thick accumulations of peat formed, which were ultimately converted to coal. Today, these former peat accumulations form the extensive coal deposits of KwaZulu-Natal and the Highveld regions. Over time these layers can become buried under sediment. Multiple layers of peat were deposited.

Peat contains about 50% carbon, the rest being made up mainly of oxygen and hydrogen. Once peat is buried beneath sediment, it is compressed and slowly heated. Oxygen and hydrogen are expelled as water, and carbon content increases. Ultimately, the process leads to the conversion of peat to coal.

The Karoo Sea started to shrink. This transition into terrestrial environment marks the boundary between the Ecca Group and the Beaufort Group, and occurred over an interval of time up to about 250 million years ago.

The rocks of the lower Karoo Supergroup document a period during which climatic conditions where changing in southern Gondwana, when reptiles were beginning their evolutionary diversification and progression toward the forms we see today, including their descendants, the mammals and birds. This evolutionary march changed dramatically 251 million years ago. At this time, for reasons still unknown, life was very nearly extinguished – some 96% of species became extinct. This global event, which has been called the Mother of all Mass Extinctions, brought an end to the Permian Period. This is also known as the Permian mass extinction. The effects of this catastrophe are well preserved in the rocks of the Beaufort Group, which provide a window into the aftermath (unfortunately, however, the rocks are mute as to the cause).

Eon/Era	Period	Starting	Ending	Years
Palaeozoic (3rd phase)	Cambrian	545 my	495 my	50 my
	Ordovician (4th phase)	495 my	443 my	52 my
	(Ice age)	+/- 460 my	1st mass extinction 441 my	
	Silurian	443 my	417 my	26 my
	Devonian (Warm period)	417 my	354 my	63 my
	2nd mass extinction 353 my (towards end of warmer period)			
	Carboniferous (Ice age)	354 my	290 my	64 my
	Permian (Ice age)	290 my	251 my	39 my
	3rd mass extinction 251 my (end of ice age) = Permian extinction			

A FEW TREES IN BIVANE NATURE RESERVE

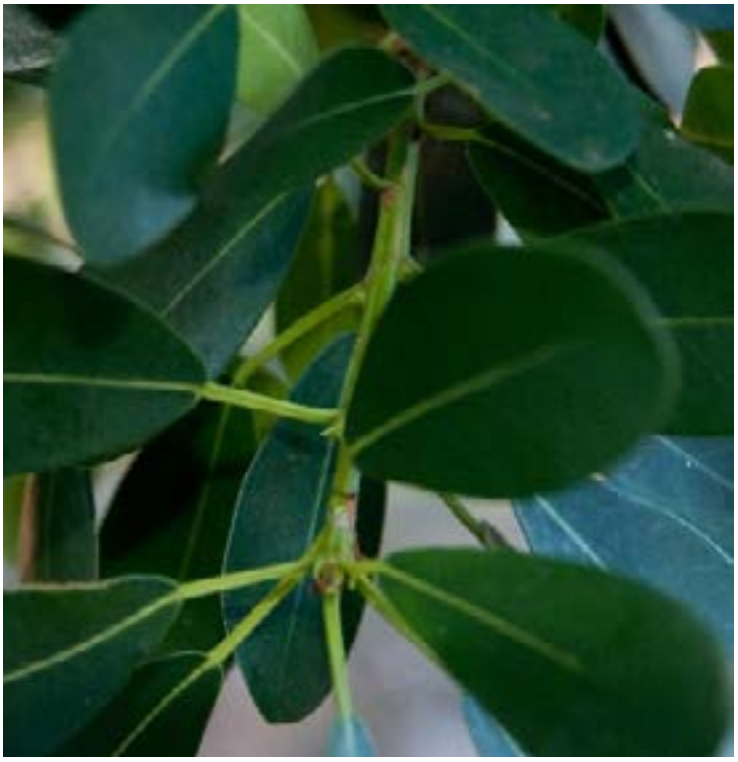
Opposite page, top: *Acacia ataxacantha* (now *Senegalia ataxacantha*) (vlamdoring) *Senegalia ataxacantha* can be easily confused with *Senegalia caffra*, omnipresent in Bivane nature reserve.
Bottom: *Vachellia davyi* (kurkbasdoring/corky-barked thorn)

This page, top: *Ekebergia capensis* (essenhout) in fruit
Middle: *Berchemia zeyheri* (red ivory/ rooi ivoor)
Bottom: *Bridelia micrantha* (mitseri) in fruit




Top: *Combretum zeyheri* (raasblaar) (left). *Dalbergia armata* (doringtou/Hluhluwe creeper) (right)
Bottom: *Diospyros lycioides* subsp. *guerkei* (left) and *Ekebergia pteryphylla* (right)

Top: Englerophytum magalismontanum (stamvrug) (above) – the furthest south distribution, like many other species in this region, for example kiaat (*Pterocarpus angolensis*) (middle)
Bottom: *Euphorbia cooperi* (bosveldkandelaarnaboom) (left) and *Faurea rochetiana* (breëblaarboekenhout) (right)



Top: *Faurea rochetiana* (left) and *Faurea saligna* (boekenhout) (right) – both members of the Proteaceae family
Bottom: *Ficus glumosa* (harige rotsvy) (left) and *Ficus natalensis* (kuswurgvy) (right)





Top: *Ficus glumosa* (left),*Combretum zeyheri* (middle) and an interesting, but rare tree – *Ochna arborea* var. *arborea* (Kaapse rooihout/Cape plane) (right)
Bottom: *Olea capensis* subsp. *enervis* (bosveldysterhout/bushveld ironwood) (left) and *Gymnosporia tenuispina* (klokkiespendoring) (right)






Top: *Pavetta edentula* (kliertjiesboom), Middle: *Protea caffra*
Bottom: *Pterocarpus angolensis* (kiaat) (left) and *Sesbania punicea* (right)

Top: *Syzygium legatii* (Soutpansberg waterberry, totally out of its distribution, called the Bivane "Water wood" in the reserve pamphlet). Middle: *Strychnos gerrardii* (left) and an invader plant. There are a few more serious, but controlable, invaders in the reserve. Bottom: The endemic *Euclea natalensis* subsp. *magutensis* (ithalaghwarrie)

The birdlife is exceptional, but there are not many mammals (2015). The rare Ithala gladiolus, *Gladiolus scabridus*, is the emblem of the dam and reserve. There are many smaller plants, flowers, sedges and grasses.

There are many interesting places to visit, including Geelvis weir, Schurwerand road, red ivory and geeldoring bush camps. You could do the 4x4 routes and Klipdrift river crossing, go to picnic sites along Mazaan Gorge, Schurweberg 4x4 obstacle, bikini beach bush camp, kiaat bush camp, the steep 4x4 Helpmekaar hill mountain crossing, Palmietfontein, Fisherman's Retreat, Klipbank 4x4 route and Dead End.

This page:
Top: left: *Ozoroa sphaerocarpa* (korenteharpuisboom/ currant resintree). Right: the small flowers of *Hippobromus pauciflorus* (false-horsewood/ valsperdehoutbos)
Bottom: *Helinus integrifolius* (soapcreeper)

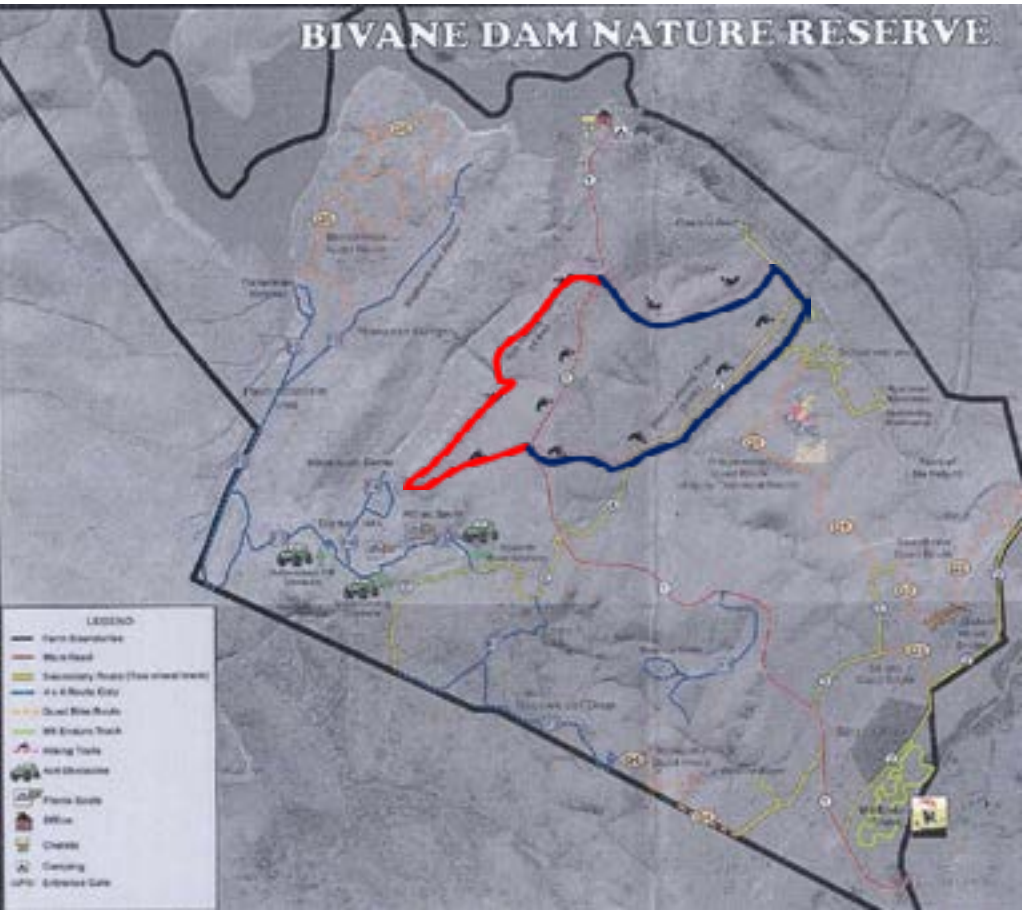
Opposite page:
Top: left: *Dianthus mooiensis* (left) and *Barleria* sp. (right)
Bottom: *Gladiolus scabridus*

The two hiking routes are the Ibis Route (4 kilometre) and the Ribbok Route (9 kilometre). The quad routes are named Frisgewaagd, Dwaalhoek, Makupane and Beestekraal.

At the start of the **Ibis Hiking Trail** (GPS: S27.52879 E31.05174 - 885 m asl) are trees like the more common *Combretum molle* (fluweelboswilg); *Pterocarpus angolensis* (kiaat), at the most southern limit of its distribution; *Faurea saligna* (boekenhout), a member of the Proteaceae family; *Trema orientalis* (hophout/pigeon wood) and the planted *Celtis africana* (witstinkhout), with similar characteristics.

There are more interesting trees, like V*epris lanceolata* (witysterhout), a member of the Rutaceae (citrus) family; *Combretum zeyheri* (raasblaar); *Strychnos madagascariensis* (swartklapper/black monkey-orange), which has a quite different growth form up at higher altitude than in the lowland of Zululand; *Bauhinia galpinii* (vlam-van-die-vlakte/pride-of-the-Kaap) with red flowers and two-lobed leaves; and *Lannea discolor* (dikbas/live-long), member of the Anacardiaceae and false-marulas.

The start of the Ibis Trail greets you with an incredible view over Mazaan Gorge and Bivane Dam, as well as the



The two hiking routes – Ibis (left of entrance road in red) and Ribbok (right of entrance road in blue)

Opposite page, clockwise from top left: Mazaan Gorge, Lafenis picnic site and Klipdrift. Dead End, Bivane Dam holiday resort, Bikini Beach and Fishermen's Retreat,

This page, top: Helpmekaar Hill (4x4) and Schurweberg. Note the horizontal quartzite ridge







Top: The Ibis Hiking Trail – view to the dam (left), An de Fortier (middle), with John Field and Johan Boonzaaier (bottom) on the Ibis Hiking Trail

endemic *Euclea natalensis* subsp. *magutensis* (italaghwarrie); *Englerophytum magalismontanum* (stamvrug), a member of the Sapotaceae, with milky latex, and edible fruit, and also at the most southern limit of its distribution; and another edible fruit, *Vangueria infausta* subsp. *infausta* (wildemispel/wild-medlar).

Along the trail we have another Rutaceae member, *Zanthoxylum capense* (kleinknophout/small knobwood); *Canthium inerme* (bokdrol or bosdoringklipels/turkeyberry), a member of the Rubiaceae; *Faurea saligna* with beautiful spikelet 'protea-like' flowers; and the magnificent *Schrebera alata* (wildejasmyn) when in flower, with opposite compound leaves and winged rachis, and wooden-pear fruits.

Combretum zeyheri (raasblaar) stays prominent, and must be distinguish from *Combretum apiculatum* subsp. *apiculatum* (rooiboswilg), which can be tricky without the prominent fruits.

A very rare and interesting tree is *Ochna arborea* subsp. *arborea* (Kaapse rooihout/Cape plane), very similar in appearance than *Ochna pulchra* (lekkerbreek), which does not occur in the region. We more commonly see *Ochna arborea* subsp. *oconnorii* (bosrooihout) with its cold bark in the lowland forests of KZN and Mpumalanga.

Take note of *Cassipourea malosana* (uiehout/onionwood) with its black branchlets and leaves smelling like onions; *Heteropyxis natalensis* (laventelboom/lavender tree), ideal for any potpourri with its fragrant leaves.

Strychnos gerrardii (kusswartklapper), normally grows in forests near the Indian Ocean, but can occur in bushveld, and must be distinguish from *Strychnos madagascariensis*. A prominent 'sand forest' tree occurring up in this region, very common in Bivane camp, is *Erythroxylon delagoense* (fynblaarkokaboom), with its flattened terminal branchlets.

The most common resintree (*Ozoroa*) in the area is *Ozoroa sphaerocarpa* (korenteharpuisboom/currant resintree),

Hikers on the Ribbok Hiking Trail

with its round fruits (sphaeros = round + karpos = fruit, in Greek), and thick leaves with numerous side veins, dividing plentifully at the leaf margins, versus the common *Ozoroa paniculosa* (harpuisboom).

The sneezewood (nieshout) is *Ptaeroxylon obliquum*. The genus name comes from the Greek ptairein, meaning to sneeze, and xylon, meaning wood, referring to the irritant in the wood when cutting it. The species name refers to the oblique leaflets, in a way very similar to the leaves of *Harpephyllum caffrum*.

Maytenus undata (kokoboom/kokotree), not related to *Erythroxylon* (kokabome/cocainetrees), they are even in different families; and is followed by the bobbejaanstert (*Xerophyta retinervis*), beautiful in full flower.

A prominent Rubiaceae and bride's bush member is *Pavetta edentula* (kliertjiesboom), with prominent domatia and (black) bacterial nodules, also at the most southern limit of its distribution.

Syzygium legatii (Soutpansbergwaterbessie) occurs high up in the Soutpansberg, but with an isolated population at Bivane and Ithala Game Reserve. It is locally known as the Bivane "Water wood".

Two more trees on the first stretch of 1.5 kilometre were *Tarchonanthus trilobus* var. *galpinii* (breëblaarkanferbos/ broad-leaved camphorbush) and a prominent *Cussonia natalensis* (rotskiepersol/rock cabbage-tree) with its digitate-compound leaves.

The **Ribbok Hiking Trail** is 9 kilometre in length, and should be walked as an extension of the Ibis trail. It ends at the same place as the start of the Ibis Hiking trail.

The most prominent and important trees seen as you walk down from the 'end' are: *Pterocarpus angolensis* (kiaat), *Ozoroa sphaerocarpa, Searsia pentheri, Ficus glumosa,* and *Faurea saligna*, on the northern-faced protea slope. Further down the trail are *Pavetta edentula*, more kiaat, stamvrug, raasblaar, *Hyperacanthus amoenus, Combretum zeyheri*

(raasblaar), *Vangueria infausta, Leonotis leonorus* shrubs, *Strychnos madagascariensis, Cussonia spicata, Senegalia caffra, Ekebergia capensis, Grewia occidentalis, Ozoroa sphaerocarpa* and *Helinus integrifolius.*

We then get a forest with *Dalbergia armata, Dalbergia obovata, Plectranthus* (? *fruticosus*), *Rhoicissus tridentata* var. *cuneifolia, Secamone filiformis* climber, *Euphorbia triangularis, Euphorbia grandidens* and *Apodytes dimidiata* at the river.

Slight further on the trail are *Mimusops obovata* (with fruit), *Ximenia caffra* (with fruit), *Euclea crispa* and *Vepris lanceolata.*

The next section is grassland, followed by a stream with *Chaetacme aristata, Manilkara concolor* and *Calpurnia aurea* (yellow flowers).

The trail ends at the quarry at GPS: S27.52706 E31.06146 (705 m asl), 980 meter as the crow flies from the beginning ('end'), a ±2 km walk.

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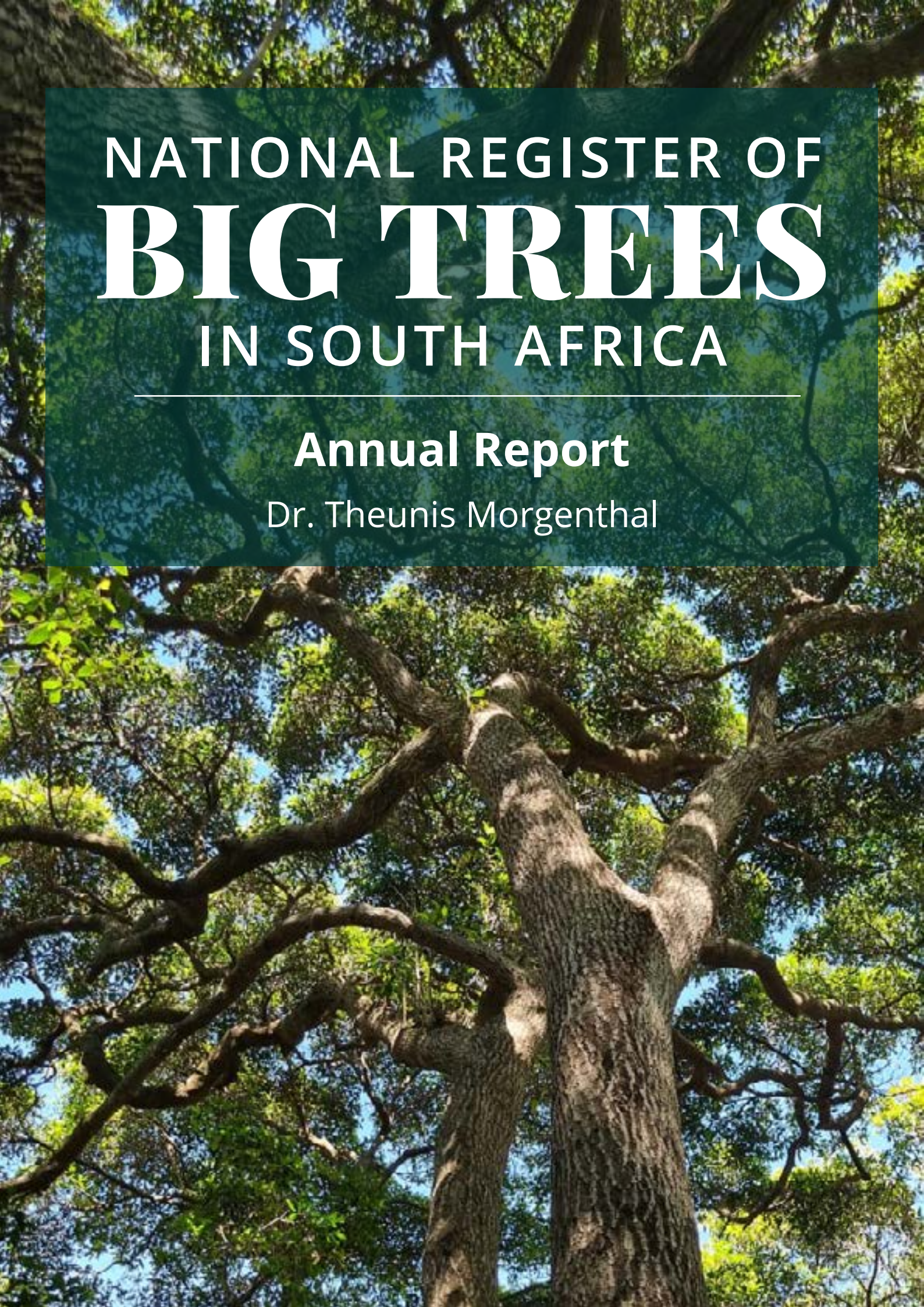
Securidaca longependuculata - Peet van der Merwe



NATIONAL REGISTER OF BIG TREES IN SOUTH AFRICA

Annual Report

Dr. Theunis Morgenthal

Mimusops zeyheri in die Magaliesberg - Naas Grove

The National Register of Big Trees in South Africa - NRBTSA© is a national initiative of the Dendrological Society to locate and record the biggest tree specimens with the aim of conserving indigenous tree heritage in South Africa. The register was established by Dr Fried von Breitenbach in 1981.

