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Grassroots

Newsletter of the Grassland Society of Southern Africa

How bees and butterflies see flowers

Tackling a BIG problem in a SMALL grassland

Continuing drought in Algoa water source areas

'Extinct' plant discovered in Piketberg

Advancing Rangeland Ecology and Pasture Management in Southern Africa

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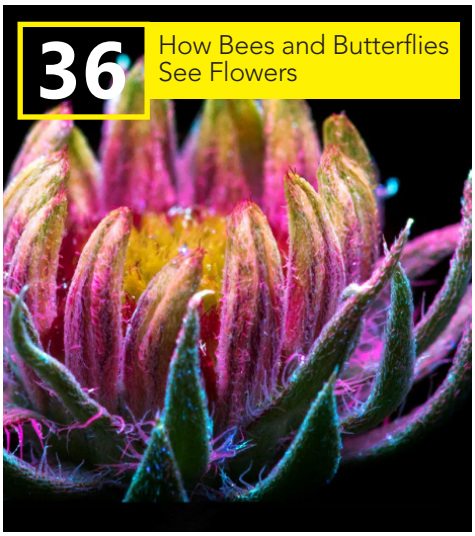

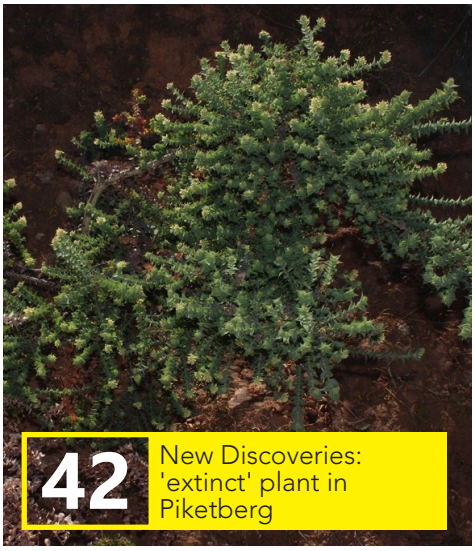

From our editor

Welcome to Issue 3 of Grassroots for 2020.

It has been a very unique and challenging year and despite all the challenges, there are still several achievements to celebrate. The Grassroots team is happy to announce that Issue 3 had the highest readership to date and we hope to keep on growing in the years to come. Thanks to everyone who have contributed, those who have shared Grassroots on various platforms, and to all our readers!

Congratulations to a long-time member of the GSSA, Prof Timm Hoffman, who recently received the prestigious Living Planet Award for 2020 from the WWF. It is also with great sadness that we announce the passing of Dr Jennifer Russell shortly after being awarded the GSSA's medal for outstanding academic achievement for her PhD in Grassland Science. Our sincere condolences to her family, friends and colleagues.

Highlights of this issue

Two of the GSSA's Congress 55 award winners, Robyn Nicolay and Anisha Dayaram, have written feature articles on the work they have been doing and presented at the congress. The spotlight falls on wire grass (*Elionurus muticus*) and forage sorghum (*Sorghum spp.*) in our grass and pasture feature of the month. A few mysteries are solved as we finally learn the reason for the deaths of 350 elephants in Botswana and the reason for the mysterious 'fairy circles' in Australia and Namibia. Discoveries were made as researchers found a new grass species in the Maloti-Drakensberg area and a PhD student found an 'extinct' plant in Piketberg. There is also a new app for karoo plant identification that you can download and try out this holiday season.

Be sure to check out the submission deadlines to Grassroots for 2021 and a few exciting upcoming events. There is also a call for special sessions for GSSAC56 which closes on 30 January 2021.

Lastly, we welcome a new Grassroots team member, Marnus Smit.

Merry Christmas and Happy New Year! Enjoy the read!

Best regards, *Malissa*

Contact us

If you have any feedback, comments, or suggestions, feel free to contact us at:
info@grassland.org.za

@GrasslandSociety-ofSouthernAfrica

Grassland Society of Southern Africa

• CONGRESS 56 •

Call for Special Session Proposals

PROPOSAL DEADLINE: **30 JANUARY 2021**

QUERIES / SUBMIT TO
INFO@GRASSLAND.ORG.ZA

‘Humble and compassionate’ prof wins WWF Living Planet Award

Mpumzi Zuzile

Current Address: South Africa

Reprinted From: https://bit.ly/3otDqPQ

The World Wide Fund for Nature (WWF) has announced leading arid zone ecologist Prof Timm Hoffman as the winner of its prestigious Living Planet Award for 2020.

The award was given to him for his contribution to both conservation and helping the people who are dependent on the land to make a living in some of the driest parts of South Africa.

The Living Planet Award is an annual award made to exceptional South Africans who, through their contribution to conservation, inspire people to live in harmony with nature.

Due to the coronavirus pandemic and the country’s lockdown regulations, this year’s award was made during a special online ceremony on Tuesday, 1 September 2020. The ceremony also showcased the splendours of the Succulent Karoo.

The Succulent Karoo is a semi-desert biome (or ecological region) that stretches from the Little Karoo to southern Namibia and is home to more than 6,000 plant species, making it the most biodiverse of its kind in the world.

WWF South Africa CEO Dr Morné du Plessis said: “Timm is not only one of South Africa’s foremost arid zone ecologists but is also one of the humblest and most compassionate people you will ever meet.”

Du Plessis said through the award WWF-SA acknowledged an individual whose work exemplifies how conservation truly can benefit both people and nature.

Hoffman, who hails from the Eastern Cape, has spent a lifetime working on dry land ecology, most recently as the director of the Plant Conservation Unit at the University of Cape Town.

He is also a long-standing member of the Leslie Hill Succulent Karoo Trust, which is administered by WWF, and celebrates its 25th anniversary this year.

Hoffman has co-authored over 130 scientific articles, contributed to more than 30 books, supervised numerous students, and added to the development of new knowledge and insights into both the Fynbos and Succulent Karoo biomes.

He also led the national review of land degradation for South Africa and has contributed significantly towards the understanding of the impacts of land use and climate change. Using fixed-point photography, his work has highlighted massive changes that have occurred in South Africa’s ecosystems over an extended period.

Figure 1: Prof Timm Hoffman was given the WFF Living Planet Award

Beyond his ecological research, Hoffman also works to understand the complex ways in which rural social, cultural and economic livelihoods interact.

According to Du Plessis, in the village of Paulshoek in Namaqualand, in the Northern Cape, Hoffman has contributed positively to the community by creating a long-term contract job, other occasional employment and training for community members, as well as funding for development projects.

Hoffman has served as a trustee of the Leslie Hill Succulent Karoo Trust (LHSKT) since 2001.

The trust supports WWF in the expansion of conservation land both through land acquisition and biodiversity stewardship agreements where landowners and communities continue to be the stewards of the land.

Hoffman has helped guide the trust, enabling WWF to secure nearly 290,000 hectares of land for formal conservation areas in the Succulent Karoo. This land includes the Namaqua National Park, the Tankwa Karoo National Park, the Knersvlakte Nature Reserve and several strategic stewardship initiatives.

Last year the award was won by Sissie Matela and Nicky McLeod, from Matatiele, who are behind a non-profit social enterprise organisation Environmental and Rural Solutions.

Accepting the award, Hoffman said: “I feel honoured to have my contribution to conservation and sustainable development recognised in this way and I am humbled by the company I share among the previous recipients of this award.

“Something of this nature doesn’t only reflect the work of one person. I am very grateful to everyone involved.”

Obituary – Dr Jenny Russell

Christine Cuénod

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Dr Jenny Russell (née Grant), the most recent recipient of the Grassland Society of Southern Africa (GSSA) medal at the University of KwaZulu-Natal (UKZN) for outstanding academic achievement, awarded for her exceptional PhD in Grassland Science, passed away in October 2020.

The third child of Peter and Hilda Grant, Jenny was born in George and grew up in the George and Knysna areas with her older siblings, brother David and sister Lesley.

Schooled in George, Jenny attended the Convent followed by Outeniqua High, although the pursuit of her first love of horses and riding meant she was involved in school activities only when obliged. Her teen years were spent exploring the forests around George on horseback, often equipped only with an apple for lunch on day-long outrides.

It was on horseback that Jenny met her husband Peter when he was working in Mossel Bay and riding with a friend at Tantivvey stable yard outside George where Jenny's horse was stabled. Taking Peter on a ride through the forests she loved ended in a dinner invitation from Peter, and the two were married on 28 January 1978 in George's St Mark's Cathedral.

Keen on jumping, dressage and cross-country events, Jenny participated in local shows, playing polocrosse with a team in Knysna and continuing to play with the Shongweni Club after moving to KwaZulu-Natal.

Jenny completed her undergraduate and honours studies in biological sciences at the then University of Natal in the 1980s, her Honours project involving a study of bush encroachment in the Hluhluwe Game Reserve.

Jenny went on to work for The Valley Trust as an ecology education facilitator, before spending several years focusing on motherhood after her son William was born in March 1988. Hesitant yet excited at the prospect of becoming a mother, Jenny continued riding as late into her pregnancy as she could, and described the birth of her son as bringing absolute joy. Turning to storytelling as an offshoot career, she became a professional battlefield guide in KwaZulu-Natal, where she passionately shared the beauty of South Africa and vivid battle stories with foreign visitors.

Spending much of her time in Isandlwana, Rorke's Drift and Fugitives' Drift, Jenny began to consider re-entering a career that involved working with the natural environment. Encouraged by UKZN's Professor Pat Berjak, she decided to enrol for a master's degree.

Professor William Bond, after showing Jenny a book by David Rattray comparing paintings done during the Anglo Zulu wars with modern photographs, suggested a study comparing the vegetation change in the intervening years, and Jenny embarked on the project under the supervision of Professor David Ward, her battlefield experience and knowledge of the area providing access to a suitable supply of photographs from the war years.

Figure 1: Jennifer Russell

Achieving the milestone of a PhD, which was conferred at UKZN's April 2019 graduation ceremonies, followed a return to academic life for Jenny decades after her undergraduate and Honours degrees.

Granted the GSSA medal for her research tracking 60 years of woody encroachment in the Van Reenen's Pass district, where her brother-in-law farms, Jenny had completed this research through UKZN under the supervision of Dr Michelle Tedder.