This report provides a current, annual account of the register's status. Basic statistics from specimens added during the reporting period from 2022-10-11 to 2023-10-11 are presented. A list of species, and the measurement details for the largest specimen for that species in the register are tabulated in Table 1.

Basic statistics concerning the database

The number of records in the NRBTSA© is 447, representing 135 species. During the reporting period 44 records were added to the register representing 31 species. Contributions were made by 11 people. Waldie Le Grange was the biggest contributor to the register during the reporting period. He contributed 11 specimen records to the database. The largest specimen added to the register during the reporting period was *Faidherbia albida* with a size index of 389.1.

Species size records

A list of tree species is presented in Table 1, sorted according to their size index. The table also shows the basic measurements for the largest specimen for each species in the NRBTSA©.

Concluding remarks

Hopefully more regular reporting on the NRBTSA© will stimulate greater interest from branches to contribute to the register. Existing records need to be found and resurveyed. Big tree records for species can only be determined when tree species are well sampled and represented.

On 16 September 2023 a short introductory tree measuring course was held to improve knowledge on the basics of measuring big trees. During the training a magnificent specimen of *Sclerocarya birrea* subsp *caffra* originally measured in 1987 was remeasured as part of the training exercise (Figure 1).

Table 1. List of tree species and the biggest measurements associated for each species sorted based on size index within the NRBTSA©

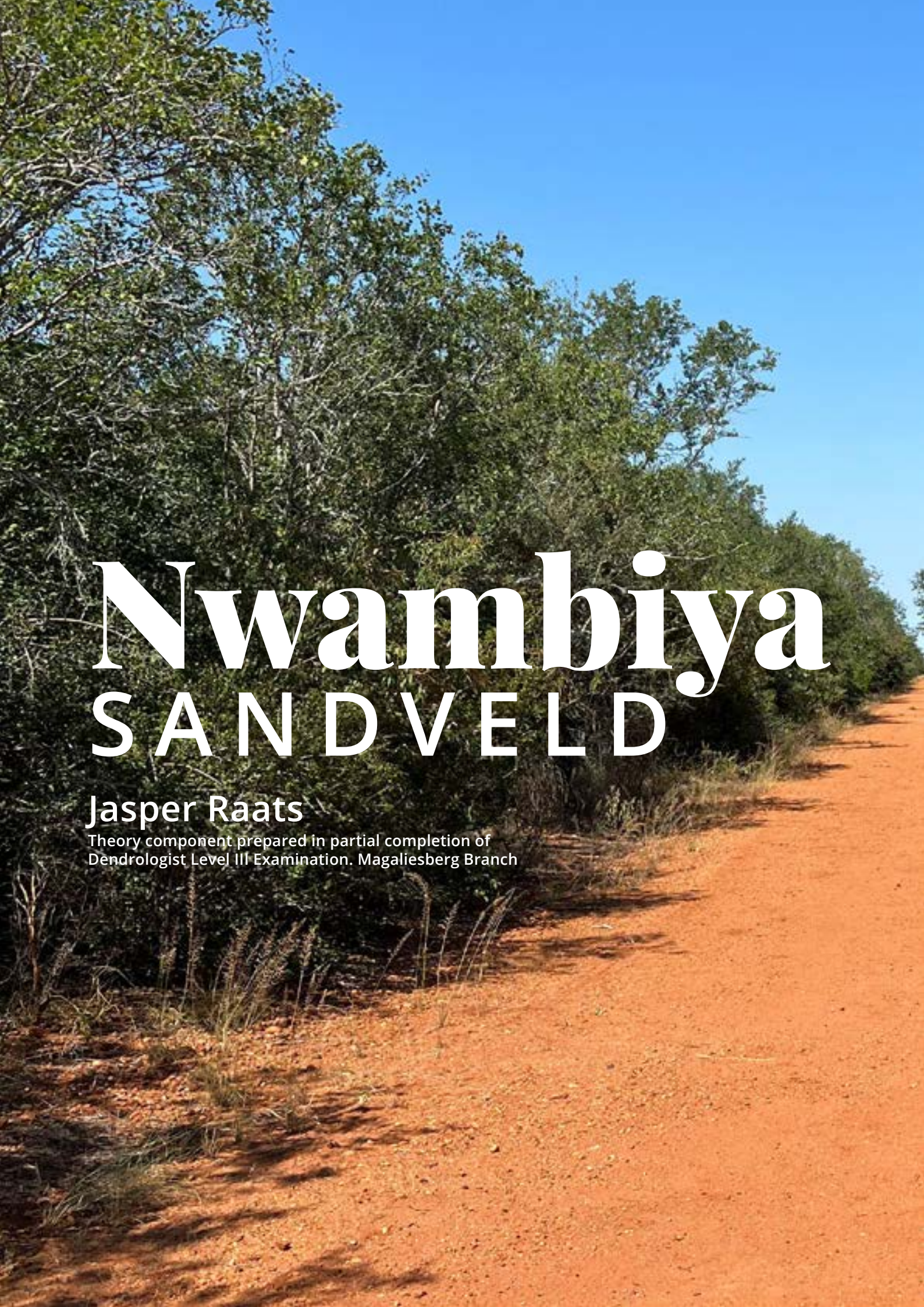
Measurements						
Scientific name	**Trunk girth**	**Trunk diameter**	**Crown diameter**	**Tree height**	**Size Index**	**Nr of specimens**
Adansonia digitata	32.9	10.5	38.2	22.0	439.8	20
Faidherbia albida	11.1	3.5	36.5	34.3	389.1	14
Ficus salicifolia	16.8	5.3	56.0	22.0	380.1	1
Afrocarpus falcatus	8.7	2.8	33.6	39.0	376.4	18
Breonadia salicina	7.7	2.4	32.3	41.0	363.9	5
Ficus sycomorus subsp *sycomorus*	10.5	3.3	35.1	31.0	335.8	11
Senegalia galpinii	9.5	3.0	41.0	30.0	333.3	9
Cussonia spicata	11.7	3.7	22.0	35.0	316.3	2
Xanthocercis zambesiaca	6.8	2.1	33.5	35.0	297.2	6
Prunus africana	5.8	1.8	28.9	40.0	290.9	2
Ficus burkei	10.4	3.3	31.9	28.0	287.6	10
Ptaeroxylon obliquum	4.0	1.3	22.7	45.0	243.4	1
Ekebergia capensis	7.7	2.5	30.2	27.3	234.9	13
Ficus ingens	24.3	7.7	33.4	14.0	225.1	7
Diospyros mespiliformis	6.6	2.1	30.1	26.6	211.7	11
Ficus cordata	15.0	4.8	32.0	17.0	210.2	1
Celtis africana	4.6	1.5	19.7	39.0	210.0	2
Ficus natalensis subsp *natalensis*	9.5	3.0	30.0	22.0	209.3	2
Cussonia sphaerocephala	6.3	2.0	22.1	30.0	200.3	5
Vachellia xanthophloea	4.3	1.4	33.2	27.4	184.1	2
Ficus sansibarica subsp *sansibarica*	6.3	2.0	32.3	22.0	177.6	3
Ficus glumosa	8.0	2.5	32.0	18.5	166.9	1
Cordyla africana	6.1	2.0	37.4	19.0	162.4	4
Anthocleista grandiflora	4.0	1.3	22.6	30.0	160.7	2
Ficus polita var *polita*	3.9	1.2	26.8	27.0	155.6	1
Newtonia hildebrandtii	7.1	2.3	26.2	18.0	138.8	31
Combretum erythrophyllum	5.2	1.6	28.2	20.0	136.3	2
Combretum imberbe	4.3	1.4	30.3	21.0	135.6	10
Sclerocarya birrea subsp *birrea*	4.3	1.4	32.5	20.2	135.2	12
Schotia brachypetala	5.6	1.8	24.8	20.1	133.5	8
Harpephyllum caffrum	3.8	1.2	18.5	28.0	133.0	2
Trichilia emetica subsp *emertica*	5.6	1.8	26.8	19.2	132.6	9
Kigelia africana	5.7	1.8	21.8	20.4	128.6	3
Rauvolfia caffra	5.0	1.6	26.0	20.0	128.1	3
Podocarpus henkelii	4.5	1.4	19.1	24.0	125.4	1
Ficus lutea	7.5	2.4	32.0	14.0	122.1	1

Measurements						
Scientific name	Trunk girth	Trunk diameter	Crown diameter	Tree height	Size Index	Nr of specimens
Trichilia dregeana	4.1	1.3	21.5	22.0	116.7	1
Brachylaena transvaalensis	2.9	0.9	15.4	30.0	112.9	1
Afzelia quanzensis	4.1	1.3	25.4	19.6	112.8	3
Sideroxylon inerme	10.0	3.2	20.0	14.0	111.7	3
Albizia forbesii	3.3	1.0	22.0	23.1	110.7	1
Phyllogeiton discolor	3.7	1.2	22.3	21.0	107.8	2
Olinia radiata	7.0	2.2	8.3	25.0	107.3	4
Ziziphus mucronata	3.2	1.0	20.7	22.5	103.5	3
Albizia versicolor	4.0	1.3	24.9	18.0	101.2	5
Guibourtia conjugata	4.5	1.4	20.0	18.6	99.3	1
Philenoptera violacea	3.1	1.0	25.8	19.4	98.7	3
Vachellia karroo	2.5	0.8	15.6	27.0	94.2	1
Kirkia acuminata	4.0	1.3	21.2	18.0	93.0	6
Spirostachys africana	5.0	1.6	18.0	16.5	88.2	7
Ficus sur	3.9	1.2	10.7	24.0	87.7	1
Parinari curatellifolia	3.2	1.0	18.5	20.0	87.2	3
Colophospermum mopane	4.1	1.3	16.9	18.6	87.2	4
Scolopia mundii	2.7	0.9	15.5	23.0	83.9	1
Entandrophragma caudatum	3.0	1.0	22.2	17.5	81.1	2
Vachellia sieberiana var *woodii*	3.9	1.2	24.0	14.8	80.7	5
Vachellia robusta subsp *clavigera*	2.4	0.8	22.0	19.6	79.6	2
Chaetachme aristata	8.5	2.7	19.0	11.0	79.0	2
Olea europaea subsp *africana*	4.8	1.5	20.3	14.0	78.3	12
Vachellia erioloba	3.5	1.1	19.8	16.6	78.2	3
Noronhia peglerae	2.0	0.6	9.6	32.0	78.1	1
Albizia adianthifolia	3.0	1.0	24.1	16.0	76.9	2
Mimusops zeyheri	5.0	1.6	21.7	13.0	76.6	7
Vachellia tortilis subsp *heterocantha*	2.8	0.9	21.9	17.0	75.5	4
Lannea schweinfurthii var *stuhlmanii*	3.5	1.1	25.1	14.0	73.5	2
Vachellia hebeclada subsp *hebeclada*	6.1	1.9	55.6	7.0	72.5	1
Senegalia nigrescens	2.3	0.7	22.4	17.6	71.3	6
Burkea africana	3.0	0.9	23.5	15.0	70.8	1
Pterocarpus rotundifolius subsp *rotundifolius*	3.7	1.2	18.8	15.0	70.3	3
Schinziophyton rautanenii	5.4	1.7	21.1	11.6	69.9	4
Searsia chirindensis	2.1	0.7	17.7	20.0	68.8	1
Balanites maughamii	2.6	0.8	15.6	18.5	67.0	5
Mimusops caffra	2.6	0.8	16.8	18.0	66.7	1
Nuxia congesta	3.2	1.0	15.0	16.9	66.6	1

Measurements						
Scientific name	Trunk girth	Trunk diameter	Crown diameter	Tree height	Size Index	Nr of specimens
Strychnos henningsii	2.4	0.8	16.2	19.0	66.1	2
Heteropyxis dehniae	2.7	0.9	14.1	18.0	62.7	1
Heteropyxis canescens	1.9	0.6	6.8	30.0	60.5	1
Olinia emarginata	3.2	1.0	10.2	18.0	57.7	1
Zanthoxylum davyi	1.9	0.6	11.4	22.0	57.0	1
Faurea saligna	2.6	0.8	10.6	19.0	56.4	3
Senegalia burkei	2.8	0.9	17.6	14.0	55.7	1
Ilex mitis var mitis	1.0	0.3	15.0	25.0	54.6	1
Pterocarpus angolensis	2.0	0.6	18.6	15.6	52.9	4
Strychnos decussata	2.5	0.8	10.2	18.0	51.4	1
Kirkia wilmsii	2.4	0.8	12.3	16.6	50.8	3
Combretum zeyheri	2.9	0.9	14.6	13.1	48.1	2
Peltophorum africanum	2.2	0.7	15.8	14.0	46.6	2
Aloidendron barberae	4.2	1.3	10.0	12.7	46.1	1
Sterculia murex	1.3	0.4	13.4	19.8	45.8	2
Senegalia polyacantha subsp *campylacantha*	1.5	0.5	11.8	19.0	45.7	1
Lydenburgia cassinoides	2.5	0.8	14.2	13.0	44.0	1
Heteropyxis natalensis	1.4	0.5	10.2	20.0	43.4	1
Gymnosporia harveyana subsp *harveyana*	1.8	0.6	8.7	19.0	41.9	1
Bolusanthus speciosus	1.8	0.6	14.2	14.5	41.5	3
Erythrina latissima	3.4	1.1	14.8	10.0	40.3	1
Searsia pyroides var *pyroides*	2.1	0.7	13.6	13.0	39.5	2
Phyllogeiton zeyheri	1.6	0.5	11.6	16.0	39.5	3
Senegalia goetzei	2.1	0.7	17.6	11.0	37.9	1
Terminalia sericea	1.7	0.5	18.3	12.0	37.8	1
Warburgia salutaris	1.8	0.6	12.5	13.5	35.7	1
Elaeodendrum transvaalense	2.2	0.7	12.9	11.0	33.1	2
Croton megalobotrys	1.7	0.5	10.7	13.2	31.7	1
Albizia anthelmintica	2.3	0.7	13.1	10.0	31.0	1
Gardenia volkensii subsp *volkensii var volkensii*	2.4	0.8	11.3	10.5	31.0	2
Leucosidea sericea	2.3	0.7	10.3	11.2	30.6	1
Ochna pulchra subsp pulchra	1.7	0.5	11.2	12.0	29.2	3
Cussonia natalensis	2.0	0.6	11.1	10.5	28.0	1
Vachellia natalitia	1.6	0.5	12.6	11.0	27.9	1
Garcinia livingstonei	1.6	0.5	10.2	12.0	27.4	2
Boscia albitrunca	2.9	0.9	9.5	9.0	26.7	3
Combretum molle	1.5	0.5	11.7	11.0	26.3	1
Dalbergia melanoxylon	1.7	0.5	11.5	10.4	26.0	2
Strychnos madagascariensis	2.0	0.6	13.0	9.0	26.0	1
Erythrina lysistemon	2.2	0.7	8.9	10.2	25.4	1
Dovyalis zeyheri	1.6	0.5	11.5	10.0	24.5	2

Measurements						
Scientific name	Trunk girth	Trunk diameter	Crown diameter	Tree height	Size Index	Nr of specimens
Leucadendron argenteum	1.6	0.5	6.1	13.0	23.1	1
Dovyalis caffra	2.5	0.8	10.3	8.0	23.0	1
Senegalia mellifera subsp *detinens*	1.4	0.4	14.9	8.8	22.7	1
Sterculia rogersii	1.9	0.6	10.4	8.9	22.5	2
Combretum hereroense	1.3	0.4	11.8	9.8	21.7	1
Cassia abbreviata subsp *beareana*	1.5	0.5	12.2	8.9	21.6	1
Wrightia natalensis	1.2	0.4	5.7	13.1	19.6	1
Androstachys johnsonii	1.4	0.4	8.6	9.9	19.5	1
Dichrostachys cinerea subsp *africana*	2.1	0.7	11.6	6.0	16.7	2
Pseudolachnostylis maprouneifolia	1.3	0.4	11.8	7.0	15.7	1
Bauhinia galpinii	0.9	0.3	8.8	9.4	15.4	1
Schrebera alata	1.0	0.3	6.9	10.0	15.1	1
Diospyros lycioides subsp *sericea*	1.9	0.6	7.8	4.5	9.8	1
Eugenia woodii	0.7	0.2	4.4	9.0	8.8	1
Gymnosporia buxifolia	1.3	0.4	6.4	5.0	8.3	1
Maerua cafra	1.2	0.4	6.0	5.0	7.5	1
Zanthoxylum capense	0.4	0.1	3.3	7.1	4.4	1

Figure 1. *Sclerocarya birrea* subsp *caffra* measured during tree measuring course at Pretoria Noord Hoërskool. From left to right: Isak Lombard, Jasper Raats, Bernd Wenhold, Henry Francis, Dweenie Bester, Johan Bester, Clive Richer, Waldie Le Grange.



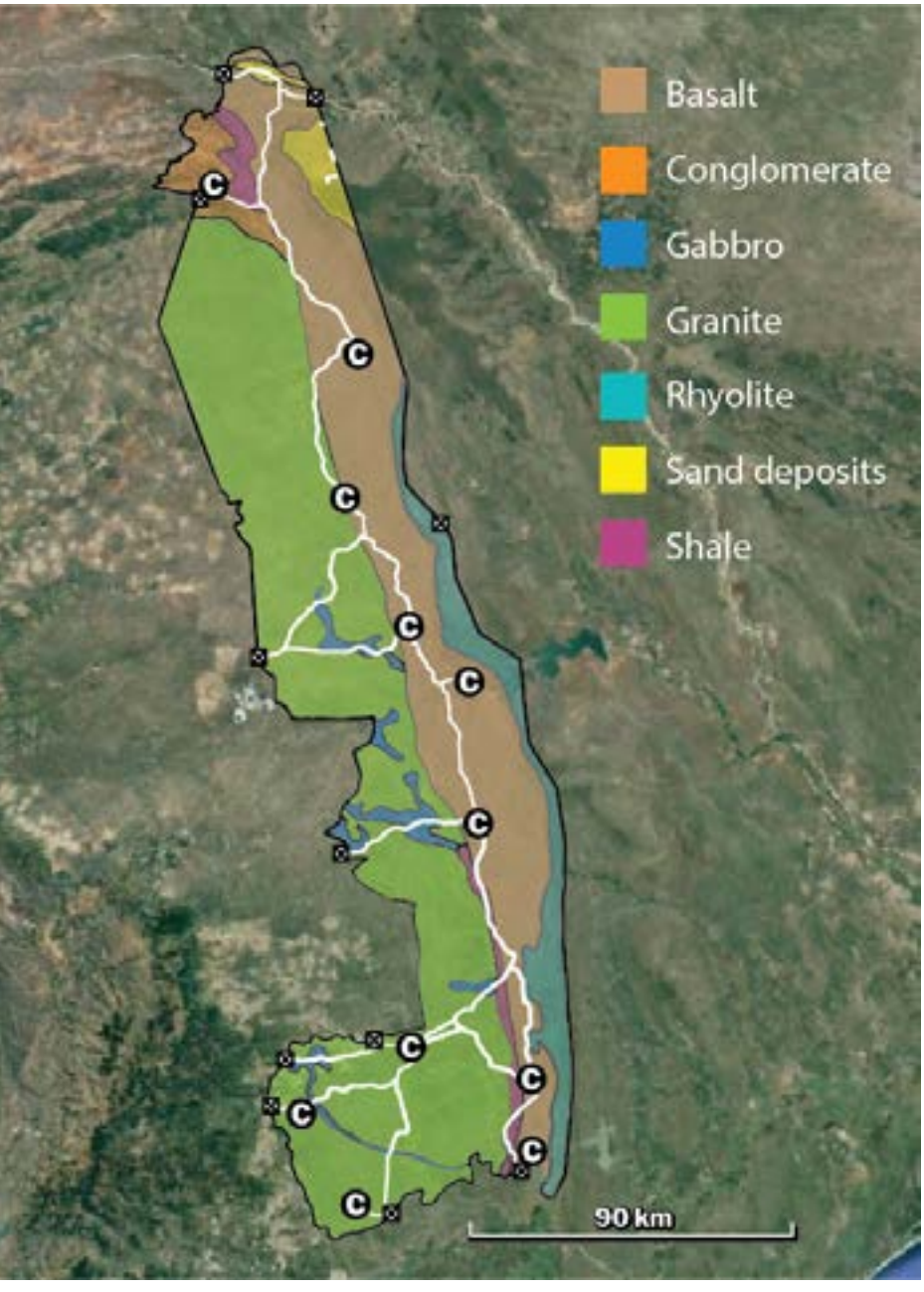
Nwambiya
SANDVELD

Jasper Raats

Theory component prepared in partial completion of
Dendrologist Level III Examination. Magaliesberg Branch

The Magaliesberg Branch undertook an excursion to the northern part of the Kruger National Park during 27 Apr – 1 May 2023 with four specific days of tree excursions. On the first and last day we had a guided tour (arranged with SANPARKS) in specific areas around Punda Maria with a wide variety of tree species. The third day was a "rest" day but most of us explored the area around Pafuri and Crooks Corner.