Working at sites made available to her by the farming community in Van Reenen's, Jenny found that the level of encroachment decreased with increasing altitude, that the influence of grassland management regimes on woody species differed depending on altitude, and that climate, in particular temperature, was a likely driver of paperbark thorn (*Vachellia sieberiana*) distribution.

Jenny was extremely successful in securing funding for her PhD research and was published in the **African Journal of Range and Forage Science** and the **South African Journal of Botany**. Aiming to contribute to the scientific body of knowledge, Jenny was happy to see her publications gain citations, and was pleased and surprised to receive the GSSA award recognising her achievements.

After achieving her PhD, Jenny moved with her family to Wakkerstroom, Mpumalanga in 2020 where she established contacts with organisations she hoped to work with before a decline in health halted her plans.

A passionate birder, Jenny had joined and was active in the Wakkerstroom Bird Club, and applied to become an Honorary Ranger with SANParks before she fell ill.

Together with her husband, Jenny was active in the Anglican Church, serving as a Lay Minister.

Jenny is survived by her husband Peter, her son William who now works as an electrical and projects engineer in Johannesburg, and her daughter-in-law Elizabeth Badria, who joined the family in September 2019, to Jenny's delight. In addition, Jenny's brother David lives in Gonubie; her sister Lesley died while Jenny was in her late teens.

Jenny is remembered for her valued friendship to many, her sense of humour and the ability to find it even in the most unlikely situations, and quick smile.

"For me, she was more than my wife, she was my closest friend and life's partner as we tackled life together," said Peter.

Jennifer Russell receiving The Grassland Society of Southern Africa medal for outstanding academic achievement for her PhD from Prof Kevin Kirkman recently.

The topic of her thesis was: *Vachellia sieberiana* var. woodii a high-altitude encroacher: the effect of fire, frost, simulated grazing and altitude: https://bit.ly/3qznxJt

She was nominated for the award by Dr Michelle Tedder of the University of KwaZulu-Natal: "I would like to motivate for Jennifer Mary Russell to be awarded the GSSA medal for outstanding academic achievement for her PhD.

Jenny produced an excellent thesis which received great feedback from her examiners and delegates when presented at conferences. She has also produced two journal articles and one popular article from her research.

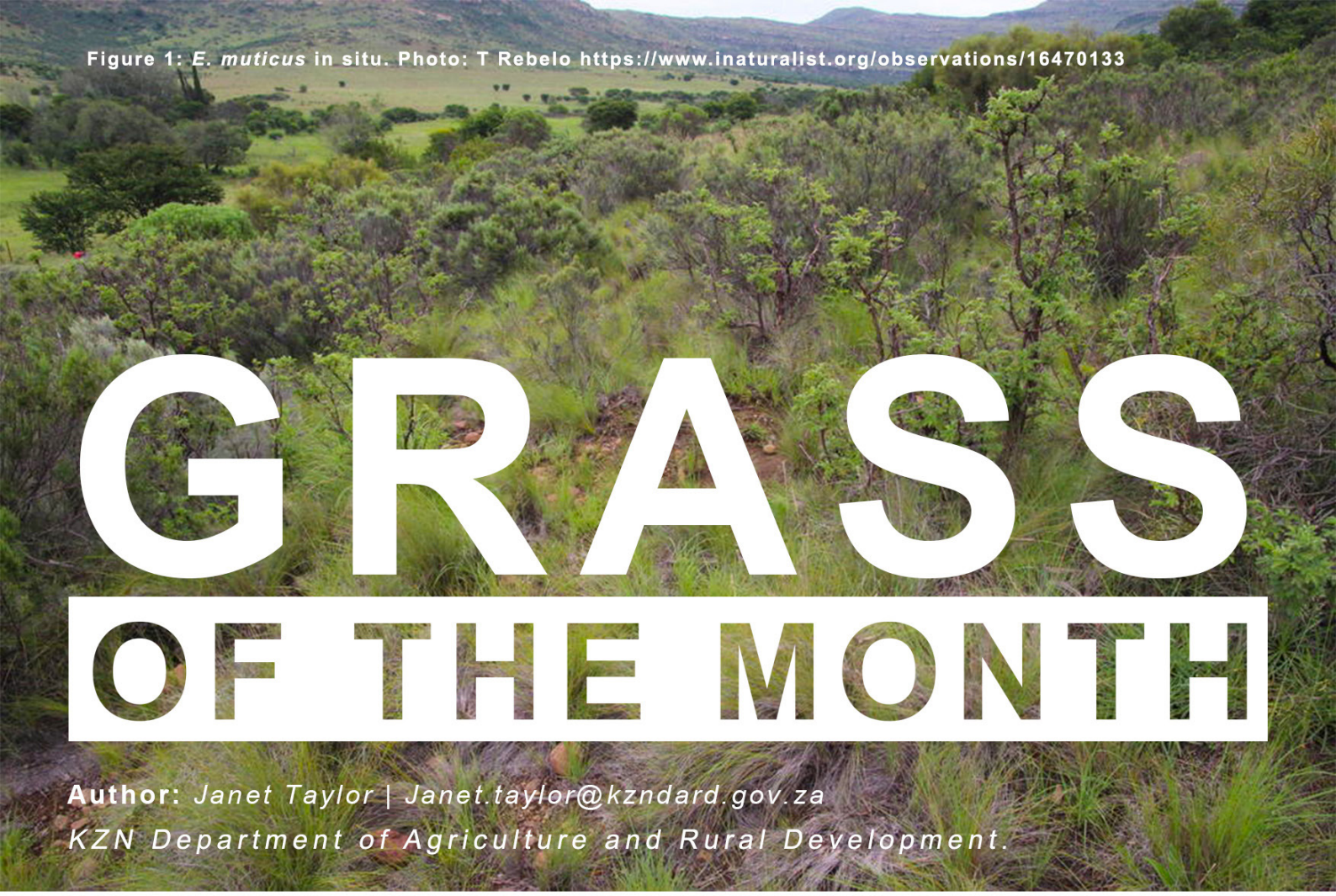

Figure 1: *E. muticus* in situ. Photo: T Rebelo https://www.inaturalist.org/observations/16470133

GRASS OF THE MONTH

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KZN Department of Agriculture and Rural Development.

Elionurus muticus

(Wire Lemongrass / Wire Grass)

Elionurus muticus is a perennial grass which grows in the sourveld and open grasslands of eight of South Africa's nine provinces (excluding the Western Cape). It is a tufted grass which grows between 200 and 1000 mm tall and common in overgrazed veld and sandy soils (Van Oudtshoorn, 2002, Fish et al. 2015). The name "muticus" is translated into English as "pointless" or "blunt" describing the lack of awn on its inflorescence.

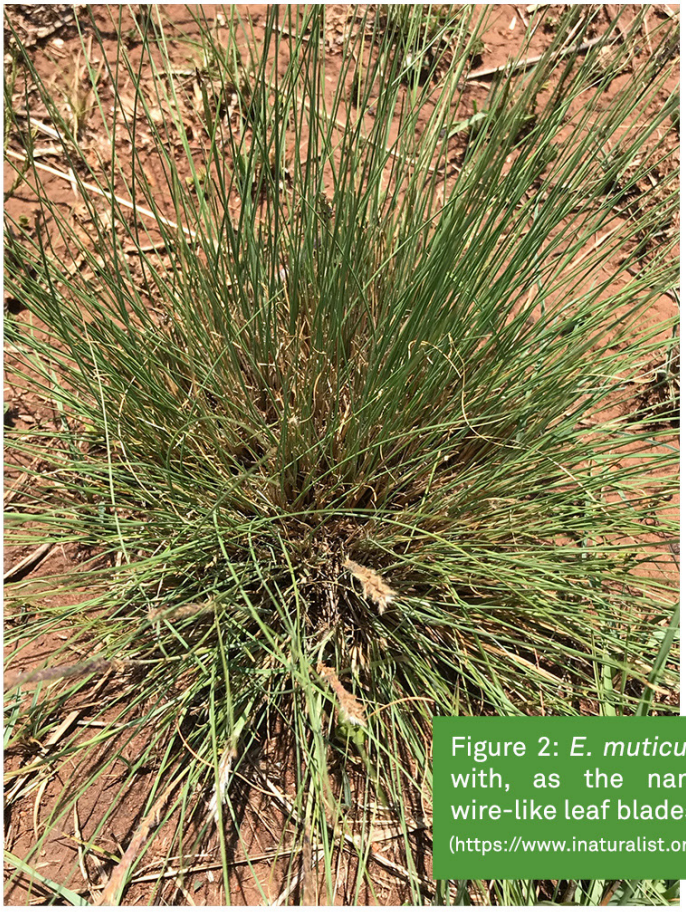

Figure 2: *E. muticus* is a tufted grass, with, as the name suggests, thin wire-like leaf blades. Photo: D. Hoare (https://www.inaturalist.org/observations/36159356)

Distinguishing features:

- *E. muticus* is referred to as a wire grass due to its very thin leaf blades, which have a lemony aroma when crushed.
- These leaves are situated at the base of the plant
- The flowers are in a slight sickle shape and each spikelet is covered in white hairs, giving the inflorescence a silvery look to it.
- *Elionurus* flowers between September and May (Van Oudtshoorn, 2002).

Figure 3: Distinct sickle shape inflorescence. Photo: T. Rebelo
https://www.inaturalist.org/observations/16470133

Economic use:

- Volatile oils exist in this grass making it a very unpalatable species which falls into the ecological category of Increaser III (indicating that they are rare in veld of good condition but increase in abundance in veld which is selectively overgrazed) and scores a grazing value of 0 (fibrous, bitter taste and very low palatability).
- It is only utilized by grazers in the spring when the new leaves are soft.
- *E. muticus* is an indicator of poor veld management and is known to increase in numbers with lots of fire and decrease with low grazing pressure and, along with Cymbopogon pospischilii, causes more selective grazing problems in semi-arid grasslands than any other grass species in South Africa (Snyman 2015).
- Gardening: *E. muticus* is a good soil binder in sandy soils (Useful Tropical Plants).
- Has minor medicinal uses: a medicine is made from the root to treat issues in the intestine and chewing of the root has been known to remedy toothache (Useful Tropical Plants).