Figure 5. Border between South Africa (right) and Mozambique (left) in northern Kruger Park (Note – no boundary fence present due to transborder conservation area)



The second day was a very special excursion to the Nwambiya sandveld which is roughly directly east of Punda Maria on the Mozambican border. During the four days roughly 200 indigenous tree species were identified and recorded. This article, however, will specifically focus on the tree species observed during the Nwambiya sandveld trip.

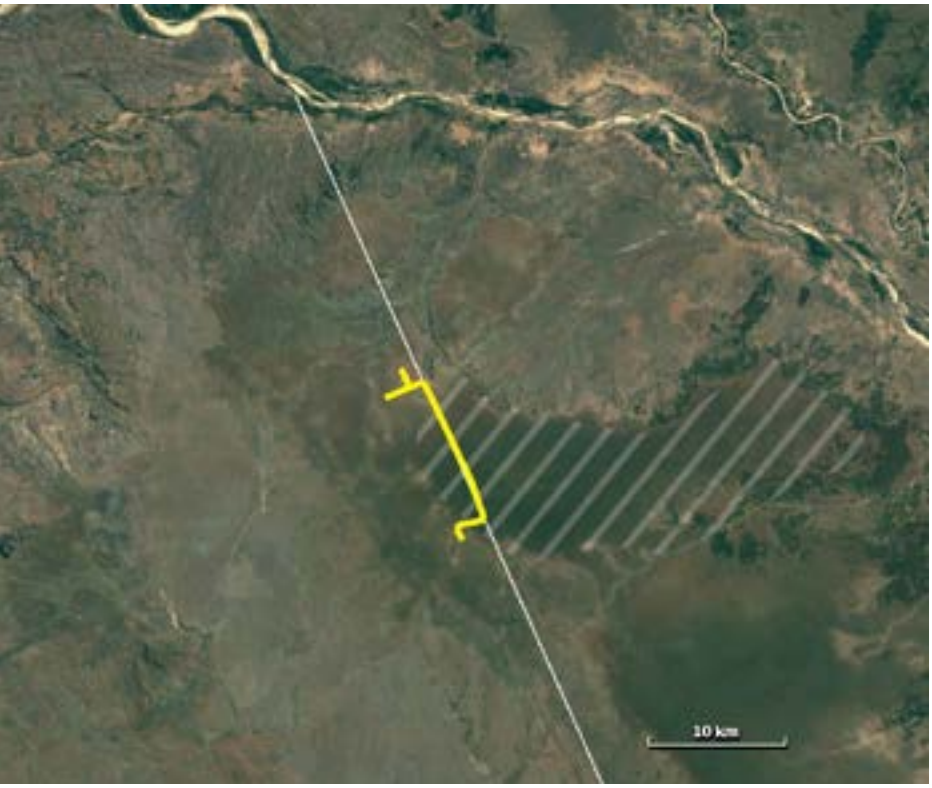
NWAMBIYA SANDVELD

The Nwambiya sandveld is a remnant coastal deep sand deposit that stretches from within Mozambique and cross the South African border for only a few kilometres. The specific fauna of this area was first explored by Piet van Wyk who, at the time, was the Head of the Department of Research and Information of the National Parks Board. Most of the Kruger National Park geology are dominated by basalt and granite formations, which makes the Nwambiya sandveld with its deep sand, flat topography, and low rainfall (400 – 450 m) a

Figure 1 (top). Map of excursions showing locations of days 1-4 excursions

C. Punda Maria Rest Camp
1. Day 1: Area southwest of Punda Maria towards boundary of KNP
2. Day 2: Nwambiya Sandveld
3. Day 3: Pafuri/Crooks Corner
4. Day 4: Area northeast of Punda Maria

Figure 2 (bottom). Geology of the Kruger National Park with the sand deposit regions in the far north



unique habitat for some very interesting and rare fauna species. Many tree species are, within the borders of South Africa, only found in this area.

Typical Kruger National Park trees like *Combretum imberbe* (hardekool, leadwood), *Diospyros mespiliformis* (jakkalsbessie, jackalberry), *Philenoptera violacea* (appelblaar/apple-leaf), *Senegalia nigrescens* (knoppiesdoring/knobthorn) do either occur not at all or is scarce in the Nwambiya sandveld and not very large.

TREE SPECIES OF THE NWAMBIYA SANDVELD

The following trees are some of the unique species which are either found exclusively in the Nwambiya sandveld, around Pafuri or other remote sandveld areas in northern KZN (South African borders). All these were observed during the excursion. Besides own observations, descriptions for the trees discussed are from Schmidt *et al*, (2004), van Wyk & van Wyk (2013) and van Wyk (1990).

Figure 3 (top). A satellite view of the Nwambiya sandveld area. Clearly visible is the Nwambiya sandveld stretching from within Mozambique into a small area across the South African border. Yellow line indicates the route we took through the sandveld.

Figure 4 (bottom). Typical sandy soil found in Nwambiya

Baphia massaiensis subsp. *obovata* var. *obovata*

sandkamhout, sand camwood (jasminepea), mothwakeja (Tw)

Basic description and distribution - Small tree or shrub 2-6 m occurring in bushveld, usually in areas with deep sand in northern Namibia, Botswana, north-east Zimbabwe, southern Zambia and around the border junction of Zimbabwe/South Africa and Mozambique. In South Africa only found in the sandveld of the far northern Kruger National Park - in the Nwambiya sandveld.

Leaves - Leaves simple, alternate, obovate, often folded upward along midrib, buff-green above, paler green with 6 - 10 pairs of lateral veins below, hairless, margin entire, 90 x 50 mm, base tapering, petiole swollen at both ends at base of leaf blade.

Flowers - Attractive pea-like flowers , white with golden yellow spot in in centre of upper petal, jasmine-scented.

Fruit - Pods up to 120 cm long, narrow, very hard, dark to reddish brown. Dehiscent whilst still on the tree.

Stem/Bark - Usually multi-stemmed, smooth bark,

Drypetes mossambicensis

sandysterpruim, sand ironplum (lowveld ironplum), xakwari (Tso)

Basic description and distribution - Large upright tree up to 20 m tall, deciduous, crown spreading, usually in sandy soils near seasonal pans, elsewhere in riverine thickets and at the base of rocky hills. Occurring in Swaziland, Mozambique, eastern Zimbabwe, Malawi and Zambia. In South Africa limited to the Nwambiya sandveld in KNP.

Leaves - Leaves simple, alternate, oblong to elliptic, margin entire, apex rounded and sometimes notched, sometimes wavy or rolled under, glossy green above, dull green below, 30-110 x 15-50 mm, petiole grooved often almost black

Flowers - Sexes on different trees, yellowish green, male flowers in clusters, female flowers solitary +-5 mm in diameter (Oct-Dec)

Fruit - Fruit fleshy, red to orange when ripe, 14x10 mm, trilocular, tipped, edible

Stem/Bark - Bark grey and smooth, dented, cracks in almost rectangular sections, wood very hard and heavy

Hugonia orientalis

ramshoringbos, ram's horns, congulutamute (Tso)

Basic description and distribution - Multi-stemmed shrub, climber up to 6 m. North-eastern corner of South Africa (sandveld areas in northern KNP, Punda Maria and Nwambiya sandveld), South-eastern Zimbabwe and southern Mozambique.

Leaves - Leaves simple, alternate usually in clusters above tendrils, elliptic, margin slightly serrated and wavy, 40-80 x 15-25 mm, tapering, round base, +-12 pairs of lateral veins sunken above and prominent below

Flowers - flowers star-shaped, yellow and sweet-scented, petals clawed at base (Feb-June)

Fruit - Fleshy yellowish drupe, 15 mm long

Stem/Bark - Bark yellowish-white to brown, corky, branch tips have characteristic woody tendrils curling backwards like a ram's horns.

Pterocarpus lucens subsp. *antunesii*

kleinblaarkiaat (doringkiaat), small-leaved bloodwood (thorny teak), tsandjanhovo (Tso)

Basic description and distribution - small to medium-sized tree, deciduous, on deep sands. Occurring in north-western Namibia, along Zambesi River and adjacent areas in Zimbabwe, South Africa and Mozambique. In South Africa only found in the Nwambiya sandveld of KNP.

Leaves - Leaves compound (imparipinnate), 2-9 pairs of leaflets, leaflets oval to lanceolate, bases asymmetric to tapering, edges wavy 20-30 x 10-20 mm, shiny green, black glands on the rachis

Flowers - Flowers small but striking, pale yellow, pea-like (Nov-Dec)

Fruit - Fruit pods, small and flat, 50 x 30 mm, swollen over the seed case and surrounded by a membranous wing

Stem/Bark - Multi-stemmed, branches with occasional stiff, spine-like side shoots, bark smooth, grey, flaking on older trees. Exudes a red-brown sap when cut. Wood very heavy

Spine-like side shoots, hence the common name of thorny teak

Pterocarpus lucens subsp. *antunesii* leaves, multi-branched stem and foilage

Strophantus kombe

kombegiftou (grootblaargiftou), kombe poisonrope
(kombe tailflower, large-leaved poisonrope), ntsulu (Tso)

Basic description and distribution - Small up to 7 m climber in rocky woodland, ravines and deep sand. Northern KNP, northern KZN, Mozambique, Zimbabwe, Zambia

Leaves - Leaves simple, opposite, elliptic to oblong, entire, 70-160 x 45-110 mm, dull green to dark brown green above, paler below, veins sunken above and distinctly raised below, thick and leathery, hairy

Flowers - Flowers trumpet shaped, cream to pale yellow, speckled purple or red, petals elongated into long strips up to 120 mm long

Fruit - Fruit a large two-horned capsule, 200-400 x 20-35 mm, tapering to a point, smooth, brown, spreading at right angles to each other. Crushed seeds and fruit used to make arrow poison

Stem/Bark - Branches hairy, bark grey to purple-brown, pale brown lenticels, latex present

Uvaria lucida subsp. *virens*

grootvrugtrospeer, large-fruited clusterpear, umavumba (Z)

Basic description and distribution - Shrub or small tree, evergeen. Occurring in northern KNP Nwambiya sandveld, northern KZN and Swaziland,

Leaves - Leaves simple, alternate, oval to oblong, tapering apex, with slight drip tip. Margin entire. Grey-green above, bright green below, leathery hairy or hairless, 40-115 x 17-55 mm

Flowers - Flowers solitary or clustered, dull green to yellowish green, 15-30 mm wide, cup shaped bud splitting into 3 parts when flowers open,

Fruit - 10-20 fruiting segments each 20-50 x 10-18 mm, brown to orange-brown when ripe, smooth to hairy,

Stem/Bark - Main stem smooth and grey, lenticels,

Xeroderris stuhlmanii

vlerkboon, wingpod (wingbean), mudzungu (V)

Basic description and distribution - Medium-sized tree (10 m), deciduous, in bushveld on deep sand. In South Africa only in northern KNP Nwambiya sandveld. Northwards up to Tanzania

Leaves - Leaves clustered near end of branches, compound 4-8 sub-opposite pairs plus terminal one (imparipinnate), greyish green, hairy below, folded upwards, leaflets 40-120 x 25-65 mm.

Flowers - Flowers small and white, pea-like,

Fruit - Fruit pods flattened with prominent wing, 100-180 x 30-45 mm, hairless,

Stem/Bark - Main stem grey, bark flaking when mature, young branches hairy, red sap when cut

Xylia torreana

harige sandessenhout (sandessenhout), hairy sand-ash (Sand-ash)

Basic description and distribution - Medium-sized tree (10 m), deciduous, upright, spreading at the top.

Leaves - Leaves characteristically bi-pinnately compound with only one pair of pinnae, six pairs of leaflets per pinnae, leaflets 100 x 40 mm, dark green and hairless above and hairy below, one flattened, brown, slightly sunken gland on the petiole

Flowers - Flowers inflorescence dark brown buds, when mature consists of large number of florets with white filaments, and yellow anthers (Oct-Nov)

Fruit - Fruit pods resembling broad "pangas", very hard, dark brown when mature, 100 x 50 mm, splitting open while still on the tree

Stem/Bark - Main stem grey and rough,

Many other tree species were observed during this day's excursion, some notable species include *Pavetta catophylla* (sandbruidsbos/sand bride's bush), *Guibourtia conjugate* (kleinvalsmopanie/small copalwood), *Clerodendrum pleiosciadium* (sandtontelhout/sand tinderwood), *Heinsia crinite* subsp. *parviflora* (jasmynkatjiepiering/jasmine-gardenia), *Monodora junodii* var. *macrantha* (dikblaargroenappel/thick-leaved green-apple), *Boscia filipes* (sandveldwitgat/sandveld shepherd's tree), *Vitex patula* (goue vingerblaar/golden fingerleaf), *Xylotheca kraussiana* (afrikahondsroos/African-dogrose), *Hippocratea parvifolia* (gladdeblaarspaanvrug/smooth-leaved paddlepod).

Photo credit: Dr. Theunis Morgenthal
Louise Kritzinger

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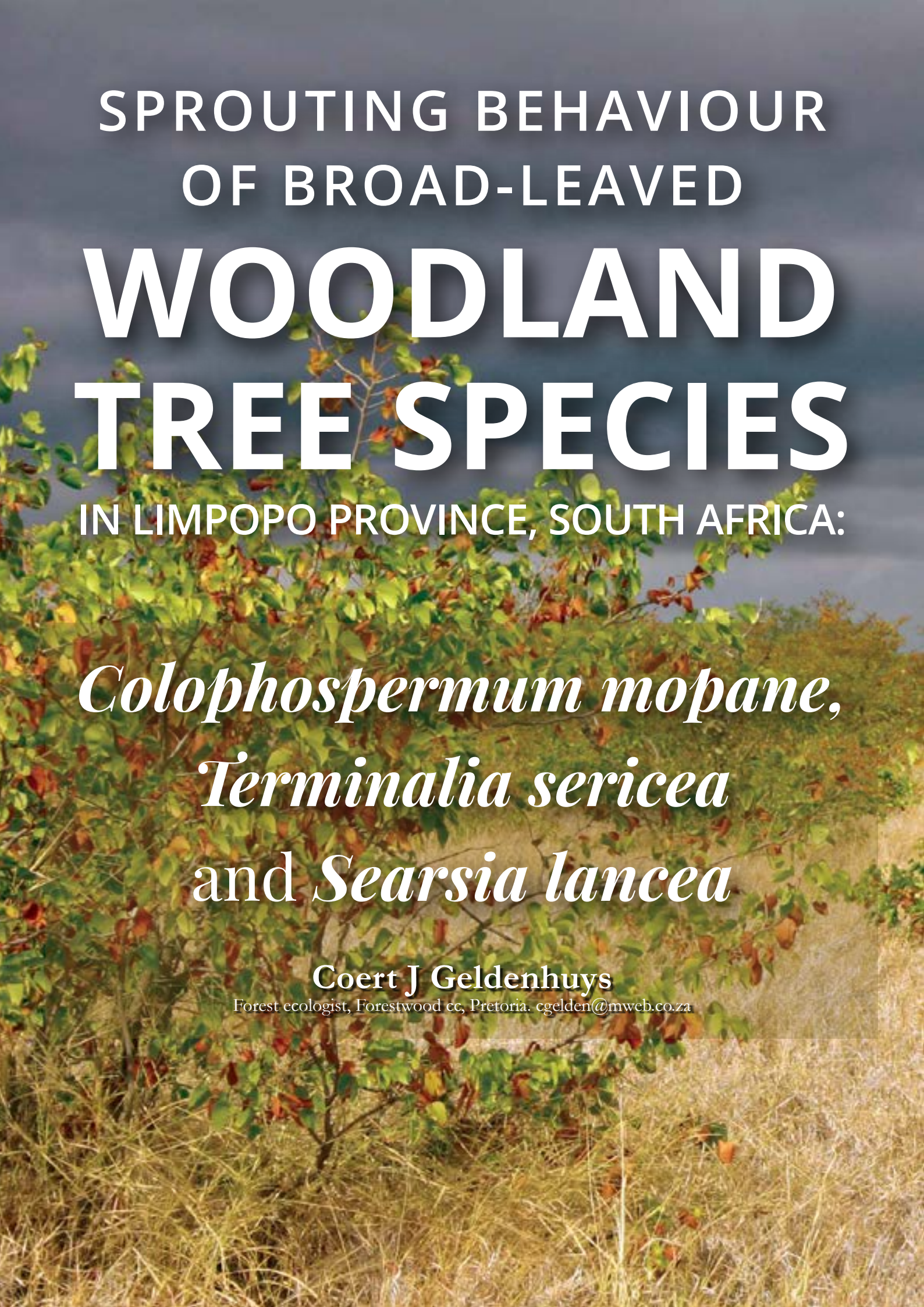

SPROUTING BEHAVIOUR OF BROAD-LEAVED WOODLAND TREE SPECIES IN LIMPOPO PROVINCE, SOUTH AFRICA:

Colophospermum mopane, *Terminalia sericea* and *Searsia lancea*

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Regeneration strategies of tree species and natural forest-related ecosystems are critical to their sustainable use for timber, poles, firewood, charcoal, bark for traditional medicine, and recovery after clearing for cropping in slash-and-burn traditional agriculture. Native tree species became grouped into three major vegetation systems by their adopted main regeneration strategies to survive natural disturbance-recovery processes: evergreen forest systems with shade-tolerance and regeneration from mostly seed in fleshy fruit, and sprouting; fine-leaved deciduous woodlands (mainly thornveld) with regeneration mainly from hard-coated long-living seeds and little to no sprouting; and broad-leaved deciduous woodlands with regeneration mainly from sprouting with some regeneration from dry seeds. The last two systems are fire-adapted systems in fire prone environments covering the largest part of southern Africa, and Africa. Most of their canopy tree species are strongly light-demanding, mostly leading to even-aged stands in recovery.

Land use practices of agriculture, forestry, nature conservation, and infrastructure and urban developments, have changed fire regimes to cooler fires or no fires. The tendency is then for trees to become dominant in the fire-prone and fire-adapted vegetation, causing a loss of the herbaceous (sometimes mainly grass) component and various important values and services. This is causing conflicts between continued use of such resources, such as by poor rural and urban societies highly depending on such resources for daily livelihoods (the perception of forest degradation and loss), and maintenance of their genetic diversity, their productivity, and their diverse use value (including environmental services). Two contrasting approaches are followed in dealing with these natural woody systems: (i) The woodland/bushveld is cleared for commercial development considered to be more useful to society; (ii) The woody systems are protected because the perception is that their important diversity and environmental services (such as climate mitigation) are lost.