Figure 4: The inflorescence is covered in small white hairs. Photo: J. Taylor
(https://www.inaturalist.org/observations/10594472)

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Fish, L. Mashau, A.C., Moeaha, M.J. and Nembudani M.T. 2015. Identification guide to southern African grasses. Strelitzia 36. South African National Biodiversity Institute, Pretoria.Snyman, HA. (2015) Fire and the dynamics of two unpalatable grass species (Cymbopogon pospischilii and Elionurus muticus) in a semi-arid climate, African Journal of Range & Forage Science, 32:1, 1-12, DOI:10.2989/10220119.2014.913076.

Useful Tropical Plants. http://tropical.theferns.info/viewtropical.php?id=Elionurus+muticus Van Oudtshoorn, F. 2002.Guide to Grasses of Southern Africa. Briza Publications. Pretoria.

PASTURE OF THE MONTH

Figure 1: Forage sorghum (https://pxhere.com/en/photos?q=sorghums)

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NW DARD, Agricultural Research Services, Pasture Science Division, Potchefstroom

Forage Sorghum (*Sorghum spp.*)

Forage sorghum is an upright, summer growing, tufted grass, that can grow to two meters tall if not utilised. The inflorescences are panicles and sorghum produce copious quantities of leaves. It is more suited to the warmer parts of the country and can be cultivated under irrigation or dryland conditions.

Figure 2: Sorghum seeds
https://pxhere.com/en/photos?q=sorghums

Utilisation:

- Forage sorghum can be used for haymaking, although it is more suited for grazing, silage and cut-and-carry systems. It should preferably be utilised before the stems get too thick. Three to four utilisations (cuts or grazings) are possible in a season if it is done when the sorghum is 75 – 90 cm tall.
- For good quality grazing, cows can start to graze sorghum when it is 75 – 90 cm tall and sheep when it is 50 cm tall. The utilisation period depends on when establishment took place but can last until March/April.

Establishment:

- Forage sorghum can be planted between October and January when the soil temperature reaches 16°C and higher. The exact planting date is determined by when grazing is needed. Under dryland cultivations, the arrival of spring rains is the determining factor. For optimum grazing utilisation, it is preferable to distribute the establishment of sorghum over the entire cultivation period.
- Forage sorghum can be planted on sandy-, loam-, and clay soils. It grows well on heavy types of soil e.g., Arcadia and Rensburg. In general, forage sorghum can also be cultivated on low potential soils.
- Under dryland conditions, seasonal rainfall of > 500 mm are needed, but sorghum doesn't tolerate waterlogged conditions.
- Always do a soil analysis for accurate fertilisation recommendations. Forage sorghum reacts positively to N-application.
- The recommended sowing rate is 20 – 25 kg/ha under irrigation and 12.5 – 18 kg/ha under dryland, depending on the soil type and expected rainfall. The row width can be increased in drier areas.
- For soil preparation, it is important to control weeds and conserve soil moisture.

Warning

Sorghum shouldn't be grazed when it shows signs of wilting as it produces prussic acid; or directly after high N-application with insufficient rain as nitrate poisoning might occur.

Figure 3: Forage sorghum
https://www.tropicalforages.info/text/entities/sorghum_annual.htm

References:

Dickson, E.B., Hyam, G.F.S., Breytenbach, W.A.S., Metcalf, H.D., Basson, W.D., Williams, F.R., Scheepers, L.J., Plint, A.P., Smith, H.R.H., Smith, P.J., Van Vuuren, P.J., Viljoen, J.H., Archibald, K.P. & Els, J.M. 2004. Die Kynoch Weidingshandleiding. Keljafa Knowledge Works. Barenbrug Production Guide. Fifth Edition.

Biological Soil Quality: Methods of Assessing Soil Quality using Microarthropod *Collembola*

Robyn Nicolay

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Initial concepts of soil quality concentrate on the productivity of soils and the properties that contribute towards its productivity (Carter 1996; Bünemann *et al*. 2018). Developing concepts of soil quality has been viewed within a broader understanding of interactions between ecological systems, and how agriculture connects with as well as affects parts of this ecological structure (Carter 1996). Larson and Pierce (1994) expanded on the concept of soil quality within, as well as beyond agricultural ecosystems, defining it as "the capacity of a soil to function within its ecosystem boundaries, and interact positively with the environment external to that ecosystem".

Edaphic faunae perform a key role in soil ecosystems by their involvement in the regulation of microbial activities, nutrient cycles and most aspects of organic matter decomposition, ultimately influencing soil functioning. Factors which may degrade the nature of soils, such as pollution and land-use intensification, may result in changes in fauna composition and ultimately soil functioning and quality (Gardi et al 2006).

In some cases, specific soil properties are difficult to measure directly, such as soil and ecological processes, and thus indicators, such as indices of edaphic fauna serve as a secondary measure (Bouma 1989). Such indicators should be easily measured, have relatively low sampling error, however showing sensitivity to variation in the management of soils (Bouma 1989). It is, for this reason, biological indicators using soil microarthropods as a benchmark is generally accepted to express the quality of soils that are subject to degradation risk (Parisi et al. 2005).

Methods of evaluating soil quality were developed by Vittorio Parisi and Cristina Menta in the determination of soil quality by means of Qualita Biologica del Suolo (QBS) or Biological quality of

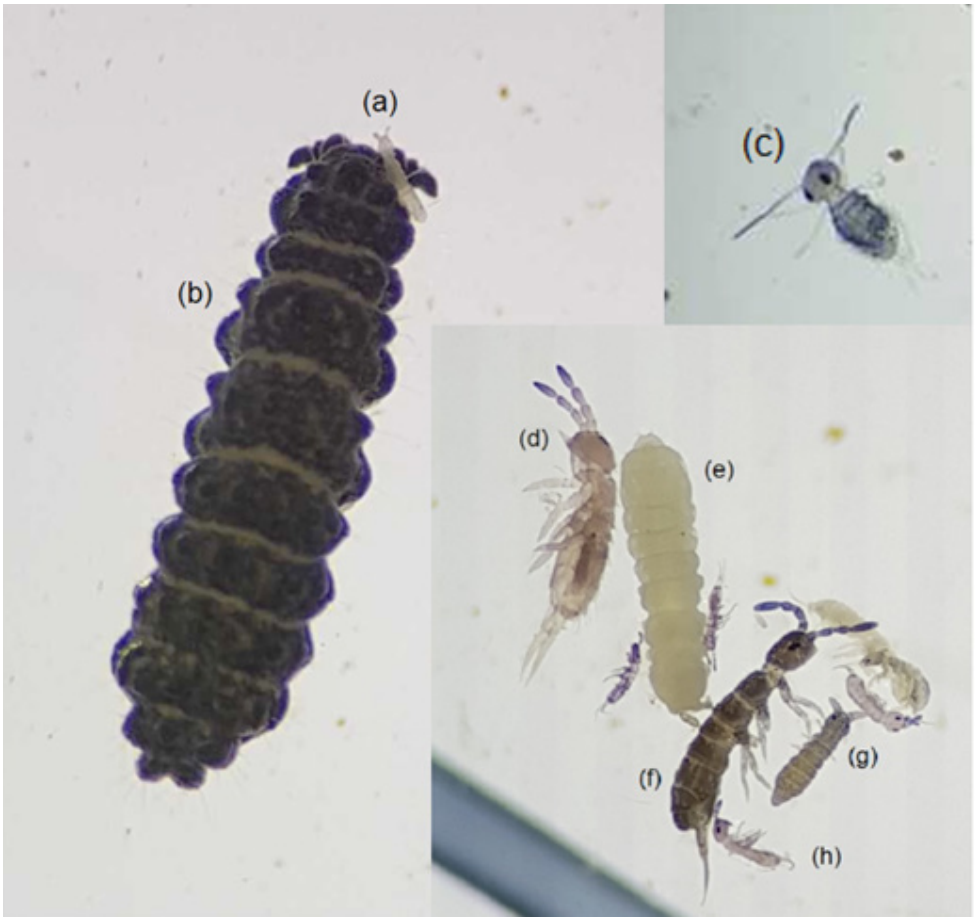

Figure 1: Extracted *Collembola* specimens exhibiting varying morphological phenology according to their adaptions to the soil environment. Specimen (a) indexed as a true Euedaphic type *Collembola* from the order Poduramorpha, with no discernible ocelli, pigmentation, reduced antenna length, and absent furca. Specimens (b) and (g) exhibit phenological traits characteristic of hemidaphic type *Collembola* from the order Poduromorpha, exhibiting prominent pigmentation, ocelli and absent furca. Specimen (c) displays phenological type features consistent with epigeic *Collembola* from the order Symphypleona, displaying clustered ocelli, body segmentation that is not clearly visible and is commonly found in surface soil habitats and leaf litter. Collembolan (d) and (h) are showing characteristics comparable to order Entomobryomorpha, an epigeic type *Collembola* with fully developed furca, pigmentation and ocelli. *Collembola* specimen (e), with absent pigmentation, furca, and a present fifth thoracic segment, is consistent with true euedaphic phenology within the order Poduromorpha. Specimen (f) shows fully developed furca and obvious pigmentation, phenology consistent with epigeic type *Collembola* within the order Entomobryomorpha (Image source: Authors own 2019).

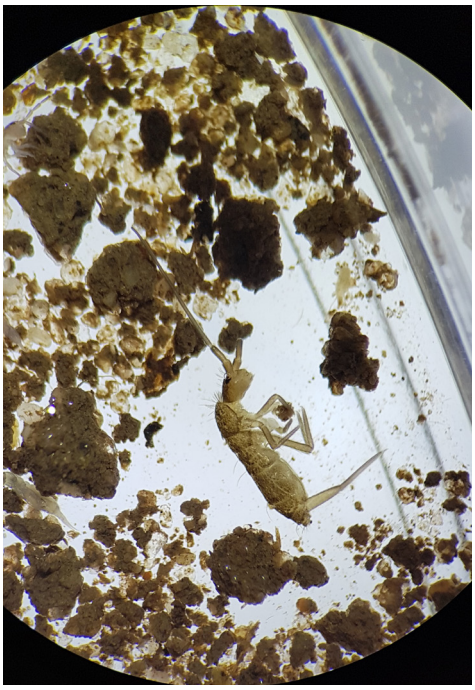

Figure 2: Epigeic *Collembola* specimen as an example of adaptions to edaphic habitats on shallower surface horizons. Augmentation of appendage dimensions such as antennae, furca and legs, strong pigmentation, discernible body hairs and obvious ocelli can be noted (Image source: Authors own 2019).

soil (BQS) indexing, using microarthropods and *Collembola* due to their high abundance in a wide range of soils as well as their sensitivity to land management practices, having been noted to correlate positively with beneficial soil functions (Parisi and Menta 2008). Here, we discuss these methods of soil quality evaluation.

What is *Collembola*?

Collembola are the most abundant arthropods in many agricultural and rangeland soils and can be found in a diverse range of habitats globally, often in great densities per cubic meter. These microarthropods are mostly known in their important role within the soil food web as fungal feeders, mineralising nutrients into plant-available forms. Soil invertebrates are generally classified according to their size, with *Collembola* being Mesofauna (body size between 200 µm and 2 mm).

Despite their six legs, *Collembola* (Springtails) are not classified as insects, but rather form a separate class within the phylum Arthropoda. *Collembola* are distinguished by their double furca, a spring mechanism utilised as a means of predator evasion, although the prominence of this appendage is dependent on the depth of soil it has evolved to inhabit.

Biotic and abiotic factors such as resource availability and physiochemical properties, in most habitats, create conditions for *Collembola* that would promote or impede persistence, with species demonstrating varying levels of specialisation suited to these environments.

Collembolan communities have been shown to vary according to open or closed vegetation types. Soils with low pH, high soil moisture as well as soils with high organic matter providing abundant resources favour overall *Collembola* abundance and diversity (Heiniger et al 2015).

As the most abundant groups within terrestrial ecosystems, *Collembola* have been used alongside earthworms and nematodes in assessing soil quality (An et al. 2013). Recent methods of evaluation by means of biological soil quality (BSQ) indices are based on the idea that high soil quality exhibits greater diversity in the assemblage of microarthropods such as *Collembola* (Paz-Ferreiro and Fu 2016).

What can *Collembola* tell us?

Collembola have been noted as being negatively impacted by the removal of organic matter observed as part of a temporal interaction and extremely sensitive to soil disturbances (Eaton et al. 2004), therefore being considered useful as a bioindicator of soil condition and evaluation of soil quality.

It is understood that cultivated soils exhibit less diverse *Collembola* or exhibiting certain adapted morphological characteristics following soil disturbance. Because of their differences in response to contaminants, specific *Collembola* is frequently used as test organisms in soil toxicology tests, such as *Folsomia candida*, *Onychiurus armatus*, *Orchesella*, *cincta*, *Isotoma notabilis* and *Tetrodontophora bielanensis* in both sub-lethal and lethal testing (Crouau et al 1999; Menta 2012; An et al 2013).

Morphological changes in *Collembola* composition characterise the soil stratum to which it has adapted (Figure 2). *Collembola* adapted to deeper soil horizons, for instance, would exhibit characteristics suited to small dark soil spaces, such as reduced antenna, development of particular sensory hair, no discernible pigmentation, absent ocelli and a reduced or absent furca (Figure 1e) (Conti 2015).

These morphological adaptions mean that they would be more sensitive and vulnerable to environmental changes, and so, regularly abundant in less disturbed soils such as permanent or semi-permanent grasslands and vegetative cover (Gregorich and Carter 2007). The degree to which they have adapted to varying hypogeal environments enables us to distinguish between biological forms of *Collembola*.

Soil Biological Quality Quantification

As most *Collembola* communities' compositions are highly dependent on their immediate environment, one could evaluate their role and function by using methodologies highlighting *Col-*

Figure 3: Berlese Tullgren Funnels are typically used to extract arthropods from soil samples, via high-gradient dynamic extraction. Cores are placed top-end downward on a 5mm mesh disc within the extractor. Incandescent light is used as the repellent stimuli and specimens collected in modules below the funnel, typically containing 20ml 75% ethyl alcohol. An extraction period of at least fifteen days is advised (Image source: Authors own, 2019).

Figure 4: Soil samples are taking on a bare field.

Figure 5: One of the vegetated sample sites.

lembola morphotypes proportionate to their adaption level (Parisi et al. 2005).

Extraction of *Collembola* is accomplished using Burlese-Tullgren funnels (Figure 3). Extraction is achieved by applying a repellent stimulus (incandescent light) that dries soil from above, actively requiring edaphic micro and mesofauna to move downward through the soil sample, falling into a collection vessel below containing a preserving agent (Gregorich and Carter 2007). Micro-arthropod extraction from soils and plant litter has been reviewed in numerous studies [Evans et al. 1961; Macfadyen 1962; Murphy 1962; Edwards 1971; Edwards 1991; Coleman et al. 2017], and have been found to be effective and inexpensive.

One of the main limitations of utilising QBS as a measure of soil quality is the identification of *Collembola* to its taxonomic level, thus many indices being unable to support abundance data (Paz-Ferreiro and Fu 2016). Parisi (2001) addressed these limitations by developing the Qualita Biologica del Suolo (QBS) index as a rapid means of characterising edaphic microarthropod populations from sampling sites without the need for taxonomic understanding of observed *Collembola* species.

Qualita Biologica del Suolo *Collembola* (QBS-c) is based on the concept that *Collembola* samples with high eco-morphological index scores (EMI) correlate positively with soil quality and positive edaphic functionality (Parisi et al. 2005). Furthermore, results obtained with QBS-c in several studies have been validated using alternate soil quality indicators including soil organic carbon and aggregate stability (Gardi et al. 2002).

Qualita Biologica del Suolo *Collembola* (QBS-c) involves examining the extracted *Collembola* under a stereomicroscope at low magnifications. Extracted *Collembola* are then ranked according to their particular eco-morphological index (EMI) determination, based on phenological characteristics.

This is done by grouping them into systematic groups according to their eco-morphological forms; Epigeic, Hemiedaphic or Euedaphic. EMI grouping is achieved by assigning a score based on phenological characteristics; Ocelli are noted and scored a '0' for present and '4' for absent.

The antenna is observed and scored a '0' should they be greater than its body length, a '2' should they be approximately half of its body length, and scored a '4' should the antenna be shorter than half the *Collembola*'s body length.

Furca is noted and scored a '0' should it be fully developed, scored '2' should it be reduced and scored a '4' should furca be absent. Hairs and scales are noted and scored a '0' should they be present and a '4' should the *Collembola* show no discernible hairs or scales. As a gen-

eral rule, euedaphic (deep soil-dwelling) forms score between 13 and 20, hemidaphic (intermediate) forms score between 8 to 12, while epigeic (surface) living forms score between 0 and 6. This method uses low-level taxonomy and is an appropriate tool for large scale monitoring with numerous samples.

Soil bioindicators are frequently undervalued and underrepresented in soil quality assessments, often with studies limiting biological measurements to respiration and biomass.

Soil biota has been considered most sensitive as indicators of soil quality, owed to their responsiveness to soil management, environmental conditions, pollutants, such as toxic chemicals and heavy metals, as well as changes in soil biophysical transformations (Bunemann et al 2018).

Stability in the soil environment and edaphic characteristics suggestive of healthy soil allows for the persistence of sensitive eco-morphic type *Collembola* groups.

The presence of a highly diverse microarthropod community within a soil's ecosystem is often indicative of increased soil quality and consequently, soil health.

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It's the season to be involved with the VEGMAP Project

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Over 15 years ago the VEGMAP Project was established at the South African National Biodiversity Institute (SANBI) through the collaborative effort of over 400 scientists who produced several national maps and classification of the diversity of vegetation across the country. The map has proven useful for research and analyses used in biodiversity planning and management. Today, advances in mapping tools and our knowledge of the landscape allow us to improve parts of the map that needed refinement and the map has been through three iterations since 2006, with the last version released in 2019 and can be downloaded from the Biodiversity GIS website here. The website is also home to digital versions of previous versions of the map, a digital version of all chapters of the publication Mucina and Rutherford (2006), guidelines to citing VEGMAP Project resources, and guidance for submitting proposed changes to the map. Users of the national vegetation map are encouraged to help refine the map and classification by sharing new data or raising their concerns through an online questionnaire or by contacting the curators via vegmap@sanbi.org.za. The next version of the map is currently under development and will be uploaded on the BGIS website as well.

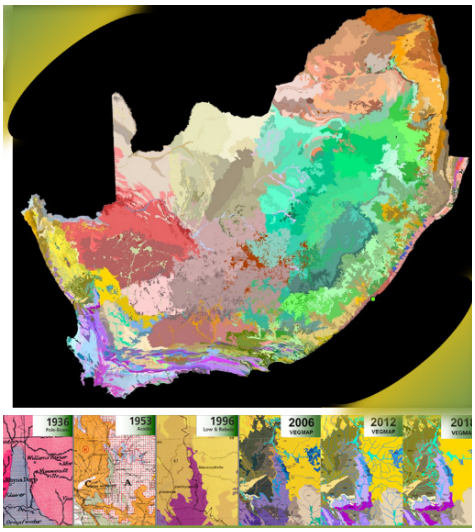

Figure 1: The National Vegetation Map captures the diversity of vegetation across South Africa and is updated through iterative versions.

Since the production of the first map, several related tools have been developed and a few exciting ones are on the way to make the map more accessible to users. In 2018 we created the VEGMAPhoto (s afr) project on the citizen science platform iNaturalist to collect landscape photos of each vegetation type listed in the classification system, eventually building a visual catalogue of all the communities existing in each of these vegetation types. We are always looking for contributions so when you are on holiday this December and travelling locally, take a moment to assist us by contributing a photo or two of the landscape you are passing through by using the iNaturalist app on your phone or by uploading it later. Instructions for the kind of photos that are best suited to the project can be found on the home page.