Colophospermum mopane - Marissa Greeff

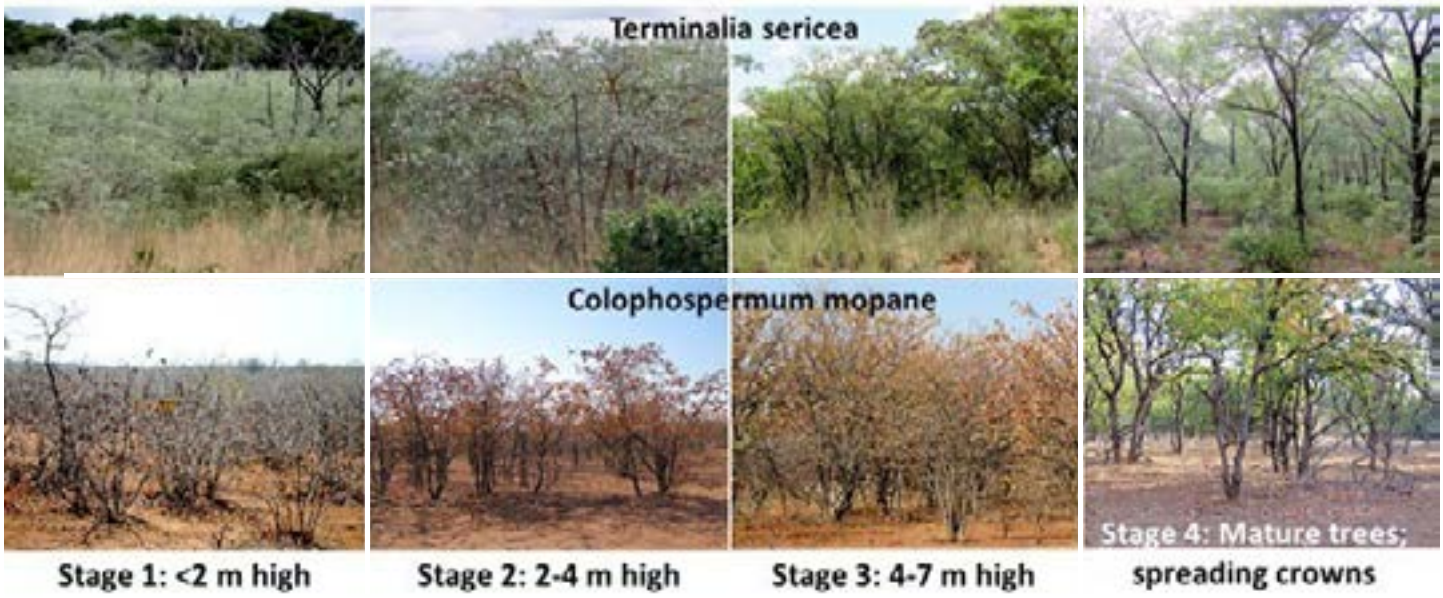

Figure 1.
A visual representation of the four Stand Development Stages for *Terminalia sericea* in the Sondela area, and for *Colophospermum mopane* in the Tshipise area.

Current land use practices caused increasing cover of woody growth of indigenous tree and shrub species in many of the bushveld/ woodland areas in Northwest, Limpopo, and Mpumalanga Provinces (generally considered as bush encroachment) in South Africa. In general, the herb/grass cover with its associated biodiversity and grazing potential is declining. Some areas described as Central Bushveld with information on species composition and vegetation structure (Rutherford et al., 2006), currently do not resemble such descriptions because of the amount of woody shrub and tree cover to the detriment of the herbaceous component. However, such woody growth does sequester carbon, and many of the woody species are also important in the livelihood of rural societies. When people use such tree growth, it is often considered as degradation, ignoring the reality that such activities restore the balance between trees and the herbaceous component.

Three studies have been conducted in recent years in the broad-leaved woodlands/ bushveld of Limpopo and North-West provinces to develop an ecological basis for restoring the balance between trees and the herbs/grass through active resource use (Geldenhuys, 2017; Geldenhuys & Monareng, 2020). The rationale used was that resource use simulates the natural disturbances of various types and at various scales and that light-demanding woodland tree species do not regenerate productively when selective cutting (small gaps) is applied (Geldenhuys, 2010a,b 2011, 2014). Human society depends on these woody systems for various products, values, and services. The woodlands function with relative dormancy during a long dry season. Their physiology underlying their dormancy during the dry season and strong vegetative response with the onset of the rainy season could be important to consider in the development of sustainable harvesting systems. The concept of developing a system of sustainable resource use was developed when considering a silvicultural management system for Miombo woodland in Mozambique (Geldenhuys,

2005) and refined through time-series studies in Zambian Copperbelt Miombo woodland (Syampungani et al., 2010, 2016), Undifferentiated woodland in Zimbabwe (Chichinye et al., 2019, 2020) and mopane woodland in Mozambique (De Sousa, et al. 2021). These studies showed that the perceived 'bad practices' of slash-and-burn agriculture, charcoal production, and fuel wood and pole harvesting, resulted in faster recovery and maintenance of biodiversity, productivity (growth rate and carbon sequestration rates) and use value than the perceived 'good practices' of single-tree timber harvesting and protection (with lowest plant diversity and productivity). The concept of Stand Development Stages was developed to guide specific silvicultural practices of stem thinning and branch pruning in each stage to facilitate faster stand development from the young Stage 1 to the mature Stage 4 (Geldenhuys, 2014; Geldenhuys & Monareng, 2020 for the Mopane-Terminalia Study, as in Figure 1).

This paper gives a brief overview of the sprouting behaviour of karee (*Searsia lancea*), mopane (*Colophospermum mopane*) and silver clusterleaf (Terminalia sericea) (hereafter called Terminalia) as observed in experimental studies. Guidelines are provided on how such gained knowledge can be used to manage the relevant broad-leaved woodland systems towards sustainable use of their resources while maintaining their biodiversity. The focus is on the behaviour of mopane, with supplemented information of the other two species.

Experimental studies assessing sprouting behaviour

Mopane and Terminalia studies

The study was conducted in four study areas, in Stand Development Stages 2 and 3 in each study area (Geldenhuys & Monareng, 2020). Mopane was studied at Mbaula rural area between Phalaborwa and Giyani (23o39'39.90" S; 31o01'33.99" E) and at Tshipise Honnet Nature Reserve (22o38'13.84" S; 30o10'42.15" E). Terminalia was studied at Sondela Nature Reserve near Bela-Bela (24o53'32.50" S; 28o23'33.04" E) and in two areas in the Hoedspruit-Klaserie area, with Stage 2 stands at Thulani Lodge area (24o34'05.19" S; 31o06'23.38" E) and Stage 3 stands at a commercial farm area (22o38'13.84" S; 30o10'42.15" E). Four experimental thinning intensities were applied to only the target species: 0% (control), 33%. 66% and 100% stem cutting. Treatments were applied during the early rainy season (November to December), and mid dry season treatment (July) included only 100% stem cutting.

Karee Study

This study was conducted on a farm between Brits and Marikana (25o38'52,38" S; 27o40'20.90" E) (Geldenhuys, 2017). Three thinning treatments were randomly allocated to selected plots within sparse and dense karee stands: 0% (control), 50% and 100% cutting of stems, in sparse and dense stands. Trees were cut during April to May 2016 (early dry season) and again end October 2016 (late dry season).

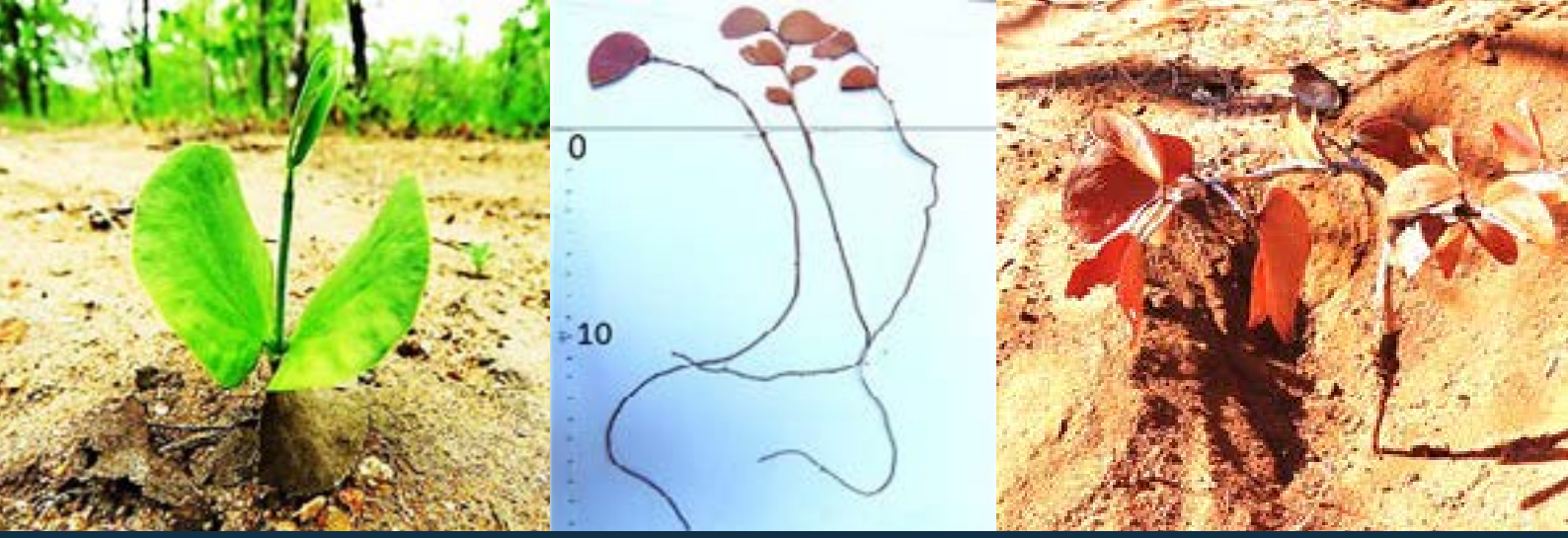

Figure 2.
Root development of *Colophospermum mopane* after seed germination. (a, Left): Germination of the seed. (b, Middle): Excavated seedlings showed immediate develop deep down the soil profile. (c, Right): Seedling developing a thickening root with little branch development in seedlings of likely two to four years old.

Figure 4.
Sprouting development from roots and cut stumps. (a, Left): A new, young *Colophospermum mopane* shoot developed from a damaged root. Several clusters developed on cut stumps of C. mopane (b, Middle), at different heights above ground level, and of *Terminalia sericea* (c, Right) with different degrees of browsing intensity of the developing sprouting clusters in both species.

Figure 3.
Root development in more mature trees of *Colophospermum mopane* (a & b). (a, Left): Deep root development in stream embankment in Tshipise. (b, Middle): Several stems with connected roots around an old stump at point of black cut-knife in the middle at Mbaula. (c, Right): Extensive underground root system with new sprouts on the roots of *Terminalia sericea* at Sondela.

Observations of sprouting behaviour

Rooting development

Root development is the basis for successful regeneration of the three target tree species of the mentioned studies and for the canopy tree species of the Broad-leaved Woodlands. It was only possible to excavate the seedlings of mopane because they were present in abundance at the start of the study during November to December 2019 in both mopane study areas (Figure 2; Geldenhuys et al., 2020). A single root grew straight down into the soil, and developed very few, widely spaced, small lateral roots. The young roots in Figure 2b were between 20 and 30 cm long, between the root collar (at the soil surface) and the broken root tip. Initially the developing root has very thin bark, but gradually the bark becomes thicker and coarser (Figure 2c).

The root spread of mature trees was observed along a stream with banks of alluvial sand in the Tshipise Honnet Nature Reserve (Figure 3a). They showed a prominent taproot, but in some trees also abundant relatively large-sized lateral roots (Geldenhuys, et al. 2020). In all these areas, mopane trees often grow in clusters of two to even more than 10 stems. Several of such tree clusters were excavated, as the example shown in Figure 3b. Terminalia trees occasionally showed such clusters but generally only a few stems. In most cases with more than one stem above ground, there was only one stem growing from the ground, even with spreading roots below ground (as in Figure 3c).

Sprouting behaviour and browsing

In most cases, single shoots developed from damaged or exposed roots at the soil surface (Figure 4a). In most cut stems, the sprouts developed in clusters of several small shoots, at different heights above-ground (Figures 4b,c; 5a,b). During the July 2020 assessment, after tree harvesting during November-December 2019, most mopane stumps in the 100% cut plots produced 5 and more sprouting clusters, with a tendency of decreasing to no sprouting with the 66% and 33% thinning, in both stages 2 and 3 (Geldenhuys, et al., 2020). In such clusters, some shoots grew stronger than others and then dominated the growth per cluster (Figure 5c). Such detailed assessments were done in the sprouting response in the experimental studies with mopane and Terminalia but are not included here.

New developing shoots on the cut stumps suffered three types of damage; browsing, frost and fire. In all study areas of Mopane and Terminalia, except for the Thulani Lodge site, most sprouting was browsed (Geldenhuys, et al., 2020): presumably by cattle at Mbaula (possibly also antelope) (Figure 4b), antelope (possibly nyala and/or impala and/or bushbuck) at Tshipise (Figure 6a) and Franklyn Park, and antelope and goats at Sondela. Such severe and almost total shoot browsing of the two species was not expected. At Thulani Lodge, cattle present in the area did browse the sprouting Terminalia stumps (there were no signs of antelope). Terminalia at Sondela suffered from severe frost and browsing (Figure 6b,c). In the Karee Study, the stumps cut during April-May 2016 developed sprouts during the dry season, but those sprouts became shrivelled and eventually died, probably because of frost and drought (Geldenhuys, 2017). The frost-damaged sprouts resumed proper sprouting during late October 2016.

Figure 5.
Developing sprouting clusters on cut stumps of *Searsia lancea*. (a, Top and b, Middle): Several sprouting clusters on cut stumps at different heights above ground level. (c, Bottom): The many initial sprouts in different sprouting clusters, reduced over time to fewer but stronger growing shoots.

Figure 6.
Two main factors affecting the sprouting after stem cutting in the experimental studies. (a, Top): Browsing of sprouts of *Colophospermum mopane* by antelope (nyala and impala) and cattle. (b, Bottom): Frost killing of sprouts of *Terminalia sericea* at Sondela Nature Reserve, but also browsing by nyala antelope and goats.

Fire damage to young karee plants was a major constraint (Geldenhuys, 2017); from the earliest stage of a seedling or sapling the plants are continuously burnt back and then develop multiple shoots on what looked like swollen roots or a thick rootstock below-ground. Even taller pole-sized trees got burnt back and then resprouted from the base. Such burning delays the rapid development of the tree to above the scorch line. After the severe browsing observed during July 2020, cut stumps were covered with cut branches and stems in a zig-zag manner to prevent the browsers to get to the sprouting stems (Figure 7), with good effect.

Experimental treatment effects

The experimental thinning treatments had

Figure 7.
Stacking branches in a zig-zag manner across the cut stumps helped to keep browsers away from the developing shoots (see black cut knife as scale). (a, Left): Developing shoots on Stage 2 stems of *Colophospermum mopane* cut during early rainy season at Tshipise. (b, Middle): Shoots on Stage 3 stems of *C. mopane* cut during mid dry season at Tshipise. (c, Right): Developing shoots on Stage 3 stems of *Terminalia sericea* cut during mid dry season at Sondela.

Figure 8.
The effect of cutting intensity on the sprouting response of *Colophospermum mopane* trees at the Mbaula study area. (a, Left): Sparse sprouting during July 2020 after the 100% cut in Stage 2 during end of November 2019, mainly because of severe browsing by cattle. (b, Middle): The same stand 2 years later during July 2022. (c, Right): The Stage 3 stand during November 2021, after 66% cutting during November 2019, showing very little to no sprouting on cut stumps.

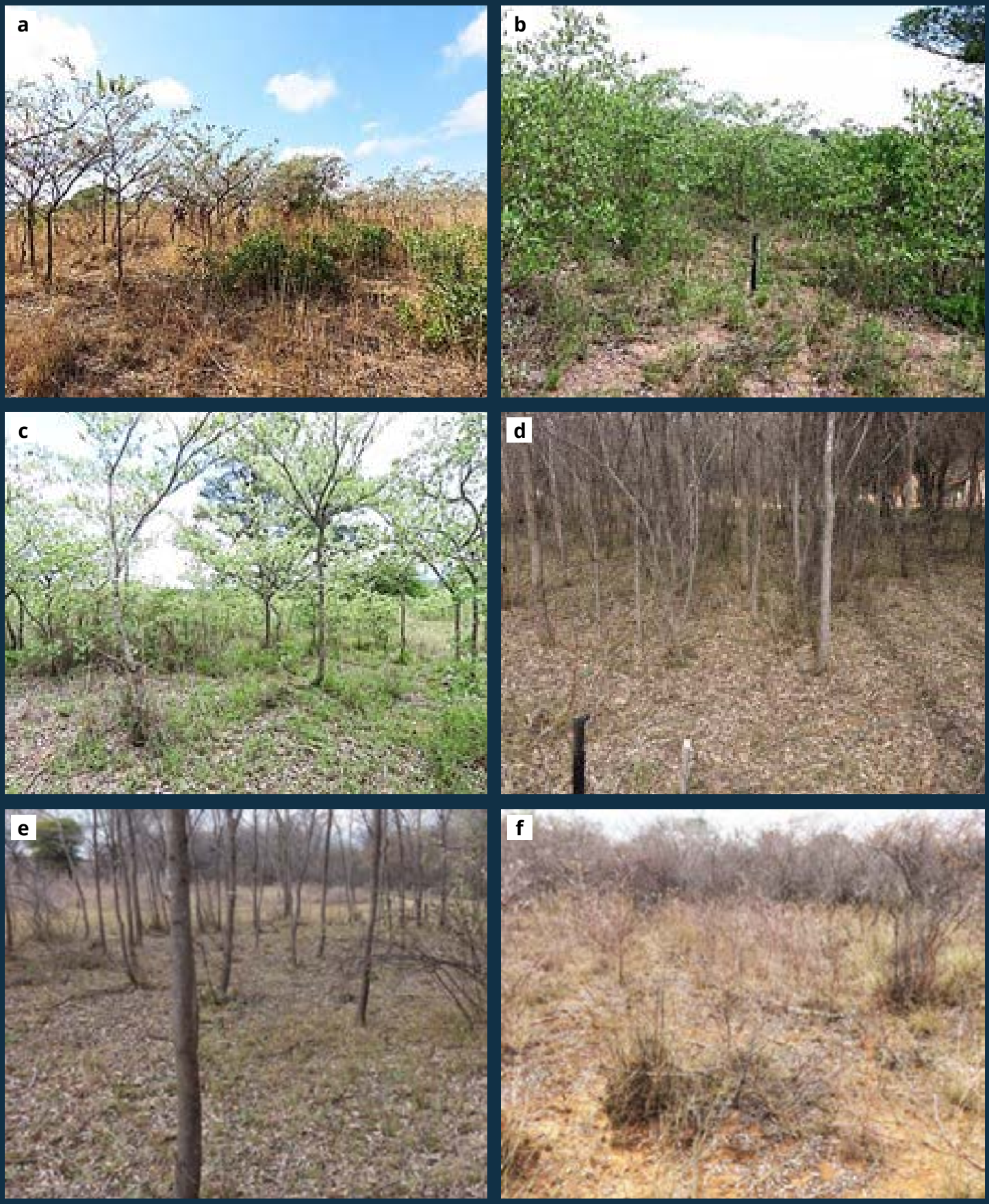

Figure 9. The effect of cutting intensity on the sprouting response of *Terminalia sericea* Stage 2 trees at the Thulani study area (a to c) and Sondela (d to f). (a, Top left): July 2020, after cutting in January 2020, showing no sprouting with 33% cutting in stand on left and very good sprouting with 100% cutting in stand on right. (b, Top right): Shoots on 100% cut stumps at end of November 2021. (c, Mid left). View at end of November 2021 through stand of 33% cutting of stems, with poor sprouting, onto stand of 100% cutting in the back, with sprouting as in (b). Bottom line: Stands in Stage 2, Sondela, during June 2022, showing (d) Control stand, (e) 66% cut with very little sprouting, and (f) 100% cut with very good sprouting.

a marked effect on the sprouting response of the cut stumps. The 100% cutting of all stems resulted in very good sprouting on most cut stumps, in both mopane (Figure 8a,b) and Terminalia (Figure 9a-c, f), in both Stages 2 and 3. Sprouting of cut stumps in 33% cutting and 66% cutting was poor to nothing (Figure 8c for Mopane Stage 3; Figure 9c,e for Terminalia in Stage 2). However, in sparser stands, or in early Stage 2 Terminalia with 66% cutting, many cut stumps produced good sprouting because of the better light conditions.

Seasonal effects

In the Karee Study, new sprouting developed during early October 2016, before the first rains, after earlier sprouts were killed by frost/drought during winter (Geldenhuys, 2017). They developed faster after the first rains, to >1.5 m height in about 6 weeks. Shoots were fewer on the stumps of the sparse 50% thinned plot (better light conditions) but still grew quite long. Results from the Karee Study suggested that (a) trees cut during the dormant season (dry season with cold conditions) produced better sprouting and shoot growth than trees cut during the rainy season, (b) shoot growth (height and stem diameter) are fast from after the start of the rainy season, and (c) that some kind of reduction of the number of sprouts developing would be needed to focus growth on strong shoots.