Another exciting addition to the VEGMAP Project is the development of the National Vegetation Map Descriptions Database. We have extracted descriptive data for each of the vegetation types and from the existing static resources and created a database that can be interrogated more easily. The database is not available online yet, however, we plan to release a truncated version with the next release of the national vegetation map. Over the last few months participants from various forums, including attendees of the 55th Annual Congress of the Grassland Society of Southern Africa, were asked to vote for the descriptive data that may be most useful to their research. It is still possible to vote for data fields that you would like to see included in the truncated table here. The descriptive data with the most votes are currently being shortlisted and will be included as a table that can be linked to the spatial map for further analyses.

VEGMAP Project resources such as the national vegetation map and the photo catalogue on iNaturalist is a collaborative effort that is curated by a small team at SANBI but driven by your efforts and contributions. The wide applications of this resource in local, provincial and national research, planning and management mean that even the smallest contributions have a significant impact. We look forward to interacting with you on our many platforms so that we can map the path to sustainable ecosystems together.

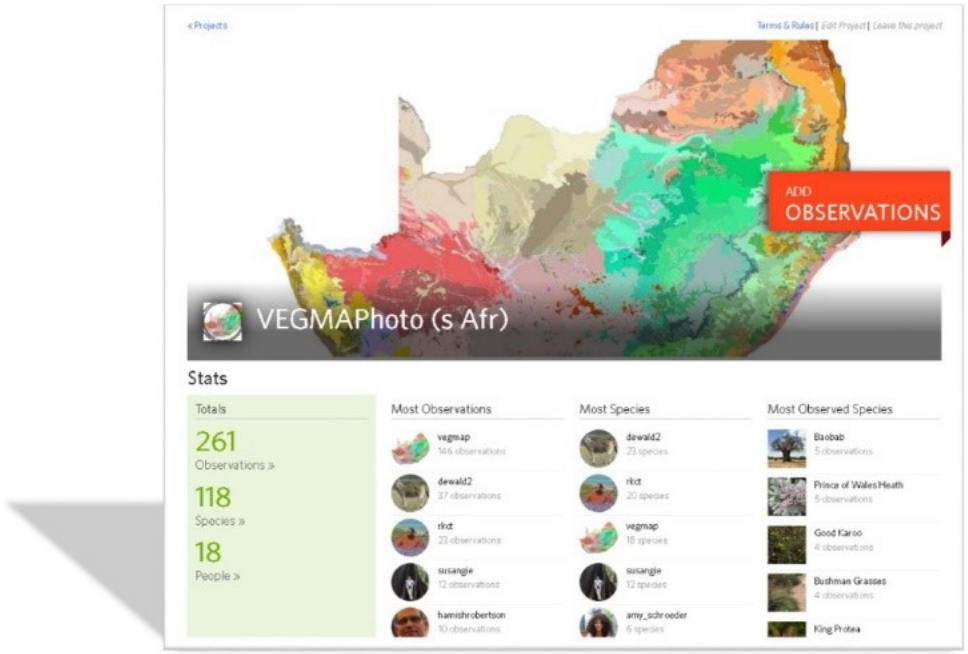

Figure 2: With the VEGMAPhoto project on iNaturalist, we hope to create a photographic catalogue of all examples of communities within a vegetation type.

Revealed: How 350 elephants in Botswana mysteriously died three months ago

Abhishek Sharma

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The mystery of the death of about 300 elephants a few months ago has been finally resolved. Termed as 'mysterious mass die-off', the deaths were reported in elephants of all ages and both sexes.

A Guardian report in May had said that a cluster of elephant deaths was first reported in the Okavango Delta, with 169 dead by the end of the month. By June, the number more than doubled. 70 per cent of the deaths were clustered around waterholes. The number of deaths now stands at 350, according to reports.

"This is a mass die-off on a level that hasn't been seen in a very, very long time. Outside of drought, I don't know of a die-off that has been this significant," Guardian had quoted Dr Niall McCann, the director of conservation at UK-based charity National Park Rescue as saying.

At that time, no one knew the reason behind the deaths as the Botswana government had said that it hadn't tested any samples.

However, it has now been revealed that toxins in water produced by cyanobacteria killed the elephants, officials said, announcing the result of an investigation into the deaths which had baffled and alarmed conservationists.

Cyanobacteria are microscopic organisms common in water and sometimes found in soil.

Not all produce toxins but scientists say toxic ones are occurring more frequently as climate change drives up global temperatures.

Cyril Taolo, deputy director of the Department of Wildlife and National Parks, told a news conference the number of elephant carcasses found since deaths were first reported around early May had risen to 330, from 281 in July.

Figure 1: A combination photo shows dead elephants in Okavango Delta, Botswana May-June, 2020. Source: Handout via REUTERS

"What we just know at this point is that it's a toxin caused by cyanobacteria," said Taolo, adding the specific type of neurotoxin had yet to be established.

Authorities will monitor the situation during the next rainy season, and Taolo said, for now, there was no evidence to suggest that Botswana's wildlife was still under threat as officials were no longer seeing deaths.

The department's principal veterinary officer Mmadi Reuben told the same news conference that questions remained as to why only elephants had been affected.

Other animals in the Okavango Panhandle region appeared unharmed.

Continuing drought in Algoa water source areas: climate and streamflow trends in the Kromme catchment

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Reprinted From: https://bit.ly/3mRX2Nh

Wash your hands well and often, for 20 seconds each time, and keep your surroundings clean, but be sure not to use more than 50 L of water per day…

It is never a good time for a drought, but with the ongoing Covid-19 pandemic a water crisis is a double whammy for the Algoa region of the Eastern Cape.

This article takes a look at some recent and historical climate and estimated streamflow statistics for the Kromme catchment, one of the major water supply catchments in the area where SAEON postdocs and students have been conducting research.

Algoa drought and water supply – keeping up with an uncertain future

While much of the Western Cape has emerged from the infamous 2017–2018 'Day-Zero' drought over the last year, other parts of South Africa have experienced continued or renewed water scarcity. As of 20 September 2020, the five water supply reservoirs of the Algoa Water Supply System had combined storage of 18.7%.

The Algoa Water Supply System supplies the city of Port Elizabeth in the Nelson Mandela Bay Metropole (NMBM) and several surrounding towns, as well as the Coega Industrial Development Zone and large areas of commercial irrigated agriculture. Water restrictions have been in place for several months, with those listed in July 2020 allowing agricultural users 20% of their normal allocation and the NMBM 70%. From September 2020, a 50 L per person per day restriction was placed on domestic users in the NMBM, with flow restrictors to be widely installed.

Even without drought conditions, the

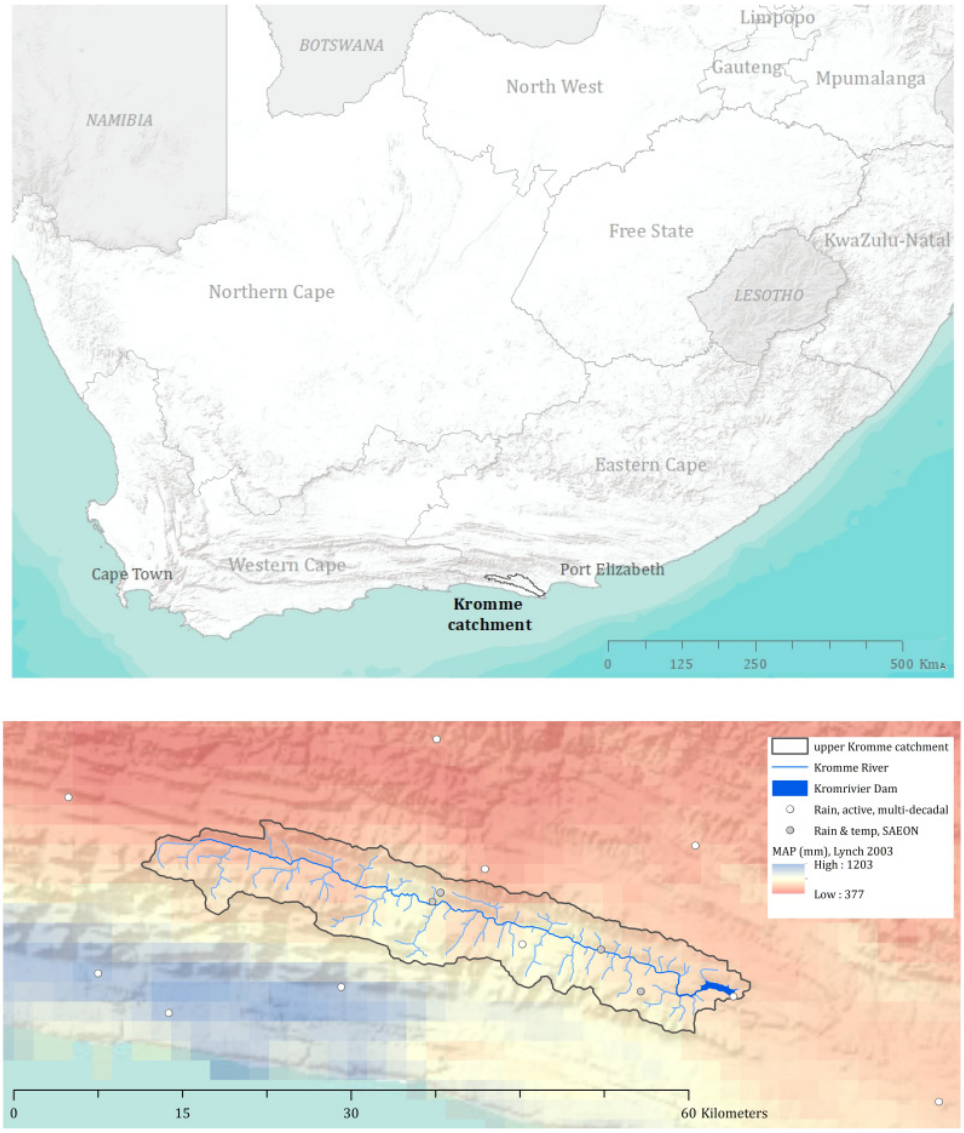

Figure 1. (a) Location of the Kromme catchment area in the Eastern Cape (above), the upper Kromme catchment area showing active rainfall gauges and (b) an interpolated surface for mean annual rainfall (MAP) produced by Lynch 2003.

Algoa Water Supply System was recognised to be insufficient to meet projected demand, last thought to be in theoretical balance in 2009. Efforts to

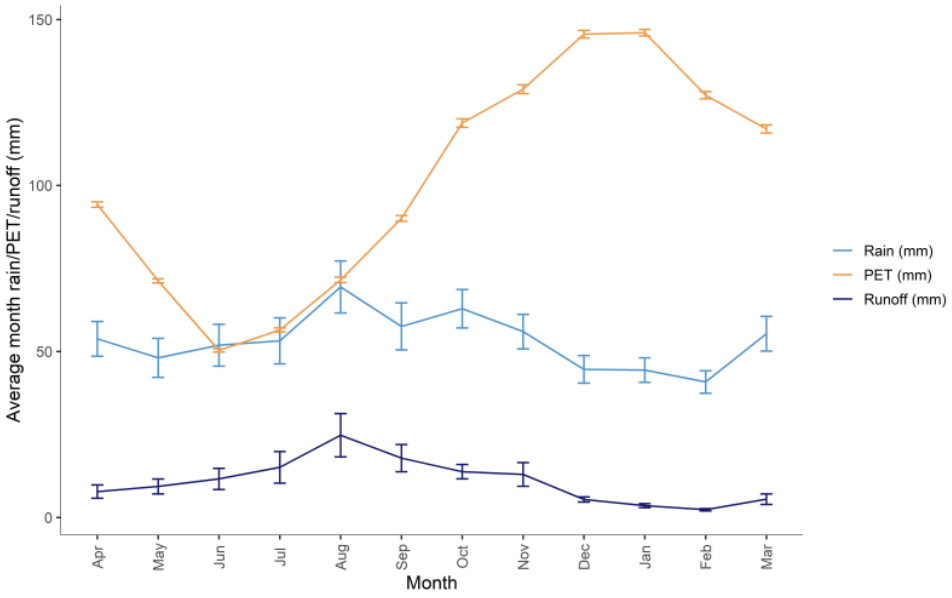

Figure 2: Estimated average rainfall, potential evapotranspiration (PET) and runoff by month for the Kromme catchment based on data for 1960-2018 (error bars indicate standard error of the mean), shown for a water year from April-March. This alternative water year was selected over the typical October-September water year to account for the winter peak in runoff, keeping the recession period following it withing the same water year.

reconcile supply and demand have led to investment in river transfer infrastructure, bringing in water all the way from the Orange River via the Fish River into the Sundays River, at no small cost.

The reconciliation strategy also calls for addressing system leaks and water recycling in the NMBM and acknowledges the positive impacts of clearing of invasive alien plants in catchment areas of the reservoirs, an ongoing effort largely through the Working for Water Programme.

This, and other water supply-demand reconciliation strategies across the country, rely on assumptions about the level of climate variability that can be expected in areas feeding their supplies. There is growing recognition of the need to take climate change into account going forward, urgently underlined by the current prolonged dry periods.

The Algoa region lies in the a-seasonal rainfall zone of South Africa, between the winter rainfall zone to the west and the summer rainfall zone to the east. It has inherently high interannual climate variability, sometimes catching the edge of winter and/or summer weather systems and sometimes not. This poses an extra challenge for predictive climate modelling.

However, looking across the suite of downscaled global climate models' (CMIP3 and 5) predictions across different greenhouse gas emissions scenarios (RCP 4.5 and 8.5) presented on the Climate Information Platform of the University of Cape Town Climate Systems Analysis Group (https://cip.csag.uct.ac.za/), the majority of models suggest a future decrease in winter rainfall and an increase in summer rainfall on average, with increasing average temperatures and the likelihood of extremes (2040–2060 model predictions relative to 1980–2000). The magnitudes of predicted change vary notably across the models and scenarios, but there is less discrepancy about the direction of change.

Upper Kromme catchment and available data

Water supply shortfalls are the outcome of many factors which change over time. Prolonged dry and warm weather conditions will impact the supply-vs-demand scarcity differently depending on properties of the catchment areas that impact streamflow generation and groundwater recharge (e.g. land cover and use), the water supply infrastructure and management (e.g. storage and leakage) and the magnitude of the demand.

Analyses presented here for the Kromme catchment focus on the climate and the catchment response. They provide a preliminary exploration into a few key questions: How extreme is the current climatological drought compared to the long-term climate record for the area? Is there evidence of a long-term trend in annual and seasonal rainfall and streamflow? If there is a shift towards less winter and more summer rainfall, what could this mean for water supply?

The upper catchment of the Kromme River feeds the Kromrivier Dam (also referred to as the Churchill Dam), one of the major reservoirs in the Algoa Water Supply System, contributing close to 30% of NMBM's normal water allocation. The 360 km^2 catchment area lies in the Tsitsikamma and Suuranys mountains and is dominated by fynbos vegetation. It is also known for its palmiet wetlands, however much of the area is highly invaded with black wattle (*Acacia mearnsii*).

The area supports fruit orchards, dairy and small stock farming. There are a few rainfall and temperature gauges from the South African Weather Service (SAWS) and Department of Water and Sanitation (DWS) in operation in and around the catchment (Figure 1), some with data going back to the 1950s or earlier.

Unfortunately, there is no long-term streamflow gauge in the catchment. However, the water balance from the Kromrivier Dam, i.e. recorded reservoir water levels, outflows, rainfall and evaporation available from DWS, can be used to back-calculate an estimate of the streamflow entering it starting in 1957, with useable data until late 2017 when an outflow gauge malfunctioned.

Being so mountainous, rainfall is unevenly distributed over the catchment. Rainfall spatial surfaces derived from station data by Lynch, 2003 (Figure 1), accounting for elevation, aspect, and distance from the sea, were used to upscale station data to estimate a catchment-scale average rainfall time-series for the Kromme for the 1960–2018 water years.

Temperature data was similarly scaled using surfaces from Schulze and Maharaj (2004) and was used to estimate potential evapotranspiration (PET) using the Hargreaves and Samani (1985) method. PET is a measure of the potential for water to evaporate or be transpired by plants if there is water available.

Data from SAWS, the Agricultural Research Council (ARC), DWS and SAEON were used to patch gaps in records for the long-term stations. 'Water years' are used instead of calendar years in hydrological analyses to avoid splitting seasons down the middle. In this case, an April to March water year (i.e. April 1960 to March 1961 as the 1960 water year) was applied because average streamflow was found to be higher in winter.

Starting the water year in October is more typical, but less appropriate when

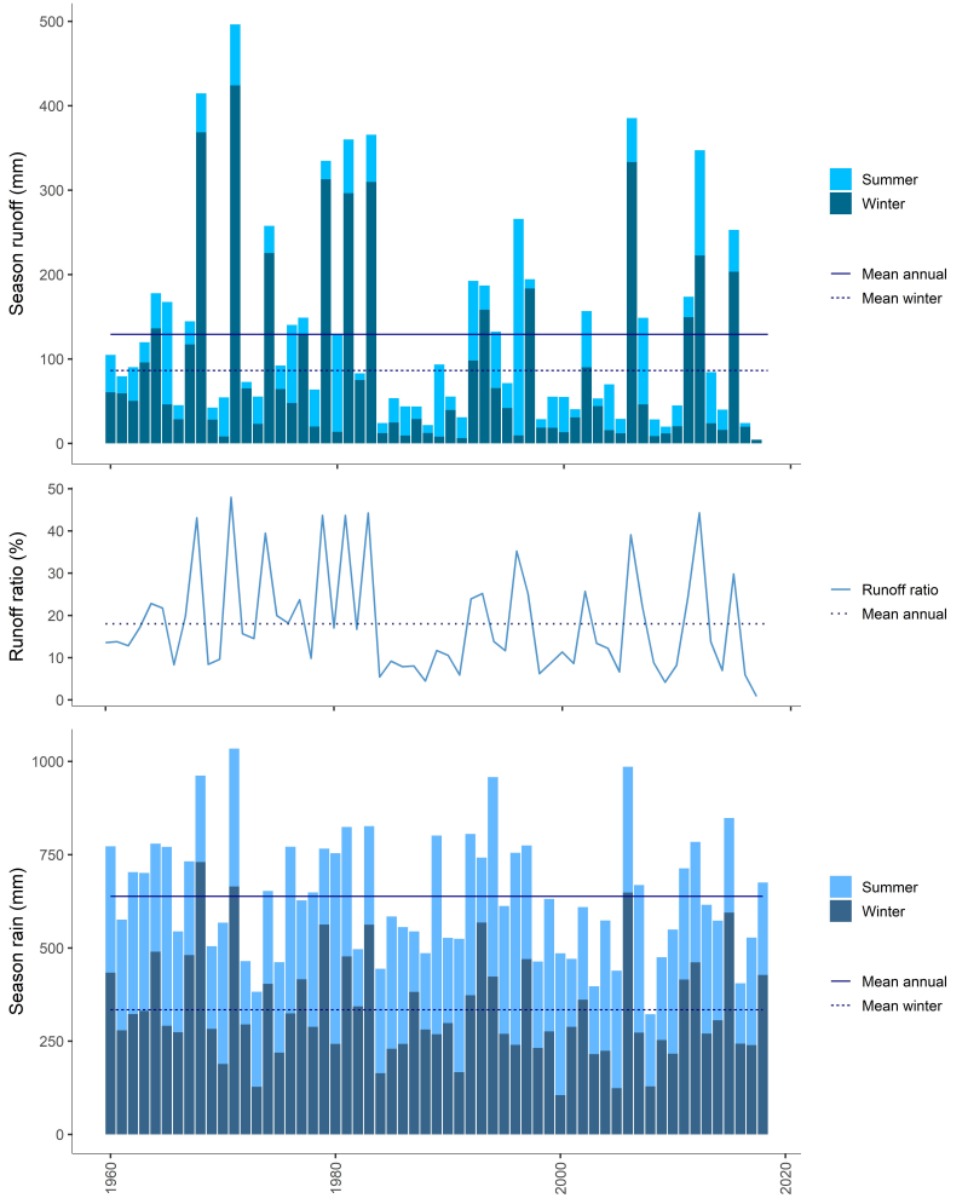

Figure 3: Annual rainfall (bottom), runoff (top) and runoff ratio (middle) for the Kromme catchment indicating seasonal winter-summer split and long-term averages. NB: Displayed by water year, rainfall 1960-2018, runoff and runoff ratio 1960-2016.

there is a winter streamflow peak because this would place the flow recession from a winter high into the next 'water year' (Figure 2).