In the Mopane and Terminalia study areas, the cutting of trees during the mid-dry season produced better sprouting and shoot height growth than with cutting during the early rainy season, in both Stages 2 and 3 (Figures 10 & 11). In the Mopane example, shoots on stems cut during November 2019 (Figure 10b) developed on a much better developed root system that those of the developing seedlings – above-ground parts are of same age (Figure 10a). Shoots on stumps cut during the mid dry season (Figure 10c,d) were taller with better development than shoots on stumps cut during early rainy season, even when they were 8 months younger. The shoots on Stage 3 cut stumps (Figure 10d) were taller than shoots on Stage 2 cut stumps (Figure 10c), because of better developed root systems. In the Terminalia example (Figure 11), stem groups A and B were growing 20 m apart. The shoots on stems cut during the mid dry season (July 2020), were 7 months younger but taller with bigger stem diameter than shoots cut during the early rainy season (early January 2020).

Options for sustainable resource use management

The most important message from understanding the sprouting behaviour of the broad-leaved woodland system is that we can maintain the system in a good condition with high diversity and productivity, while actively harvesting resources. A tree has one root system that anchors it, that takes up moisture and nutrients from different parts of the soil profile to transport that to the leaves to be used along with photosynthesis to produce food reserves that is then stored in the leaves, bark, and root system. Those reserves must be shared between the different stems of the tree. When the rains start early in summer, the food reserves plus growth hormones are mobilised to activate the production of new leaves, flowers, and fruit/seed. Most canopy tree species of the fine- and broad-leaved


A
B

woodlands are strongly light-demanding. The new growth develops into even-aged stands. The faster-growing stems dominate the stands, and the smaller trees are not younger stems, but suppressed, deformed and/or damaged stems. In the silvicultural management practices that we have developed (Geldenhuys, 2014), we selectively cut the smaller stems, and maintain the best stems (like what we do in plantation forestry). In that way, the better stems grow faster and maintain higher production rates of quality stems.

The stems removed with 33% and 66% cutting should preferably not sprout. Such sprouting shoots will not grow well with the lower light conditions and may compete with the remaining stems for moisture and nutrients to survive. The concept is that selective stem thinning is applied in Stand Development Stages 1 to 3, with branch pruning of remaining stems. When the stand reaches Stage 4, such mature stands should be cut through group-felling, causing a gap diameter of 3 to 5 times the height of the mature stand (Geldenhuys, 2014). Such a gap would provide the light requirements for fast shoot growth and rejuvenation of the stand (as shown with the 100% cutting treatment).

Figure 10. (Opposite top) Development of regeneration of *Colophospermum mopane* from seed or sprouting on cut stumps (see black panga for scale). (a, Top left): Seedling development from seeds since November 2019 – 2 years, 2 months. (b, Top right): Shoot development on Stage 2 stumps cut during November 2019 – 2 years, 2 months. (c, Bottom left): Shoot development on Stage 2 stumps cut during July 2020 – 1 year, 6 months. (d, Bottom right): Shoot development on Stage 3 stumps cut during July 2020 – 1 year, 6 months.

Figure 11. (Opposite bottom) Shoot growth on cut stems of *Terminalia sericea* at Thulani Lodge area (a, Left): The Group A stems sprouted from stems cut during early rainy season in January 2020 (2 years, 6 months old). (b, Right): The Group B stems sprouted from stems cut during mid dry season in July 2020 (1 year, 11 months).

Figure 12. (Below) Options for sustainable resource use practices within the broad-leaved woodlands, without cutting all stems, as is often done, but to restore and maintain biodiversity, productivity, and diverse resource use value of the system. The red lines indicate which tree stems should be cut first.

In the daily livelihood of rural societies, people (mainly women and children) regularly collect firewood for cooking and warmth, and they use poles of different sizes for constructions of different kind. Implementation of the following simple and practical guidelines for sustainable resource use are to restore the biodiversity, productivity, and diverse resource use value of the woodlands (Figure 12). The rural resource users are familiar with such resource use practices although they need slight adjustments, such as not cutting all the stems of a tree, but to retain the better stems and the tree stands, with many other products, values, and services. This approach and practice had been implemented in the conversion of plantation forestry to natural bushveld, woodland and forests in the Mariepskop-Hoedspruit-Bushbuckridge area, Mpumalanga Lowveld, with training of local fuel wood and pole harvesters from the surrounding communities (Geldenhuys, 2018). Rural resource users, particularly the women and children, when guided on such better practices, can become key contributors to restoring the natural woody systems of southern Africa.

The basic guidelines are as follows (see Figure 12):

(i) Harvest stems for firewood and poles during the mid dry season. This harvesting period has two benefits. Firstly, such activities will not conflict with growing crops with the onset of rains. Secondly, stems cut during the mid dry season, develop new shoots on the cut stems when the rains start, using all the stored reserves. When stems are cut during the early rainy season, most stored reserves are used for developing leaves and new growth and cut stumps retain limited reserves to grow fast.

(ii) Small branches for firewood can be harvested any time of the year. Branch pruning should consider the following:
   a. Retain 30 to 50% of the foliage of the tree to ensure continued growth of the tree through optimum photosynthetic activity.
   b. Cut a branch level with the main stem to ensure rapid recovery of the wound to avoid stem damage and decay (from insects and fungi). Avoid cutting branches >10 cm thick because they may recover very slowly.
   c. Avoid branch tearing down the stem by first making an undercut before the branch is cut. Such tearing may cause infection of the wound and stem deformation through abnormal cambium development around the wound.
   d. Removal of lower small branches with foliage to reduce the potential for running fires to climb into the tree crown and kill the tree, and to stimulate the development of herbaceous vegetation other than grass and thereby increase the species and functional diversity of the site.

(iii) Start with a good look at the trees in the harvesting area, to consider the different situations shown in Figure 12.
   a. Exclude trees of species with the potential to produce good edible fruit and do not prune their branches.
   b. First select the 1 - 3 best trees used for fuel wood and poles (Figure 12a,b) to be

retained and ensure that they are not damaged when cutting other stems (Figure 12d). This would focus tree growth on the better stems of good form and faster growth.

c. In selecting stems to be cut, ensure an unform distribution of the remaining stems (see Figures 8c and 9e)
d. Then first cut the worse suppressed, deformed and/or damaged stems close to ground level. After cutting a stem, re-evaluate the remaining trees.

(iv) Cut stems close to the ground to ensure that sprouting shoots root into the ground and develop stable stems. Sprouting shoots developing higher above the ground may blow over during strong winds and would be affected more during abnormal dry periods.

a. Old stumps with sprouting stems high above the ground should be cut at ground level to ensure better shoot development (Figure 12c).

(v) Do not strip bark from the retained trees for use as binding material for piles of firewood, poles and other material; such debarked strips cause stems to become deformed and diseased. They should only be collected from the cut stems.

People often do not perceive that poles could be obtained from a site until they are shown that most trees, even when they were still small, have the potential to develop into good poles, if they apply selective stem harvesting, without cutting all stems. Selective stem

thinning and branch pruning can be practiced anywhere where trees grow, in all stages of their development - in natural areas, along roadsides, on the edge of fields, and between houses within a village. This practice of selective stem thinning, and branch pruning, need to be applied during normal and regular collection of poles and fuel wood by households. Much material could be harvested in this way, while maintaining a good stand of trees for future use.

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Vaalbome - Marissa Greeff

DIE PROBLEEM VAN *bosverdigting* IN SUID-AFRIKA

Ronél Eksteen

Teorie komponent ter gedeeltelike voltooiing van die Dendroloog Vlak II eksamen. Waterbergtak

Wat is bosverdigting?

Bosverdigting is die toename van digtheid van inheemse bome en struike in hul natuurlike omgewing sodat die natuurlike ewewig tussen bome, struike en grasse versteur word. Dit veroorsaak 'n afname van grasse en kruidagtige plante in die savanna biome (Botha, 2023).

Die implikasie van bosverdigting

Die Departement van Omgewingsake (2019) het in 'n studie bevind dat 7.3 miljoen ha of 6% van Suid-Afrika se landelike area geaffekteer word deur bosverdigting, veral in dele met 'n reënval van 500 mm of meer per jaar. As fotos vergelyk word, wil dit voorkom asof hierdie probleem al 'n paar eeue reeds bestaan (sien Figuur 1), maar die afgelope 30 jaar begin toeneem het. Eienaars van bees-, en wildsplase asook in wildreservate sien oor jare dat bosverdigting plaasvind en besef dat die probleem aangespreek sal moet word (Botha, 2023).

Figuur 1. Magersfontein (Ward, n.d.)

Die meeste wildspesies het ontwikkel in savannatoestande met 'n mate van 'n boom / boskomponent wat dan ook benodig word vir skuiling en by sommige vir voeding. Wild wat takke en blare vreet se behoefte is 'n gemiddelde boomkroonbedekking van 40-50% eetbare bome (ongeveer 300-400 bome per ha). Wild wat gras vreet en bome net vir

'n skuiling benodig, se behoefte is maar 25% kroonbedekking. Erge bosverdigting van 80% en meer, wat tans in die bosveldgebiede voorkom, dui op 1600 tot meer as 2000 bome / struike per ha. Hierdie tendens veroorsaak 'n afname en verdwyning van die graslaag en 'n toename van breë-blaarkruide wat gronderosie tot gevolg het a.g.v. 'n verlies aan grondbedekking. Hierdie tendens veroorsaak 'n verswakking in die veldtoestand en uiteindelik 'n verlies aan drakrag en afname in die kondisie van die meeste wildsoorte (Furstenburg, 2015).

Oorsaak van bosverdigting

Boere het opgelet dat al bestuur hul hul grond dieselfde as hul grootouers, het die aantal bome steeds toegeneem – hoekom?

Klimaatsverwarming:

Klimaatsverwarming veroorsaak verhoogde CO_2 konsentrasie. Dit veroorsaak dat bome bevoordeel word deurdat hulle d.m.v. fotosintese ekstra koolhidrate kan vervaardig wat 'n toename in bogrondse plantproduksie en wortelgroei veroorsaak. Die CO_2 toename bevoordeel ook die plante se waterverbruiksdoeltreffendheid. CO_2 word deur die huidmondjies opgeneem en water word deur die huidmondjies verloor (transpirasie). As die CO_2 konsentrasie in die atmosfeer hoog is, hoef die plant nie sy huidmondjies so groot oop te maak nie en transpirasie verminder (Furstenburg, 2015).

Wanbestuur van veld:

Bosverdigting veroorsaak dat die grond soveel voedingstowwe verloor dat grasse verswak en al hoe swakker groei totdat dit verdwyn. Volgens Botha (2023) veroorsaak dit dat grasvreters se voedselbron afneem en oorbeweiding begin plaasvind. Die hoë worteldigtheid plaas druk op die grondvog en bome verloor hul blare vroeër in die winter wat 'n beperking op die blaarvreter se voedselbron plaas. Verder is baie van die bosverdigters doringagtig wat die voedingsgebied ontoeganklik vir diere maak. Die bome se digte stand keer lig, verdroog die grond en die grasse kompeteer met houtagtige saailinge (Fig. 2)

Figuur 2. Bosverdigting links en bosbestuur regs (Botha, 2023)

Gebrek aan 'n gesonde graslaag:

'n Kompeterende gesonde, energieke graslaag wat bestuur word deur brande en korrekte beweiding is noodsaaklik. Gras kan hulself 'dood groei'. Dit is waar gras maksimaal groei en afsterf, maar so dig is dat dit nuwe groei belemmer en glad nie meer smaaklik vir diere is nie. Dan is 'n brand noodsaaklik om die ou, onsmaaklike en onaktiewe gras te vernietig sodat nuwe groei kan verskyn.

Reënval:

Reënval bo 500 mm per jaar bevorder bosverdigting terwyl lae reënval bosverdigting vertraag.

Die nadele van bosverdigting (Ezzey, 2015)

Biodiversiteit verminder:

Savanne / bosveld is 'n kombinasie van bome en gras. Die verhouding mag verskil, maar dit is noodsaaklik vir 'n landskap. Ooptes is 'n belangrike habitat vir verskillende diere en plante. Bosverdigting veroorsaak dat grasvreters verminder en blaarvreters toeneem. Sekere voëlsoorte soos die sekretarisvoël en bromvoël asook sekere roofdiere het oop ruimtes nodig om in te jag.

Beskikbaarheid van water:

Bosverdigting plaas ook druk op beskikbare water. Die bome gebruik meer water as gras en minder water loop af na riviere.

Gronderosie:

Bosverdigting veroorsaak die verdwyning van die graslaag. Die wortels speel 'n belangrike rol om die bogrond vas te hou, maar nou neem gronderosie toe a.g.v. die afwesigheid van graswortels.

Ekotoerisme:

Vir 'n wildkyker is dit moeilik om diere in digte bos raak te sien. Die diere is ook minder en beweeg in kleiner troppe. Dit is nadelig vir toerisme en parke kan so inkomste verloor.

Figuur 3.
Grootblaarsekelbosverdigting op die R520 Mookgophong

Figuur 4. Vaalboomverdigting langs N1 naby Bela-Bela

Die sondebokke

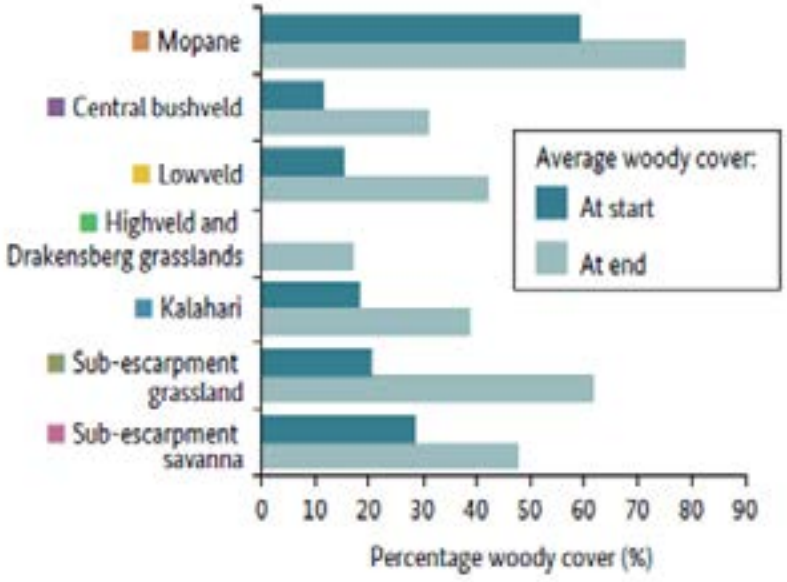
Die spesies wat verdig neem toe en voorbeelde hiervan is *Senegalia mellifera* (swarthaak), *Dichrostachys cinerea* (grootblaarskelbos), *Dichrostachys cinerea* subsp. *africana* (kleinblaarskelbos), *Colophospermum mopane* (mopanie), *Combretum apiculatum* (rooiboswilg), *Terminalia sericea* (vaalboom), *Vachellia karroo* (soetdoring), *Vachellia sieberiana* (papierbasdoring). Die grootblaarsekelbos kom wyd voor en vorm ondeurdringbare ruigtes. Die soetdoring is nou ‘n verdigter in die Oos-Kaap en KwaZulu-Natal waar voorheen boomlose grasveldlandskappe was (Botha, 2023).

Dit is belangrik om te onthou dat al die sondebokke inheems is en belangrike rolspelers in die ekologie is. Die probleem is dat hulle te veel raak of versprei na streke wat voorheen sonder bome was.

In ‘n verslag wat deur Departement van Omgewingsake in 2019 vrygestel is, is verskillende bosverdigtingsones uitgewys (Mucina en Rutherford, 2006, soos verwys in Departement van Omgewingsake, 2019). Teenoorstaande kaart toon die verskillende verdigtingsones in Suid-Afrika en die grafiek toon hoe verdigting in ‘n 23-jaar periode plaasgevind het. In elke sone is sekere faktore geïdentifiseer wat bosverdigting kan beïnvloed nl. privaat bewaringsgebiede met ‘n lae bevolkingsdigtheid en goeie bestuur, kommersiële gebiede waar met vee en wild geboer word en dan landelike gebiede wat soms dig bevolk is en bestaansboerdery in voorkom, natuurlike plantegroei geoes word en die gebied oorbenut word.

Op die grafiek (O’Connor, Puttick, & Hoffman, 2014, soos verwys in Dept of Environmental Affairs, 2019) is dit duidelik dat bosverdigting in Mopanie die vinnigste toeneem, dan die Sentraal Bosveld en dan die Laeveld. Die sub-platorand grasveld het egter die grootste verandering ondergaan met ‘n groot toename in bosverdigting. Hierdie inligting is baie basies en net ter illustrasie oor hoe vining bosverdigting plaasvind.

Figuur 5. Bosverdigtingsones (Mucina en Rutherford, 2006, soos verwys in Dept of Environmental Affairs, 2019)



Figuur 6. Bosverdigting oor 'n periode van ongeveer 23 jaar (O'Connor, Puttick, & Hoffman, 2014, soos verwys in Dept of Environmental Affairs, 2019)

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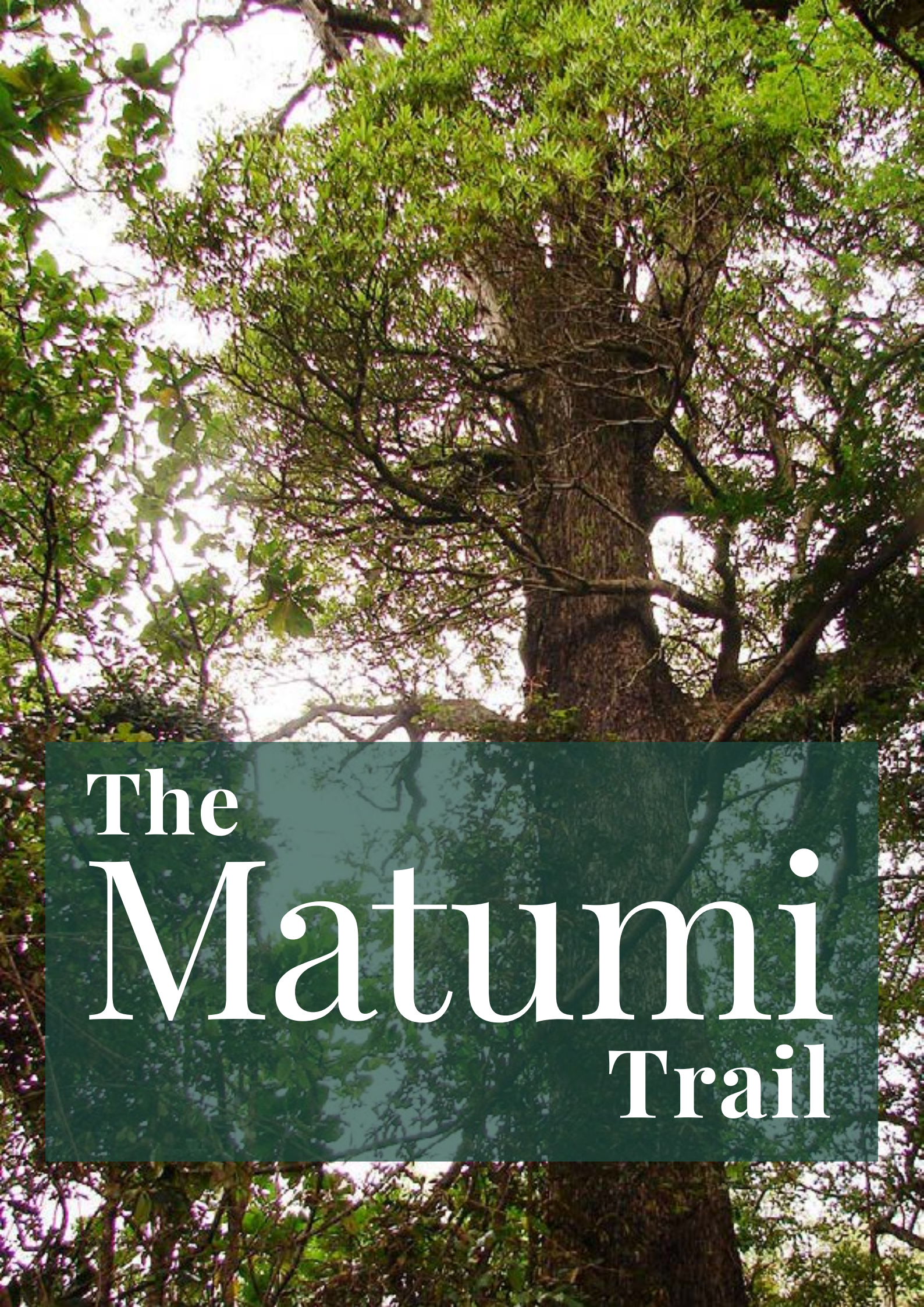
Die oplossing

Daar is geen kitsoplossing nie – dit is ‘n lang proses.