Climate and streamflow trends

Annual rainfall and runoff for the Kromme catchment by water year are shown in Figure 3. The volume of streamflow is normalised by the catchment area to give a runoff depth value in millimetres for comparison to rainfall. The annual average rainfall for this period was 638 mm, but there is high variability with values ranging from 322 mm (50% of average) in 2008 to 1 035 (165% of the average) in 1971.

On average, there is a fairly even split between rain falling in winter versus summer (52% vs 48%), but again this is highly variable, with winter rain ranging from 22% to 77% of the annual total in different years. The datasets used did not extend through the full 2019 water year, however catchment rainfall for the 2019 calendar year was 453 mm, well below average. The data shows that the current hydrological drought is not a product of the lowest rainfall years on record in recent decades, however, it is due to continuous below-average rainfall for multiple years in a row.

In the Kromme, streamflow is more variable than the rainfall. This is typical of semi-arid environments because they reach wetness thresholds for producing streamflow less often. The ratio of runoff to rainfall shows that on average, 18% of annual rainfall becomes streamflow, with values for individual years ranging from as low as 1% in 2017 to 48% in 1971.

Years with the lowest rainfall were not always those with the lowest runoff or runoff ratio: seasonal distribution, rain intensity and the duration of a dry period made a difference. Several below-average rainfall years in a row were found to result in progressively declining runoff ratios as seen in 2008–2010 and 2016–2017, such that a year with higher rainfall occurring later in a prolonged dry period can produce less streamflow than a lower-rainfall year occurring earlier in the drought.

Winter rainfall tended to produce a higher streamflow response, likely because evaporative demands are lower, as shown in Figure 4 illustrating monthly rainfall vs PET. The average winter runoff ratio was 20% versus 13% in summer. Years with more rainfall had higher runoff ratios ($R^2 = 0.52$, $p < 0.1$), but winter rainfall was a stronger predictor than total annual rainfall ($R^2 = 0.60$, $p < 0.1$). Although the long-term average showed a near-even split of rainfall between seasons, 67% of the Kromme's streamflow came in winter months.

The Mann-Kendall trend test (Mann 1945, Kendall 1975) was applied to both annual and seasonal rainfall, PET and runoff to determine if there is any statistical evidence of progressive change over time, over and above the interannual variability. Results indicate a statistically detectable declining trend in both annual rainfall (MK test statistic z = -1.37, p = 0.08) and winter rainfall (z = -1.41, p = 0.08) in the Kromme from 1960–2018, with no indication of a trend over time in summer rainfall (z = -1.0, p=0.3).

PET showed clearer evidence of an increasing trend in annual, winter and summer values (z values 3-5, all p-values <0.01). Annual and winter runoff totals showed detectable declining trends (z = -1.9 and -2, p= 0.03, and 0.04), in keeping with the rainfall, as did the annual and winter runoff ratios (z = -1.6 and -1.9, p = 0.06, and 0.08), in keeping with the increase in PET overall. No trends were detectable for summer runoff (all p-values > 0.01).

These observed trends are in general agreement with climate model predictions for future decades for the region.

More to do, for everyone

Water managers and users are well aware of the problem given the Algoa Water Supply System has had supply shortfalls and needing use restrictions in 2009–2010, 2017–2018 and again in 2020. The current dam levels in the system are similar to the extremely low

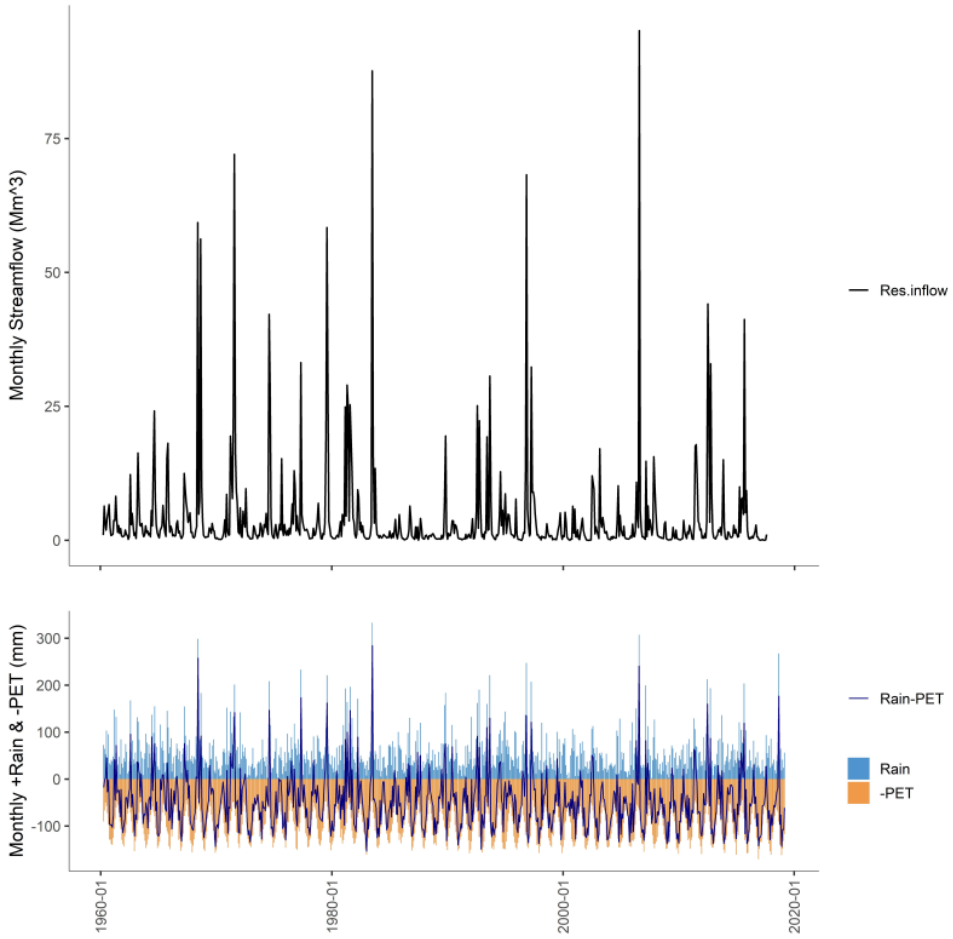

Figure 4: Monthly rainfall, PET (expressed as a negative value) and the rain-PET deficit shown with estimated monthly streamflow from the Kromme catchment (Kromrivier Dam reservoir inflow).

Figure 5: The area supports fruit orchards, dairy and small stock farming.

values observed in mid-2018 when a very large rainfall event in September 2018 helped the system rebound.

We can only hope that happens again soon for some short-term relief; however, the longer-term analyses and modelled climate predictions do suggest a continuing drier future for this region on average. This should be accounted for in planning going forward.

The sensitivity of the catchment streamflow response to evaporative demand further supports the need for removal of invasive alien plants which heighten the evaporative losses. SAEON researchers and students are continuing to do hydrology research in the Kromme catchment with the aim of improving hydrological modelling for change prediction.

Further reading

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Figure 6: Nelson Mandela Bay's second-biggest supply dam, the Impofu Dam, has reached critical levels (Image: NMBM).

Research reveals infertile spikelets contribute to yield in sorghum and related grasses

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Much of the food we eat comes from grasses such as rice, wheat, corn, sorghum, and sugarcane. These crops still resemble the wild species from which they were derived. In all grasses, the structures that contain the flowers and seeds are called spikelets. In the tribe Andropogoneae, a major group of grasses that cover 17 percent of the earth's surface, the spikelets come in pairs, one of which bears seed and one of which doesn't (although in some species it produces pollen).

This structure can be seen clearly in sorghum, and in the many wild grasses that make up North American prairies and African grasslands. It's tempting to think that spikelets that don't produce seeds are useless, but the fact that they have been kept around for 15 million years implies that they have an important function.

A team of scientists at the Donald Danforth Plant Science Center, in laboratories led by Elizabeth (Toby) Kellogg, PhD, member and Robert E. King, Distinguished Investigator, and Doug Allen, PhD, associate member and USDA research scientist, set out to answer the questions; could this apparently useless floral structure capture and move photosynthetic carbon to the seed? And, ultimately, if removed, would we notice a difference in yield?

The researchers used radioactive and stable isotopes of carbon, RNA-seq of metabolically important enzymes, and immunolocalization of Rubisco to show that the sterile spikelet collects carbon from the air and carries out photosynthesis while the awn does not. By tracking the flow of carbon, they discovered that the infertile spikelet transfers carbon to the seed-bearing one which appears to use it for energy, storing it in the seed. When they removed the infertile spikelet from a subset of the branches of sorghum plants, they found that seed weight (yield) was lower by ca. 9%.

Figure 1: Sorghum. Credit: Public Domain

"We used to think these floral structures might be vestigial, but they turned out to be quite the asset in terms of productivity," said first author, Taylor AuBuchon, senior technician in the Kellogg lab.

The findings, sterile spikelets contribute to yield in sorghum and related grasses were recently published in the journal *Plant Cell*.

"This is a great example of how plant organs and structure can contribute to biomass and yield in ways not previously described," Allen said.

"This project was incredibly rewarding because of the strong collaboration, creativity and determination of everyone, sharing expertise, designing and conducting the experiments and analyzing the data together," Kellogg reflected.

In addition to the unique collaboration, Kellogg and Allen also attribute the success of the project to the expertise and cutting-edge technology provided by the Advanced BioImaging, Plant Growth and Proteomics and Mass Spectrometry facilities at the Danforth Center.

The next step would be to determine to what extent infertile spikelets affect yield in diverse varieties of field-grown plants. Existing sorghum diversity could indicate whether the size of the infertile spikelet affects the size of the seed.