- Daar kan niks gedoen word nie en bosverdigting gaan voort en hout word geoes veral in landelike gebiede waar hout as energiebron belangriker is as weiding
- Voorkom bosverdigting deur bos uit te dun m.b.v. chemiese, meganiese en hande-arbeidsmetodes. Deur van hande-arbeid gebruik te maak word werk geskep en uitdunning kan selektief plaasvind en geen grondversteuring vind plaas nie. Die afgesnyde bos moet met ‘n onkruiddoder behandel word om hergroei te voorkom. Daar is arbeidskoste betrokke. Die meganiese metode is vinniger, maar swaar masjiene veroorsaak grondversteuring en daar moet opvolging wees omdat hergroei plaasvind en saailinge op die versteurde grond opkom. Hier is ook ‘n hoë koste implikasie. Wanneer bome nie oesbaar is nie en ‘n negatiewe invloed op die omgewing het kan die chemiese opsie oorweeg word. Hommeltuie kan baie suksesvol ingespan word om blaardoders te spuit. Volgens prof. Nico Smit (Smit, 2023) is die grootste fout wat gemaak word, om bome te vernietig en dan begin die gras groei en voed op die voedingstowwe wat die dooie bome in die grond agter gelaat het, maar na ongeveer 3 jaar raak die grond uitgeput, grasproduksie neem af en boomsaailinge begin groei. Boomsaailinge floreer op versteurde grond. Daar moet na 5 of 6 jaar opvolg plaasvind, wat weereens ‘n koste implikasie inhou, anders word die verdigting erger as ooit. Sy raad is dat selektiewe uitdunning plaasvind deur groot bome te los, want hulle onderdruk die kleintjies, maar deur die groot boom weg te neem floreer die kleintjies en verdig. Bos moet bestuur word.
- Bosverdigting kan voorkom word as korrekte veld- en weidingbestuursmetodes toegepas word en beheerde veldbrande plaasvind.
- Bos kan kommersiële waarde hê deur boskos te produseer. Die oortollige bos word gekap en gemeng met bymiddels en dan gepil en so word kos geproduseer vir vee en wild.
- Daar kan houtskool van bosverdigters gemaak word.
- Daar word navorsing gedoen om biobrandstof van ongewensde bos te vervaardig.
- Prof. Wiston Trollope (Trollope, 2003) het in sy navorsing bevind dat die oorskakeling na skaap en beesboerdery bosverdigting laat toeneem het, maar het ook gevind dat boerbokke, angoras en sekere wildsoorte ‘n goeie teenvoeter vir bosverdigting kan wees. Boerbokke, angoras en sekere wildsoorte kan die plante net tot op ‘n hoogte van 1,5 m benut. Hy beveel beheerde brande as ‘n doeltreffende bestrydingsmiddel aan. Die vuur moet alle stamme en takke tot op 3 m dood brand en sodra die bos hergroei begin toon, moet die boerbokke en angoras dit begin bewei. Daar word bereken dat 1 bok 2000 bome oor ‘n tydperk van ‘n jaar in toom kan hou.

Bosverdigting is ‘n realiteit en daar is geen kitsoplossing nie. Die bestuur van bosverdigting is ‘n lang en voortdurende proses. Die mens is die grootste oorsaak van die probleem deur ondeurdagte besluite te neem met ontbossing, oorbeweiding en die gebruik van kitsoplossings. Goeie en volhoubare veld- en bosbestuur is noodsaaklik om te voorkom dat ons plase toegegroei word met bos.


The
Matumi
Trail

“Come walk amongst giants”

by Howard Blight

howard@amorentia.co.za | 082 872 0807 | By the authority of the Amorentia Estate. Photos: Naas Grové

In the early 1840’s various families joined the Louis Trichardt Trek, left the Cape Colony and headed north, through largely uninhabited wilderness territory, into what is today the Limpopo Province, in the far north of South Africa.

The Prinsloo family trekked further east, from the Louis Trichardt settlement and in 1844, they camped where the Merensky Dam near Tzaneen is situated today. The Prinsloos are reported to have been ‘wild people’, involved in hunting, fishing and tree-felling. The family left in 1846 but returned in the mid 1860’s and built a homestead on the hillside overlooking the Politsi Valley, the ruins of which are still there today. The eldest Prinsloo son was a cabinetmaker and felled many of the large matumis (*Breonadia salicina*) along the Mabitsi River, up the Politsi Valley, for its fine quality wood.

For some reason, the massive matumi trees along the upper reaches of the Mabitsi River survived the onslaught of the Prinsloos and stand as Centurion, Mother Trees along **The Matumi Trail** on Amorentia Estate. The oldest of these trees is estimated to be around 3 500 years old and could well be the oldest tree growing in South Africa. The tree is listed as the fourth largest of the so-called **Champion Trees** in the country. There are 40 or more of these Centurion trees growing along the **Matumi Trail** on Amorentia, many of which are estimated to be over 2000 years of age.

The Matumi Trail is located 6 km up the Politsi Valley, on the Grootbosch Road, near Tzaneen, in the Limpopo Provence.

The trail navigates a 2.2 km loop along the perennially flowing Mabitsi River. There are dozens of massive matumi trees growing along the trail, many of which are estimated to be over 2000 years of age, with the oldest at 3500 years and the 4th largest tree of any species in the country and perhaps one of the oldest trees alive in South Africa.

The Matumi Trail is under restoration, with various invader species being cut and removed. This section of preserved high canopy rain forest represents approximately 12% of the farm Amorentia.

Walking amongst these giants requires adherence and silence. No shouting and loud play is allowed while visitors and their children are visiting the Matumi Trail.

Please adhere to the rules of the trail. There are other guests on the trail visiting these remarkable Mother Trees. This is a hallowed place, marked with great reverence.

The entire area deserves great respect.

The Matumi Trail
Walk Amongst Giants

THE MAKGABENG PLATEAU A LESSON IN GEOLOGY

By Dr. Francois du Randt

Just a few basics in geology before discussing this fascinating plateau includes the following. There are three different kinds of rocks, igneous (volcanic) rocks, sedimentary rocks, and metamorphic rocks. Because the earth is a dynamic system, rocks do not last forever. They are exposed on the surface to weathering and erosion, and at one stage or another, are subject to the forces of plate tectonics. The most dramatic production of new rocks are seen when volcanoes erupt. The age-old cyclical evolution of rocks is called the Rock Cycle.

Increasing temperature and pressure under the surface of the Earth cause volcanoes to erupt. Igneous rocks are formed from metamorphic rocks by heat and pressure. The melting of igneous rocks again cause metamorphic rocks. Igneous rocks are uplifted to form mountain ranges. They will again be weathered away (like the Drakensberg), or eroded away (like the Fish River Canyon).

There is also a transportation of rocks with deposition, burial and diagenesis, with the forming of sedimentary rocks. Sedimentary rocks can also be uplifted to form mountains (like the Cape fold mountains), or can be changed by metamorphism to metamorphic rocks (like the Limpopo belt).

Igneous rocks crystallize from molten magna or lava. Examples are granite, basalt, dolerite, gabbro and rhyolite. Solid rock melts deep in the Earth's crust and underlying mantle due to extreme heat and pressure. When this hot melt rises upwards towards the surface, it cools, crystallizes and solidifies to form igneous rocks. Because the melt is made up of a mixture of different chemical elements, different types of minerals crystallize simultaneously, for example oxides and silicates. For this reason igneous rocks are made up of a variety of minerals. These rocks can be coarse-grained or fine-grained. Silicate minerals are the main rock-forming minerals, although some non-silicate minerals, like oxides, hematite and magnetite, are occasionally found in igneous rocks. Carbonates such as calcite are common in certain igneous rocks such as carbonatites.

Without discussing the formation of the Kaapvaal Craton, the oldest continent on earth, with its incredible greenbelts and associated vegetation (like the Barberton belt and Sekhukhuneland), I would rather concentrate on the **Transvaal Supergroup** of rocks.

Various rifting was followed by a period of thermal subsidence, when almost the entire Kaapvaal Craton subsided below sea level

to form a large shallow continental shelf on which sedimentary rocks of the Transvaal Supergroup began accumulating. Uplands persisted in the north of the Craton, and remnants of the Limpopo Mountain range, which formed when the Kaapvaal Craton collided with the Zimbabwe Craton. These mountains were higher in elevation than the present day Himalayas, believe it or not!

As the Kaapvaal Craton subsided, river systems draining its surface drowned and were buried by beach and shallow-water marine deposits. They gave rise to the conglomerate, sandstone and mudstone deposits of the Black Reef Formation (with beautiful examples at Kaapsche Hoop and Graskop). These rocks cap the high ridge of the eastern escarpment and are widespread across the Craton, extending as far to the west as the Northern Cape and Botswana.

Features preserved in the rocks of the Black Reef suggest that at times during deposition the region must have been characterized by extensive mud flats. Ripple marks by the ebb and flow of tides are preserved in these rocks, as are mud cracks formed as the mud dried at low tide. Even casts of cubic salt crystals (1 cm across) abound in the mudstones of the upper Black Reef Formation, suggesting that the mud flats must have developed in restricted bays that periodically dried out.

Examples of these salt crystal casts are seen at Bourkes Luck in Mpumalanga. These happened around 2600 million years ago.

As the sea encroached onto the Kaapvaal Craton, a new phenomenon appeared – indications of life in the oceans on an abundant scale seen on the rocks overlying the Black Reef Formation. Cyanobacteria came to dominate the shallow sea.

The environment was probably similar to a modern day coral reef, such as the Great Barrier Reef, but coral had not yet evolved. It was occupied by cyanobacteria, which photosynthesise, extracting carbon dioxide from the water in which they live. This causes an imbalance in the water chemistry, leading to precipitation of calcium carbonate that adheres to the slimy bacterial layer. The bacterial layer reforms over the calcium carbonate deposit. Gradually, layer upon layer of calcium carbonate is added, forming stromatolites.

Such deposits formed across most of the continent at this time and produced some of the world's most spectacular examples of stromatolites. The shape assumed by stromatolites depends on water depth, tidal range and wave and current activity. In very shallow water, between low and high tide (the intertidal zone) they form mat-like structures, or occur as tiny spherical bodies, called oncoliths. Oncoliths formed by the growth of bacteria under the influence of the to-and-fro movement of water.

The **Waterberg Group** of rocks occurs in several separate regions: in the Limpopo Province extending northwards and north-westwards from the town of Warmbaths/ Bela-Bela as far as eastern Botswana, and to the north of Middelburg in Mpumalanga. These separate patches probably originally formed a single sheet of sedimentary rocks that has since become fragmented as a result of erosion. A maximum thickness of over 7000 m is attained in the Warmbaths/Bela-Bela area. The rocks consist almost entirely

of sandstone, with minor conglomerate layers that locally attain several metres in thickness. Mudstones are rare. The most distinctive feature of these rocks is their red colouration. The rocks are either totally permeated by a deep red iron oxide, or certain planes within the rock, such as bedding planes and cross beds, are stained red. The rocks are chemically resistant and very hard, so they produce spectacular cliffs and mountainous topography.

The rocks forming the Soutpansberg mountains, the **Soutpansberg Group**, also consist of these red-coloured sandstones, but they are underlain by voluminous basaltic lavas, with interlayered volcanic ash beds of rhyolite. They erupted 1900 million years ago.

The rocks of the Waterberg and Soutpansberg Groups are the earth's oldest so-called **red beds**, indicating that the rocks were deposited under an atmosphere that contained free oxygen, the product of thousands of millions of years of photosynthesis by cyanobacteria.

The oxygen-bearing atmosphere converted trace amounts of iron in the sediments to the red, ferric (Fe^{3+}) oxide form, which stains and locally even cements the sand grains.

Chemically: $2Fe^{3+}$ (ferri) + 2Fe2+ (ferro) + $2H^{+}$ (electron transfer chain) – forming ATP and water (H_2O) – this is a reduction-reaction (reduction = the addition of an electron e-)

Photosynthesis is: $CO_2 + 2H_2O + light \rightarrow O_2 + CH_2O + H_2O$

This happens in the chlorophyll of green plants.

Iron-rich layers

Securidaca longependuculata flower - Peet van der Merwe

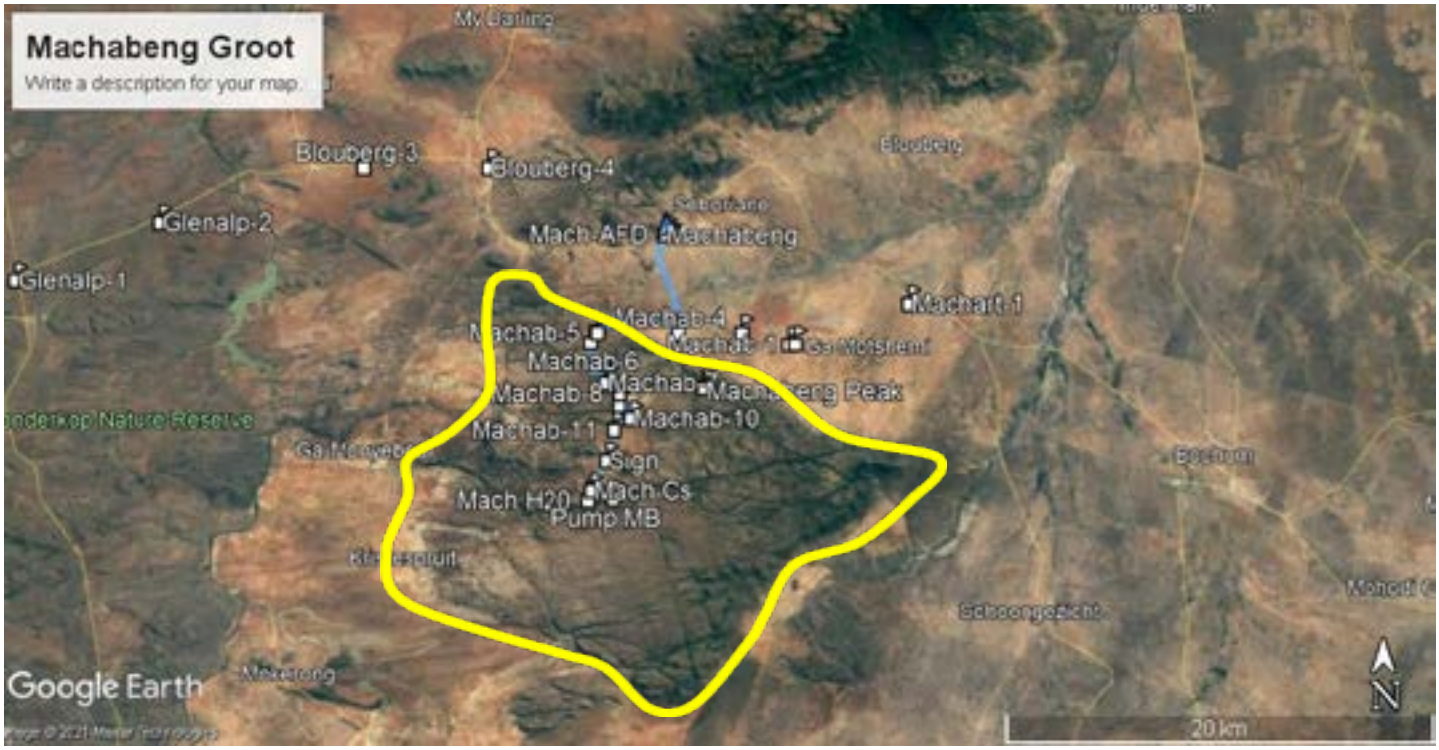
THE Makgabeng PLATEAU

Dr. Francois du Randt

The Makgabeng Plateau, also Machabeng Plateau, is located in Limpopo Province, 45 kilometre south-west of Vivo, 30 kilometre west of Senwabarwana (Bochum) and a short distance north of Steilloopbrug and the N11 tar road between Mokopane and Groblersbrug. It is a semi-arid mountain plateau as part of the Soutpansberg-Blouberg mountain chain. Geologically it is described as a pre-Cambrian fossilised desert! The geology is fascinating, even more so than the interesting vegetation.

The name seems to be a bit controversial. The Northern Sotho word *–eng* means 'location', thus the original noun will be *makgaba*. The earliest inhabitants in AD700 were Khoikhoi and San, but the name was most likely given by the black inhabitants, many years later, long before the arrival of Europeans. The German translation of the word *makgaba* means 'of little grain'. The locals used to eat the edible bulb of a potato-like plant, peculiar to this area, known as *mogaba*. This is actually the Tswana name for *Vachellia rehmanniana* (silky thorn acacia). Another plant of the area with round, yellow, sweet fruits, is known as *makgwaa*. The local word *dikgaa* means 'cliffs, which are shining', so it can also be the 'boiling place'.

Masobe massif



Google map with some of our 2022 waypoints. The Machabeng Plateau is encircled in yellow

The best entrance spot to this incredible plateau is from the northern tar road between Glen Alpine Dam and Bochum, at the GPS waypoint S 23° 10.625' E 28° 52.712'. There are no signs to indicate this turn-off. Another turn-off is marked 'Rock Art', but this is very confusing. You need to do some exploring to find your way, as there are basically no road signs.

The incredible spire of Thabanantlhana (1380 m asl)

The nearest civilized accommodation in the area is Machabeng Lodge on the eastern side of the plateau, but far away from the real action inside the plateau. There are no formal campsites, so you camp anywhere, although only one or two sites are well protected against the elements. Be warned that you have to be totally self-sufficient with drinking water, even washing water, sanitation and food. It is really wild camping, and combined with January temperatures, it can be quite challenging! The beautiful vegetation and a sense of wilderness makes up for all the hardship.

Makgabeng mountain is one of three mountains in northern Limpopo, the other two being the Soutpansberg and Blouberg mountains.

It is 31 kilometre long from east to west, with a surface area of 332 km2, at an altitude of 820 m asl in the west, and 1411 m asl on the eastern escarpment. It is a rugged, well-bushed plateau, rising about 200 m above the surrounding plains. It is just south of the 23° parallel line. It is ruggedly eroded, gently westerly dipping, with a prominent V-shaped scarp towards the east.

It lies at the western end of the 210 kilometre-long Soutpansberg mountain range, and about 22 kilometre south-west of the Blouberg inselberg. It is not linked to the Soutpansberg geologically, or floristically. It comprises of totally different rocks and rock formations.

One of the outstanding features of the plateau are the numerous Khoisan and later local rock art paintings, which a hired local guide can show you. We were fortunate to meet up with Jonas Tlouamma, a very intelligent and highly educated anthropological guide.


Jonas Tlouamma

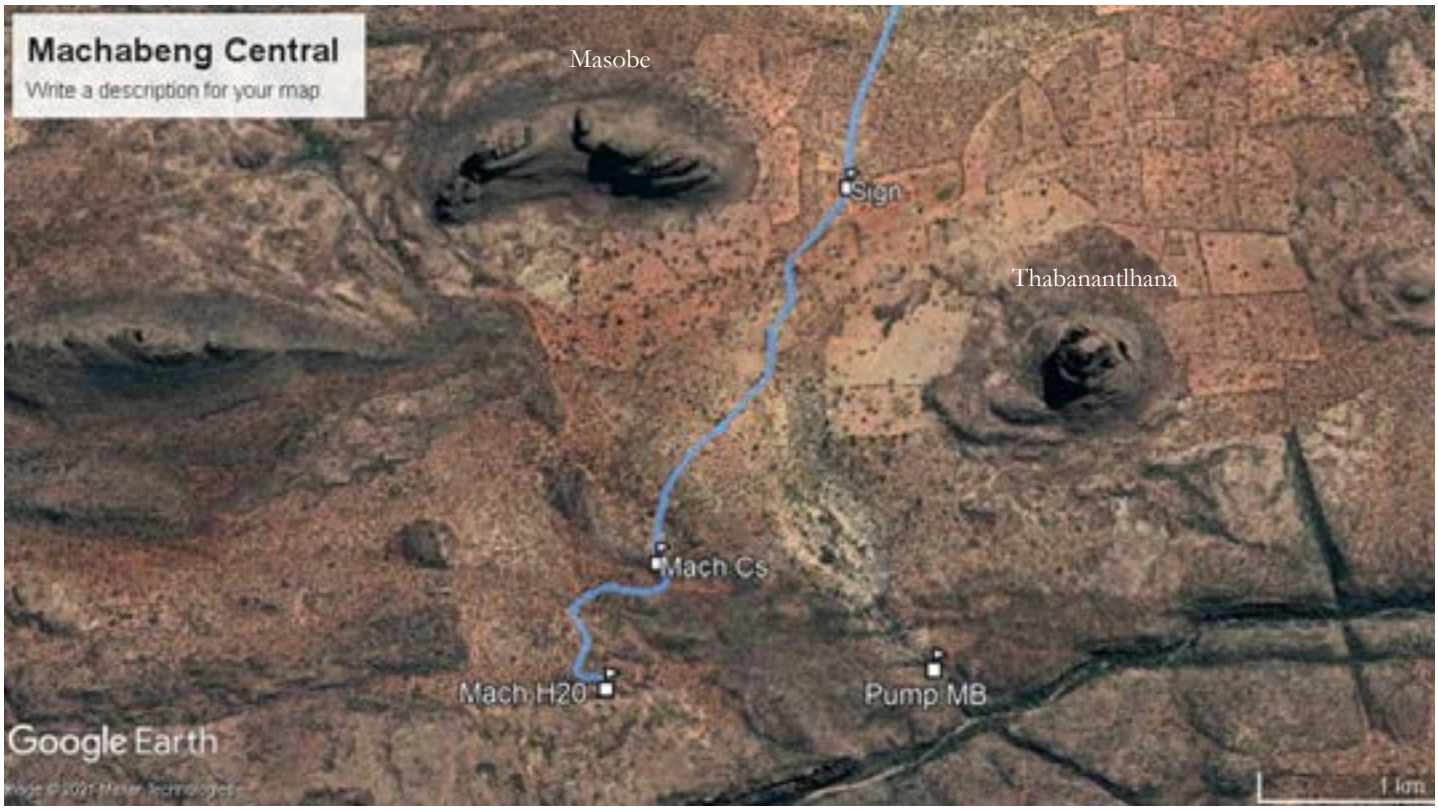
The Makgabeng Plateau

Geologically it belongs to the Waterberg Group of rocks, which are mostly red sandstone formations. Virtually the entire Waterberg and Soutpansberg Groups were deposited by rivers flowing on a vast plain, which may have extended over much of the Kaapvaal Craton. Many channels appear to have developed, which divided and re-joined in a braided network. Flow was predominantly to the south and southwest, suggesting that the sediment was derived from the north. Occasionally, strong winds shaped the sands into dunes up to 17 m high (there was still no land vegetation at that time) and there are indications that small lakes formed locally. This has played a major role in the formation of the Makgabeng Plateau.

Clockwise from top left: One of the rock spires of Machabeng Plateau. Sedimentary layered sandstone deposits The big gorge on the plateau. Waldie le Grange enjoys the view

Exploring the plants with Willem Frost and Waldie le Grange

The underlying plateau consists of characteristic fine- and medium-grained sandstone rocks, with younger rock formations, consisting of resistant coarse-grained sandstone and conglomerate outcrops, represented as steep-sided towering spires, on the northern side of the plateau, like the incredible Thabanantlhana, 1380 meter above sea-level, and Masobe, 1280 meter above sea-level.




Masobe is photogenic (left), with beautiful rock formations (right)

These rocks are said to be almost 2000 million years old. Sandstone consists of grains of sand, cemented together during burial by the deposition of other minerals. Despite burial, cementation and some compaction, sandstones usually retain many of the structures that were present during the initial deposition of the sand.

Recognition of these structures in ancient sandstone can therefore be used to determine the environment in which the original sand was deposited.

Most sandstones around the world (and in South Africa) are believed to have been deposited in an aqueous environment (i.e. under water), but the Makgabeng rocks appear to have been deposited under sub-aerial (i.e. wind-blown) conditions. This is indicated by the presence of sedimentary structures, specific to wind-blown sand.

One key indicator to discriminate between sub-aqueous and sub-aerial sand deposits concerns the angle of repose of a pile of sand. The transport of sand (by water or wind), tends to group sand into dunes. Wet sub-aqueous sand is denser than dry sand (with more water molecules between the sand grains). As sand are washed, or blown into a dune, the lee (down-stream) side of the dune builds up as successive laminae of sand grains. It builds up to such a steep angle that it collapses, like we see in the Namib dunes.

The maximum angle at which sand can rest (i.e. the angle of repose) is governed by the density of the sand. Wet, dense sand can only reach a maximum angle of repose of about 15°. Dry sand, however, only fails at angles exceeding 30°. The sandstones of the Makgabeng Plateau contain laminations inclined up to about 25°, indicating that they were dry when deposited – thus, that they were wind-blown. At some places we see preserved lee-side laminations in the plinths (lower parts) of barchan (crescent-shaped) and longitudinal desert dunes. Some of the lee-side laminations still retain ripple marks caused by sand migrating in wind storms, and small dimples caused by rain drops falling during showers, 2000 million years ago.

The tall spires of conglomerate and coarse sandstone which stand above the plateau, like Thabanantlhana and Masobe, are the remains of sheets of cobbles and sand which were deposited by rivers which flowed over the desert deposits as the climate became much wetter.

Thabanantlhana

Rolled-up mud laminations

Shade under a paperbark corkwood (*Commiphora marlothii*)

The most prominent mountain spire on this plateau is Thabanantlhana, 1380 meter asl. It is hard to belief that Thabanantlhana, as well as the other prominent mountain, Masobe, 1280 meter asl, was formed from Aeolian sandstone layers.

Rolled-up mud laminations found in playa (seasonal) lake deposits on the plateau believed to be trace fossils of 2000 million years old cyanobacteria, present in rivers or lakes. These are the remains of a fossilised desert.

The vegetation of Makgabeng Plateau is savannah vegetation on deep sand, and scrub on rocky places. It is mixed bushel with sourish mixed bushveld. The most dominant tree species is *Combretum apiculatum*, but the area in general, is semi-arid. We made a list with more than than 140 species of trees during two short visits, but there are many more species on this fascinating plateau.

The Soutpansberg chain stretches 210 km from east to west, and 60 km, at its widest, from south to north, with an altitude ranging from 200 m asl at Pafuri, to the highest point, Lejuma, 1748 m asl in the west.

Beautiful rock pools in 2022, but all dried up in January 2023




Above: *Adenia spinosa* (olifantsvoet) (left) and *Albizia brevifolia* (rock false-thorn) (right)
Below: *Combretum vendae* (left, but with shiny leaves and waxy cuticle) and *Commiphora angolensis* (right)

Above: *Elephantorrhiza burkei* (elephantroot). Below: *Ehretia rigida* subsp. *nervifolia* (puzzlebush) (left) and the fruit of the mountain mahogany (*Entandophragma caudatum*) (right)

op: *Ficus abutilifolia* (left) and *Ficus glumosa* (right), young rock splitters. *Ficus abutilifolia* is the large-leaved rock fig – the common names can be quite challenging
Ficus tettensis (small-leaved rock fig) (middle), and *Ficus glumosa* (hairy rock fig) (bottom)




Top: *Mimusops zeyheri* (moepel) (left) and *Securidaca longepedunculata* (violet-tree or krinkhout) (right)
Bottom: *Vangueria madagascariensis* (smooth-leaved wild-medlar) (left) and *Ximenia caffra* var. *caffra* (sourplum) (right)

Blouberg is 37 kilometre from southwest to northeast, with an altitude ranging from 840 m asl in the east to the highest point, Blaauberg Peak, 2053 m asl in the centre. Blouberg is an inselberg.

Blouberg and Makgabeng is separated from the Soutpansberg by a gap, called the Palala Shear Belt, which formed the border between the Limpopo Belt and the Kaapvaal Craton.

There are many endemic plant species in these three mountains, but there is only one species endemic to Makgabeng Plateau, namely *Streptocarpus makabengensis*, a very rare, little known plant in obscure crevasses.

The locals use a rock to break the bark on the stem of *Ficus glumosa* to produce a milky latex, which they leave on the bark to get hard over a day to form 'chappies'. Jonas called this the 'chappies tree'. Our guide was very knowledgeable with respect to the trees and birds and he even tested my knowledge by asking me to identify one of the prominent trees on the plateau. I identified it as *Pseudolachnostylis maprouneifiolia*. His immediate reaction was, "wragtig"!

Jonas, the local guide, took us to a few rock shelters with incredible rock art, and gave us some insights on the paintings.

The chappies tree (*Ficus glumosa*)

Thabanantlhana and rock art

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THE MAKGABENG PLATEAU

ROCK ART OF MACHABENG

By Dr. Francois du Randt

Our first few shelters were filled with San paintings, dating back to about 3000 years ago. Later shelters and caves had more recent paintings done by white ochre, not much longer ago than 150 years. Some paintings concentrate on female initiation, while a few concentrate on white farmers supervising their black labourers, the Anglo Boer War and the clashes between the black locals and the Voortrekkers. There are even pictures of white people doing 'volkspele' and trains on train tracks. The art tells a lot about the religion of the people and their disbeliefs.

The last big shelter depicts the clashes between die Ndebele and Pedi's and the boers of the Zuid-Afrikaanse Republic (ZAR) with Paul Kruger as their president. Piet Potgieter, the son of Andries Hendrik Potgieter, was shot at Makepaans Cave and fell down the cliffs. The town of Potgietersrus (today Mokopane) was originally named Pietpotgietersrust, named in honour of Piet Potgieter. The history around Makepaans Cave is another long story, but you can see a lot of it in these historic rock art of the Machabeng Plateau. Fossil remains of the hominid, Australopithecus, was found in this cave.

This page, Top: San rock art (real Bushman paintings), Bottom: The female initiation paintings cave
Opposite page, Top: The white men (left) and the monster train (right). Middle: Train paintings (left) and the war cave (right)

Waterbergtak

IN DIE NOORDE IS VLYTIG

VOORSITTER: Andries van Niekerk

Die Waterbergtak het tans 82 lede, is baie aktief en daar is gemiddeld 45 boomliefhebbers wat die uitstappies bywoon. Ons ahou maandelikse uitstappies in ons streek en een jaarlikse 4-dag uitstappie na 'n meer afgeleë plek.

Gedurende Januarie het ons die Swaershoek Gelofte-terrein asook Trichardspas naby Renckenspas (Vaalwater omgewing) besoek. Reuse vaalrosyntjies het die groep beïndruk. Oppad na die waterval het ons mooi waterbessies wat blom, in hul natuurlike habitat gesien. Hulle verskil heeltemal van die aangeplante waterbessies. 'n Ander besondere boom was die gryskokoboom.

Met Februarie se uitstappie het ons by Pumula Lodge bome geïdentifiseer. Besondere bome was die krinkhout, waterbergkroonmispel en blinkblaarkanniedood. Van die lede het heerlik aan die shakamapruime gesmul.

Dr. Carel Pretorius was baie dankbaar toe ons die *Dendron* uitdruk en vir hom gee, omdat hy nie 'n rekenaar besit nie. Met sy uitstekende geheue en helder verstand het hy nie soos ons gewone mense die internet nodig nie. Hy is wat bome betref, 'n lopende ensiklopedie en neem altyd saam met Andries van Niekerk die leiding gedurende uitstappies.

Maartmaand het ons die Mokabi Lodge van die bekende skrywer Richard Wadley anderkant Vaalwater besoek. Daar is verskeie biome met interessante bome soos oostelike koeniebos, vratjievrugbliksembos, waterbergrosyntjie, gladdeblaarmispel, rotsboswilg en 'n seldsame bergsipres.

In April het die groep Sabenza Creek besoek. Andries van Niekerk en Gertie Oosthuizen het die jaarvergadering van die Dendrologiese Vereniging in Pretoria bygewoon. Daar het dr. Melvyn Greenberg 'n baie komiese, maar insiggewende aanbieding oor hondegedrag gelewer.

Meimaand was ons vir 4 dae by die Waterberg Farm Stay vakansie-oord naby Vaalwater. Op die rivieroewer was die doringolm 'n interessante vonds.

Juniemaand het die lede Waterbessiefontein besoek en pragtige kruiswaterbessies, doringolm, en rooipendoring gesien. Die eienaar het sy buitelug-museum van ou plaaswerktuie aan die lede gewys.

Die lede het gedurende Juliemand Innikloof in die Modimolle-omgewing besoek. Koraaltaaibos, tuitpeulverfbos en 'n uitsonderlike groot donsiebos is uitgeken.

In Augustus het ons Rudolf en Sonja van Wyk se plaas besoek. Die blinkbaar was 'n nuwe vonds vir meeste van die lede.

Gedurende September het ons dr Carel en Jean Pretorius se plaas naby Modimolle besoek. Voor ons begin stap het, het ons onder reuse swartapiesdorings 'n praatjie oor boomidentifikasie gehou. Die insiggewende Tree Rooting Habits van dr. RJ Poynton is aan die lede voorgehou. Die lede beskik nou oor inligting om bome nie te naby aan strukture te plant nie. Besondere bome was groenstamkanniedood, bergbas, papierbasvalsdoring, smalblaarbotterlepelbos en 'n wonderboomvy. In Oktober het ons Thaba Moriri naby Bela Bela besoek.

Die jaarlikse afsluitingsgeleentheid in November, was by Thithombo naby Modimolle waar ons ook bome gekyk het.

Ons hartlike dank aan al die eienaars wat hul eiendomme beskikbaar stel vir besoek deur die Waterbergtak.

LINE SKETCHES

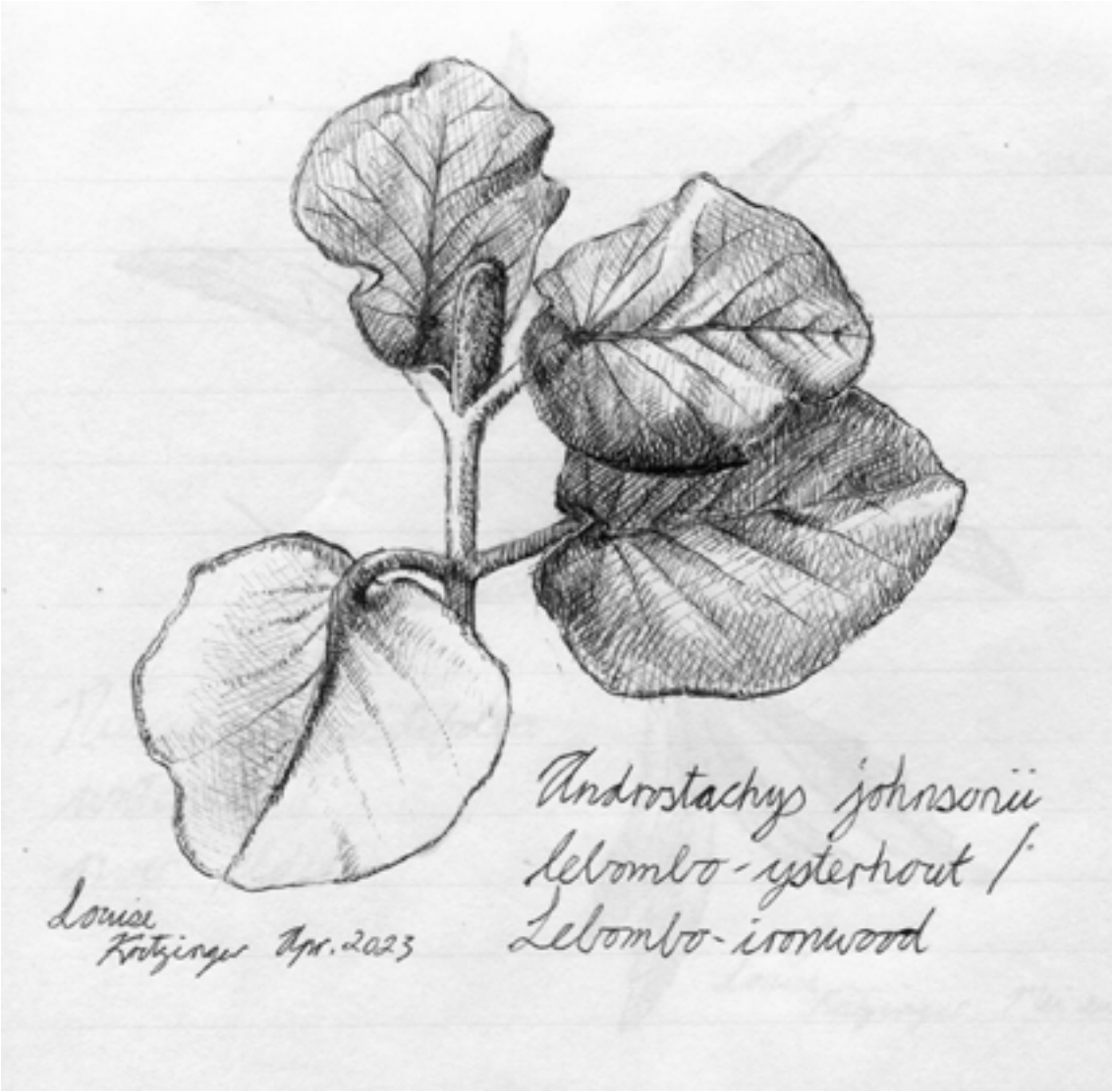
of rare and interesting trees

OBSERVED DURING MAGALIESBERG BRANCH EXCURSIONS IN 2023

LOUISE KRITZINGER &
DR THEUNIS MORGENTHAL
Magaliesberg Branch

The following line sketches were drawn true to scale from original material using a pen. It is kindly shared by Louise Kritzinger for publication in *Dendron*. Please reference each picture using the artist's name, sketch name and the *Dendron* volume e.g.:

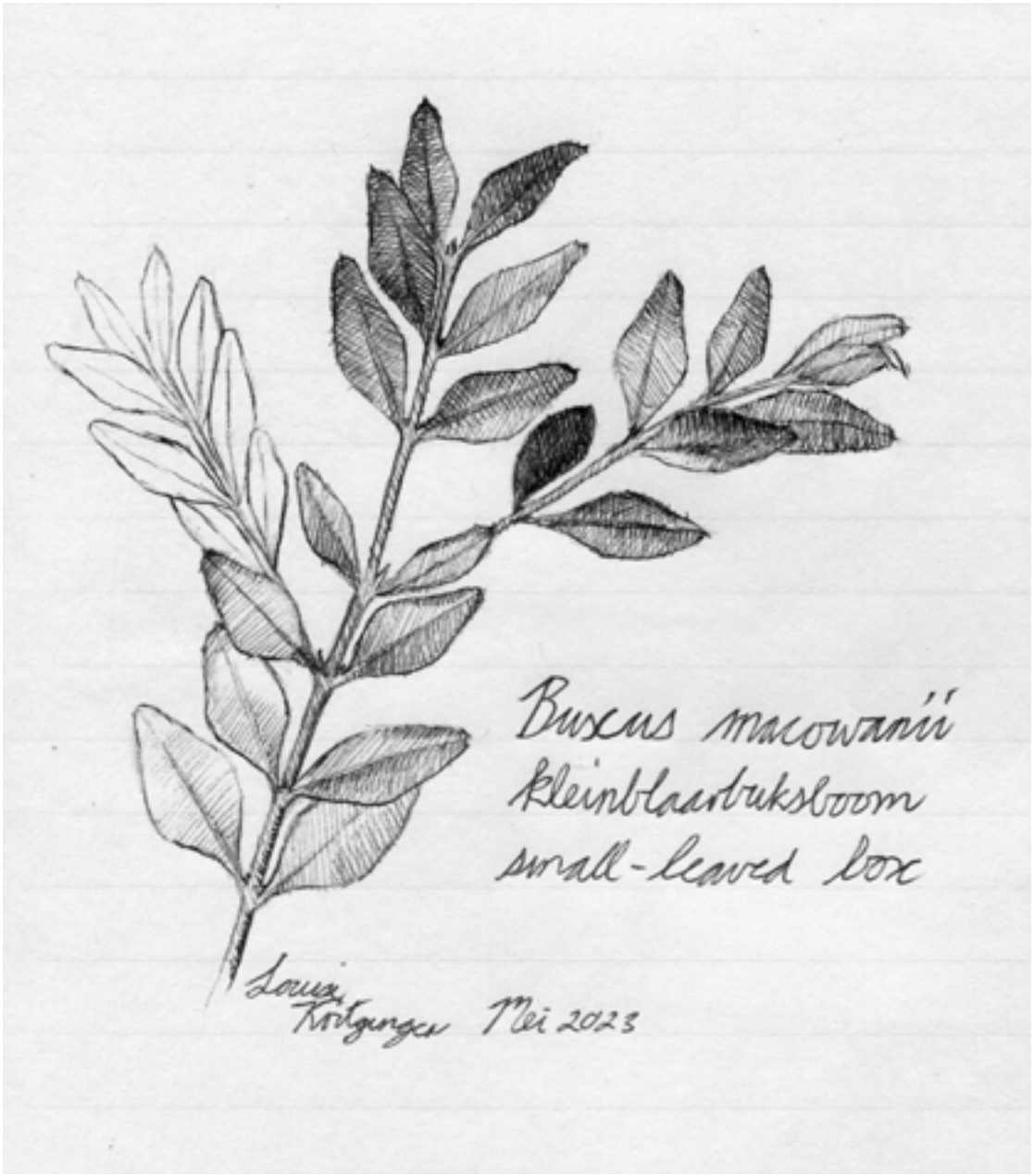
> Kritzinger, L. 2023. *Androstachys johnsonii. Dendron,* Volume 55. Publication of the Dendrological Society of South Africa, Rustenburg.



Androstachys johnsonii

Lebombo-ysterhout, Lebombo ironwood

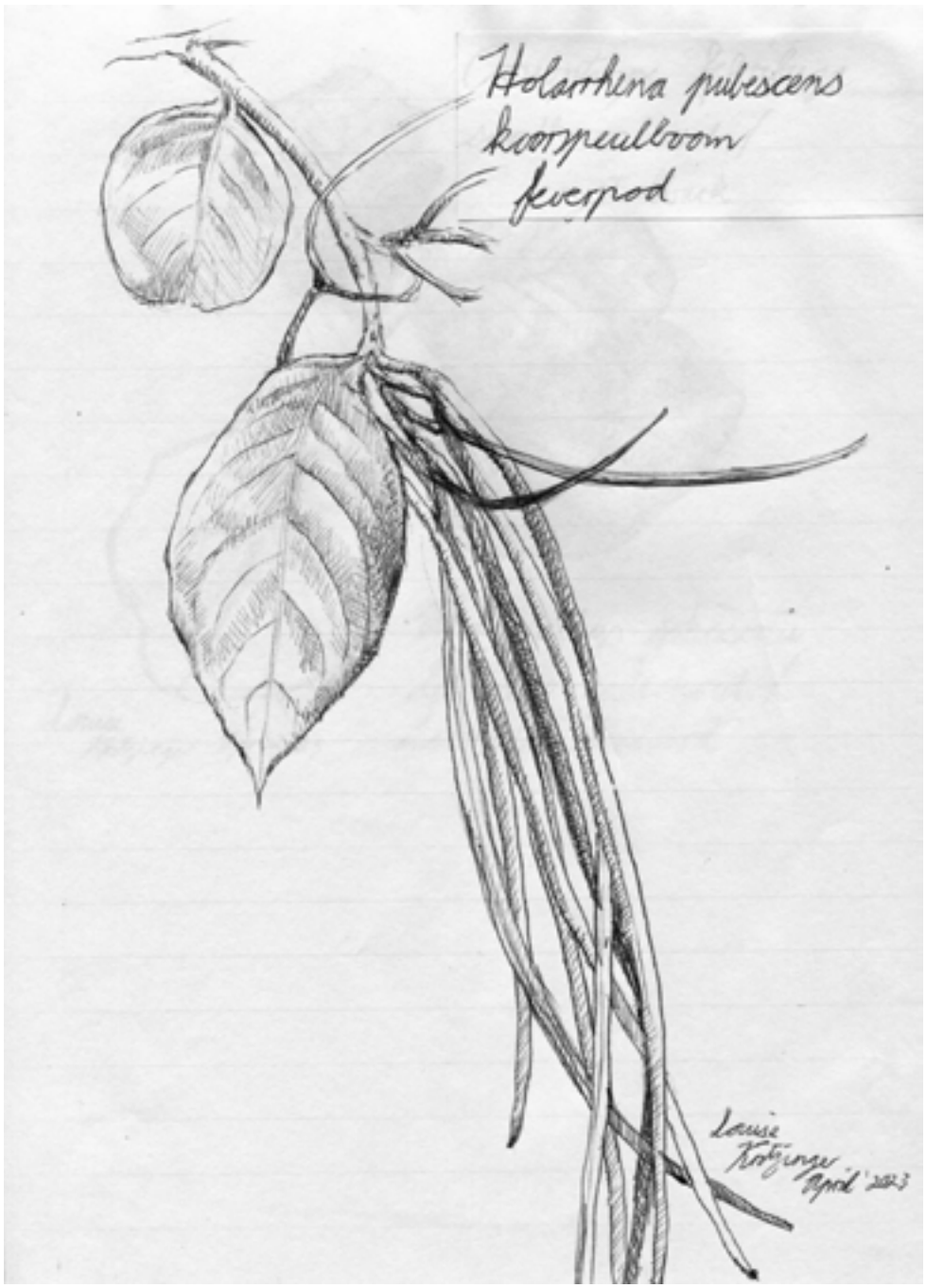
Androstachys johnsonii is a medium to tall tree, often occurring in dominant stands on dry, hot hillsides. In South Africa it has a limited distribution along the Lebombo Mountains as far south as northern KwaZulu-Natal. The specimen was drawn during an excursion to Punda Maria in northern Kruger National Park in April 2023.



Buxus macowanii

kleinblaarbuksboom, small-leaved box

Buxus macowanii occur mostly as a shrub or small tree in the sub-canopy of riverine bush and forests. It has a disjuncted distribution and known localities include Eastern Cape Coastal Belt, Kwazulu-Natal, Mpumalanga and Limpopo. *Buxus macowanii* has a limited distribution in the Waterberg but where it occurs the species is common. The opposite, small, dark green, shine rhomboid leaves are characteristic. Fruit is a small capsule crowned by three horn like protrusions. The specimen was sketched during a Magaliesberg Branch Excursion to Swebeswebe Nature Reserve, Waterberg in May 2023.



Holarrhena pubescens

koorspeulboom, feverpod

Holarrhenia pubescens is a shrub or small tree from the Apocynaceae. In South Africa it has a limited distribution from eastern Venda to Pafuri. Worldwide, *Holarrhenia pubescens* has a sub-tropical to tropical distribution. The species is well known for its medicinal properties. The line sketch depicts a terminal branch with numerous paired follicles collected during the Magaliesberg Branch excursion to Tshamavhudzi hills near Punda Maria, Kruger National Park on 30 April 2023.

VRA VIR

prof. Braam van Wyk

Sleutel tot die vier variëteite van

Pseodolachnostylis maprouneifolia

(sover die verskille in die literatuur vasgestel kon word)

Dr. Theunis Morgenthal se vraag:

Ek soek inligting en raad oor die identifisering van die verskillende variëteite van *Pseudolachnostylis maprouneifolia.* Ek sien **Plants of the World Online** (POWO) verwys na 4 variëteite naamlik var. *dekindtii,* var. *glabra*, var. *polygyna* en var. *maprouneifolia*. Var. *polygyma* kom volgens POWO nie in Suid-Afrika voor nie, maar dit lyk of die ander drie wel voorkom. Is daar `n bron wat die verskillende vareiteite se verskille aandui en wat is die variëteit wat meestal by ons voorkom?

Prof Braam van Wyk antwoord

Drie van die vier variëteite is veronderstel om in Suider-Afrika voor te kom; var. *polygyna* is beperk tot Zambië en verder noordwaards.

Aangesien manlike bloeiwyses selde beskikbaar gaan wees is die beste kenmerk om in die veld te gebruik die harigheid van die jong stingels en blare. Eksemplare in plaaslike herbaria is selde tot variëteitsvlak benaam, daarom het ons in die *Saklys* dieselfde verspreidingskaart vir al drie plaaslike variëteite verskaf. Ek weet dus nie watter variëteit is die meer algemene een en of daar ‘n geografiese skeiding tussen hulle is nie. Self het ek nog nooit probeer om in die veld die variëteite te identifiseer nie. Ek kan my dus ook nie uitspreek oor die meriete van die variëteite se erkenning nie. Die feit dat die manlike bloeiwyses ook verskil gee ‘n mate van geloofwaardigheid aan die klassifikasie. Dis die moeite werd om tydens velduitstappies maar aandag te gee aan die variasie in harigheid (en wanneer beskikbaar die manlike bloeiwyses) by die plaaslike bome. Ek sou reken dit is die beste om in hierdie geval die variëteite te ignoreer - veral vir doeleindes van die dendroloog-eksamens.

KEY TO THE VARIETIES OF *pseudolachnostylis maprouneifolia*

1a Female flowers and fruit borne in branched clusters.... **var. *polygyna*** (Zambia and further north in Africa)

1b Female flowers and fruit born singly....2

2a Young shoots and leaves hairless, or almost so; male flowerheads with stalks.... **var. *glabra***

2b Young shoots velvety, or hairy; leaves velvety on both surfaces or only on the midrib below; male flowerheads with or without stalks....3

3a Young shoots velvety, or hairy; leaves velvety on both surfaces; male flowerheads without stalks.... **var. *dekindtii***

3b Young shoots velvety; leaves only velvety along the midrib below; male flowerheads with stalks.... **var. *maprouneifolia***

André de Villiers
BOOMPLANTER VAN FORMAAT

Marissa Greeff - Magaliesberg Tak

André was tot in 2018 voorsitter van die Magaliestak van die Dendrologiese Vereniging. Hy is in April 2022 skielik aan 'n hartaanval oorlede. Hy was 80 jaar oud. Sy vrou, Anne, vertel meer oor André en sy liefde vir bome.

André se belangstelling in bome, veral bosveldbome het in Rooiberg begin waar ons 'n naweekplekkie gehad het. Hy het heelwat bome aangeplant - selfs in die parkie voor ons huis in die stad.

Ons het in 2001 die aandeel in Marulani buite Bela Bela gekoop. André was onmiddellik beindruk met die verskeidenheid bome asook die topografie van Marulani. Hoewel daar baie bome op ons perseel was, het hy dadelik nog bome aangeplant, naamplaatjies aan bome gesit en 'n boomroete uitgelê vir Marulani. Ons het terselfdertyd by die Dendrologiese Vereniging aangesluit en André het gereeld meeste uitstappies meegemaak.

Hy het ook bome in die Jan Celliers Park in Groenkloof aangeplant op Mandeladag. Op sy matriekreunie het hy twee bome by sy alma mater, die Afrikaanse Hoër Seunskool geplant. Hy het gereeld lesings oor bome aangebied by Gryskrag asook ander instansies wat hom genader het.

Die Magaliestak van die Dendrologiese Vereniging eer sy nagedagtenis. Ons het heerlike herinneringe aan André op vele uitstappies in Pretoria, die Magaliesberg en in Oktober 2021 na Pretoriuskop in die Kruger Wildtuin.

Hierdie bladsy: Bo - André en familie toe hy sy PhD ontvang het by die Universiteit van Pretoria. Onder - André tydens 'n uitstappie in die Magaliesberg.
Oorkantste bladsy: André, tweede van regs en Anne de Villiers by Jan Cillierspark, Pretoria, tydens die Magaliestak se afsluitingsfunksie in November 2022. Op die foto is van links na regs dr. Theunis Morgenthal, voorsitter, Owen Brett, Anne, André en Ivan Biggs.

op laaste reis

Johan de Villiers

André (prof. J.A.) de Villiers is onlangs op 80-jarige ouderdom skielik aan 'n hartaanval oorlede.

Hy was 'n getroue *Beeld*-leser, en sy briewe en artikels het soms verskyn.

'n Pretorianer in murg en been, was hy op skool by Oost-Eind Laerskool en later by die Afrikaanse Hoër Seunskool. Hy het die grade BSc, MBA en DBA aan Tukkies verwerf, waar hy later professor was.

Hy was by GrysKrag betrokke, het boeke vir die Bandhulp vir Blindes-vereniging voorgelees en was dienende voorsitter van die Pretoria-tak van die Dendrologiese Vereniging.

André word deur sy vrou, Ann, 'n dogter, twee seuns, 'n skoonseun en vier kleinseuns, asook 'n jonger suster en broer oorleef. 'n Gedenkdiens vind Woensdag 26 April 2023 om 11:00 by die NG Moedergemeente, Lyttelton, plaas.

HULDEBLYK AAN

Nico Hager

16 JUNIE 1934 - 27 SEPTEMBER 2023

deur sy vriende en familie

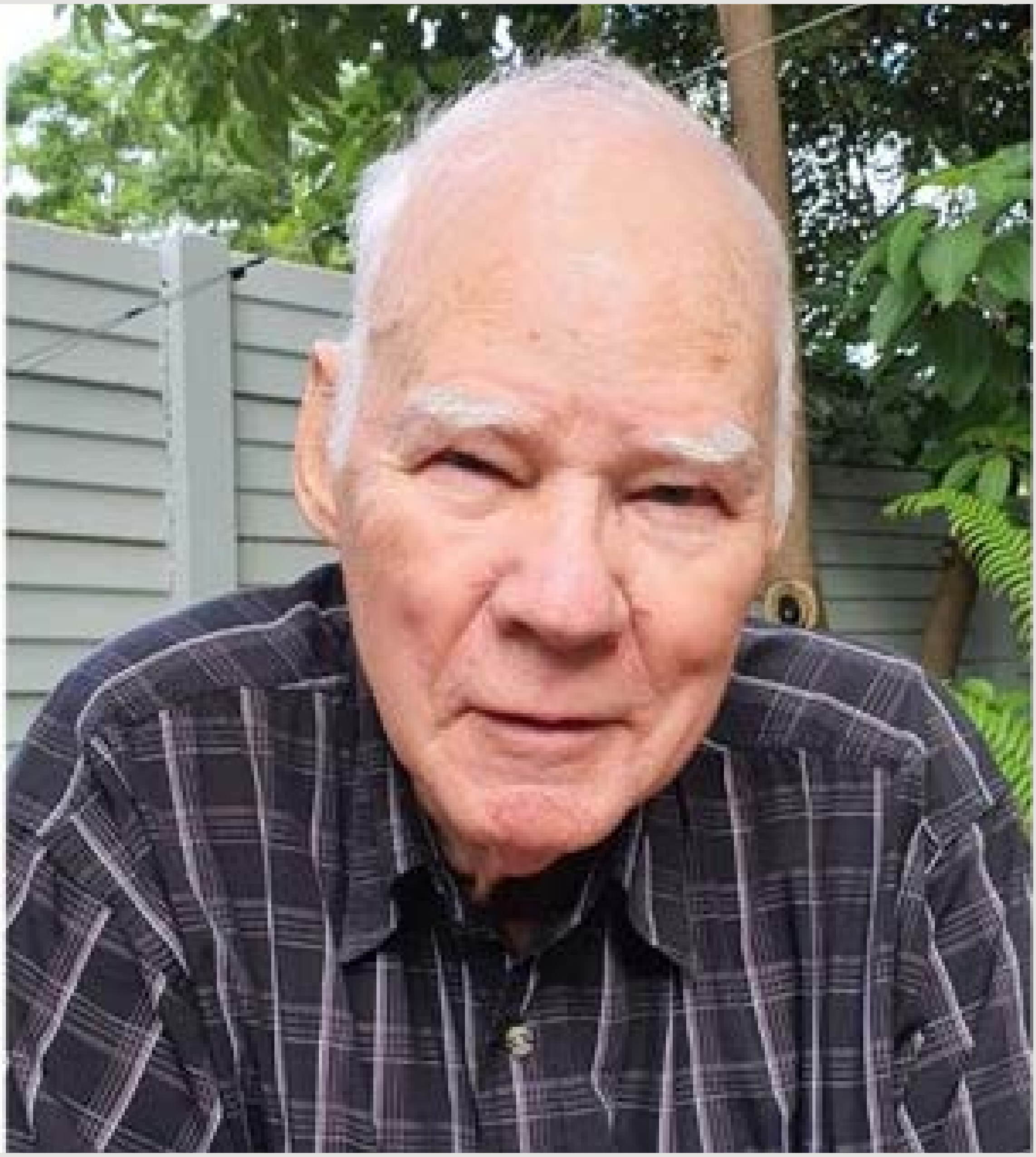
Nico Hager, ons pa, was ‘n merkwaardige man
wat op sy stil manier soveel mense magneties
na hom toe aangetrek het, en soveel,
vir wie hy ‘n inspirasie en sprekende voorbeeld
van geloof, geduld, volharding en uithouvermoë was.
Hy was vir ons ‘n wonderlike voorbeeld
van ‘n eerlike, opregte, onselfsugtige, dienende mens
en voorbeeld van ‘n Christelike leefwyse.

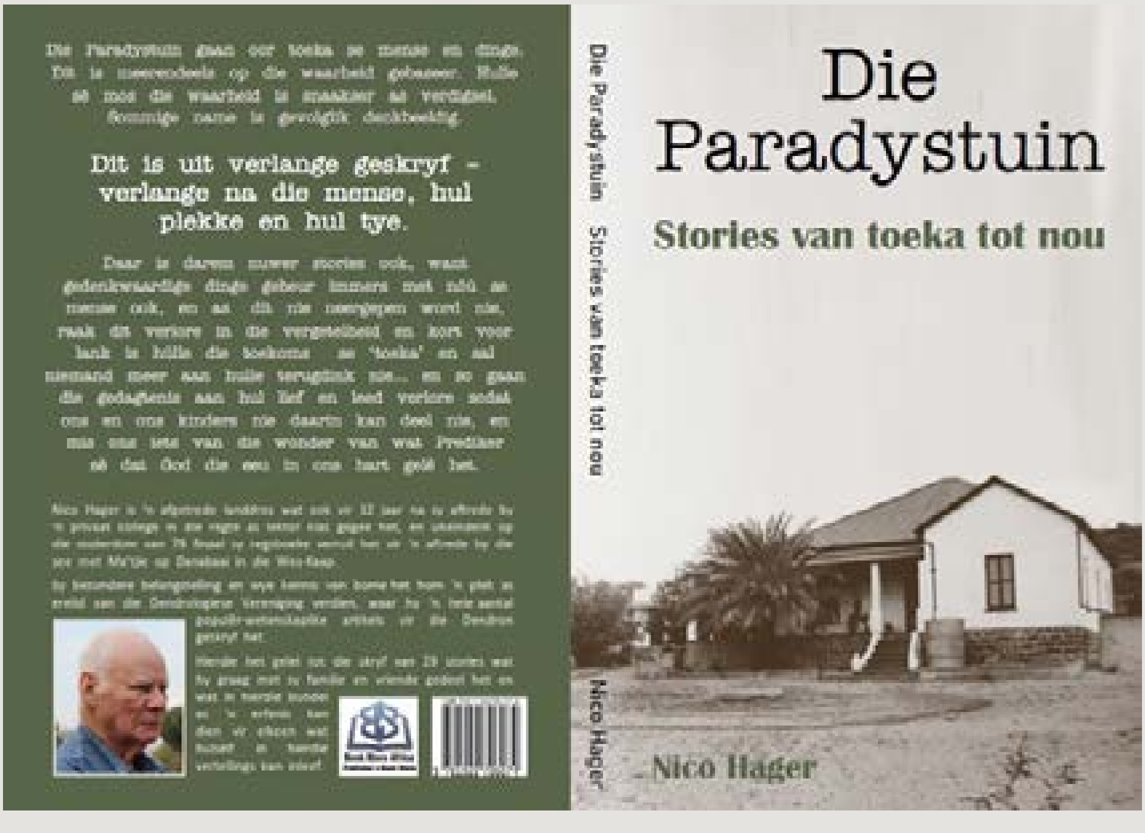
Ons pa was in alle opsigte ‘n gesinsman,
vir wie familie altyd eerste gekom het.
Hy en ‘Moedertjie’ was onlosmaaklik verweef
en ‘n ouerpaar wat in alles saamgestaan het.
Ons gesin was bevoorreg
om in ‘n liefdevolle, geborge huis te kon grootword,
en elkeen ons unieke persoonlikhede te ontwikkel.

By hom het ons ‘n liefde vir die veld, sport en woorde geleer.
Sy versameling van kortverhale, wat verlede jaar gepubliseer is,
is vir elke kind en kleinkind,’n nalatenskap
wat ons vir altyd na aan ons harte sal hou,

Hy was by uitstek ‘n natuurliefhebber,
waarvan bome altyd sy gunsteling was –
elke blaar en blom was vir hom spesiaal.
As kenner van ons inheemse bome en veldplante
was hy ‘n reuse aanwins vir die Dendrologiese Vereniging,
wat hom ook as erelid erkenning gegee het.

Daar is niks wat Ma en ons nie sou doen
om nog een dag te kon hê, saam met ons pa nie,
maar ons het die voorreg gehad
om hom vir ‘n kosbare leeftyd te kon hê ...
en ons is dankbaar dat hy nou,
in die Paradystuin kan wandel.




Die Paradystuin gaan oor toeka se mense en dinge. Dit is meerendeels op die waarheid gebaseer. Hulle sê mos die waarheid is snaakser as verdigsel. Sommige name is gevolglik denkbeeldig.
Dit is uit verlange geskryf - verlange na die mense, hul plekke en hul tye.
Die Paradystuin Stories van toeka tot nou
Nico Hager
Die Paradystuin
Stories van toeka tot nou
Nico Hager

Boscia foetida subsp. *rehmanniana* – stinkwitgat / stink sheperd's tree
Gerto Prinsloo – winning photo, Manketti-branch Spring 2023 photo competition