More information

Taylor AuBuchon-Elder et al, Sterile Spikelets Contribute to Yield in Sorghum and Related Grasses, The Plant Cell (2020). DOI: 10.1105/tpc.20.00424

Tackling a BIG problem in a SMALL grassland: Beating bracken for biodiversity's sake

The Limpopo Province's most threatened vegetation type is it's just over 2 000 km² of grassland. Mostly situated at the northern limit of the Great Escarpment, these grasslands constitute the Wolkberg Centre of Endemism, supporting high levels of often unique biodiversity, much of which are of conservation concern

Dr Dave Thompson

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Threatened plant species here include *Indigofera rehmannii*, *Inezia speciosa*, *Merwilla plumbea* and *Aloe lettyae* (Figure 1). In recent years, SAEON's Ndlovu Node has supported efforts to collect the baseline data necessary for the long-term monitoring and population assessment of this endangered flagship Aloe species, which is endemic to the critically endangered Woodbush Granite Grassland.

In 2016 it was estimated that less than 6% of this grassland type remained untransformed, restricted to just 10 isolated fragments. The largest of these includes the 126-hectare Haenertsburg Nature Reserve site of over a decade of vegetation fire-response monitoring by the SAEON Ndlovu Node (Figure 2).

Findings from this show that even frequent application of fire as a management tool cannot prevent transformation of the diverse herbaceous layer, with indigenous (and to a lesser degree exotic) woody species rapidly taking hold. On the back of these findings, reserve management now prioritises burning and the ongoing assessment of woody encroachment.

Symptomatic of this encroachment is the presence of bracken fern – *Pteridium aquilinum* (Figure 3), which is singled out in the Haenertsburg Nature Reserve management plan as needing to be closely monitored, and strategies to control its spread need to be investigated.

But why the special attention?

In 2011 the species occurred in 8% of periodically burned permanent vegetation plots being monitored by SAEON; in 2020 that figure had nearly doubled to 15%.

Figure 1: Grasslands are hyperdiverse systems, often containing endemic and threatened forb taxa. Examples from Limpopo include (from left): *Indigofera rehmannii*, *Inezia speciosa*, *Merwilla plumbea* and *Aloe lettyae*. (Photos: Sylvie Kremer-Köhne)

Figure 2: Dr Dave Thompson and Mightyman Mashele have been monitoring vegetation in permanent monitoring plots in the species-rich grasslands of the Haenertsburg Nature Reserve since 2009. (Photo: Sylvie Kremer-Köhne)

Bracken is one of the most successful invasive plant species in the world – indeed it has the widest distribution of any plant taxa and occurs in woodlands and grasslands in subtropical and temperate regions the world over. Once

Figure 3: Mismanagement of grasslands often leads to encroachment by non-herbaceous or 'woody' species. One such species – Bracken fern (Pteridium aquilinum) – can rapidly establish in dense stands. (Photo: Dave Thompson)

Figure 4: Beneath the continuous frond canopy of the bracken, the environment lacks a crucial plant resource – sunlight, and the soils are toxic from bracken exudates. Few, if any, indigenous species are able to persist here. (Photo: Dave Thompson)

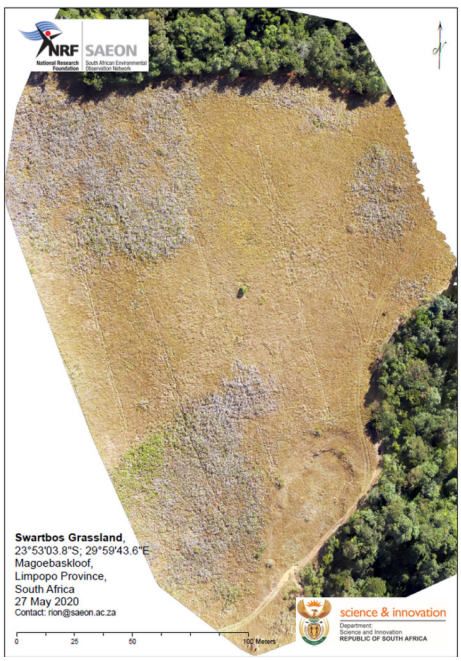

Figure 5: A small and isolated grassland fragment, which is typical of grasslands in Limpopo and more broadly, faces a big challenge. Encroachment by bracken, seen as grey in this aerial drone image, threatens local biodiversity. (Image: Rion Lerm)

established, it is difficult to eradicate because of its persistent underground rhizomes and large reserves of carbohydrates which favour vegetative spread, a tolerance of (indeed the species reportedly benefits from) physical disturbance, including fire, and toxicity to herbivores which means the species is little affected by animals.

Studies from around the world have linked the establishment of bracken across various habitats with the concurrent decrease in local species richness due to competitive exclusion by *P. aquilinum*. The high density of the bracken frond canopy, accumulation of sub-canopy litter and allelopathic exudates from the plant tissues combine to create a shaded, resource-limited and toxic environment that suppresses the germination, growth and survival of indigenous flora (Figure 4). In short, the establishment of bracken in dense stands is an ecological disaster, diminishing local biodiversity and ceasing the provision of associated ecosystem services.

The grasslands of Limpopo – being hyperdiverse, highly fragmented and under threat, are a microcosm for the status of grasslands globally. Now, a tiny grassland fragment – just over three hectares in size, has come into the spotlight in the global fight against bracken (Figure 5).

Figure 6: Frond growth following the winter dormancy will be removed from experimental bracken-eradication areas. Subsequent regrowth will be removed periodically throughout the growing season in an attempt to deplete the below-ground reserves. (Photo: Dave Thompson)

Starting in 2020, a collaborative effort between the SAEON Ndlovu Node, the national Department of Environment, Forestry and Fisheries and the non-profit organisation Friends of the Haenertsburg Grasslands, embarked on documenting the diversity of the grassland flora in bracken-encroached and adjacent bracken-free areas (Figure 7). The baseline data collected now (Figure 8) is invaluable for several reasons: 1) to generate a list of species which persist despite the presence of the bracken; 2) to identify traits associated with the persistence of indigenous flora; 3) to pinpoint the percentage cover value for bracken beyond which local species richness declines; and 4) to act as the benchmark against which to measure the efficacy of control measures.

When the new bracken growth emerges after the winter dormancy (Figure 6), a rigorous and ongoing campaign of frond cutting will be implemented in parts of this so-much-more-than-a-grassland, paving the way towards documenting the process, rate, trajectory and magnitude of local biodiversity recovery.

It is a botanical biodiversity story of David and Goliath. And we all know how that story ended.

Figure 7: Below ground bracken exists as a network of widely creeping, branched rhizomes. These are carbohydrate-rich, enabling rapid colonisation of adjacent open grassland. (Photo: Dave Thompson)

Figure 8: Sylvie Kremer-Köhne (Friends of the Haenertsburg Grasslands) and Thikhathali Netshikweta (Department of Environment, Forestry and Fisheries) aided in assessing the herbaceous plant community. Response of this community to further bracken encroachment will be monitored in the coming years. Similarly, monitoring will take place in areas where bracken eradication measures are implemented. (Photo: Dave Thompson)

Trusting local knowledge: the case of fire management in a Namibian park

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Fire and humans have a long history in African savannas. Fire management has played a role in maintaining biodiversity and in the livelihoods of rural communities. One example is when rural people in west African savannas in Mali burn a "seasonal mosaic" in the landscape. A combination of unburned, early burned and recently burned vegetation reduces the risk of more dangerous fires late in the season.

This type of burning also protects and increases biodiversity. And it enables rural people to hunt animals, gather plant foods and regenerate grazing for cattle. Understanding this history is useful when managing contemporary fire regimes.

The Bwabwata National Park in north-east Namibia has a long and complex history of fire management. The park lies at the centre of southern Africa's Kavango-Zambezi Transfrontier Conservation Area. The park is unusual in that people live in it alongside wildlife, unlike many conservation areas where people have been excluded from the landscape. People living in the villages use areas zoned for subsistence in the form of livestock and crops, and sourcing wild resources like edible and medicinal plants. These areas also host community-based tourism projects and trophy hunting enterprises.

Both the Khwe-San (former hunter-gatherers) and Mbukushu (agro-pastoralists) used fire as part of hunting and agropastoral practices in the area for millennia. These traditions were disrupted by colonial occupation because of a belief that they were damaging to the environment.

Figure 1: A late-season fire in Bwabwata National Park (Conor Eastment)

Managed burns have only recently been reinstated formally in policy. The government now encourages the use of burning for management purposes early in the dry season to prevent the spread of large fires in the late dry season.

We carried out research into how, when, why and where people have used fire in the park. We believed it would help to integrate local ecological knowledge with today's ecological management practice.

Based on our findings, we argue that understanding this history is crucial to designing effective fire management to maintain biodiversity and support the livelihoods of people who live in the park.

Politics and fire

Fires were banned in Namibia for over a hundred years (1884 to 2005), under colonial policies and in the early years of independence. This was because fire was largely misunderstood by the government. The belief was that the traditional burning practices of the Khwe-San people were unsustainable and

damaging, especially for large valuable trees used in the forestry sector for railways, mines and timber production. The banning of local fires disrupted practices central to people's subsistence, culture and their way of life.

Before independence in 1990, this area was exposed to decades of war, political and inter-ethnic conflict and deforestation. It resulted in pressures on diminishing natural resources for rural communities. During the Namibian independence struggle (1960s-1989), the South African Border War took place in the region and the park was used as a military training ground.

The Khwe-San people, renowned trackers and formidable hunters, were employed by the South African Defence Force as soldiers. These socio-political circumstances disrupted cultural fire practices over a period of three decades.

After Namibia's independence in 1990, political focus shifted to the tensions between pastoralist and former hunter-gatherer communities, as well as the need to sustain local livelihoods alongside nurturing an international tourism industry. Still, colonial policies of fire suppression persisted, and fires were only permitted again in 2006.

In our study, we surveyed the Khwe-San and Mbukushu communities, park management and fire focused stakeholders. These included government staff responsible for the Namibian wildlife and forestry sectors, non-governmental organisations, academic researchers and environmental consultants. We found that most people preferred the use of deliberate fires, set early in the dry season, to policies of fire suppression.

This finding highlights the importance of the consideration of cultural fire knowledge, history and diverse management perceptions. The confluence of indigenous fire practices and modern fire policies could benefit local fire management relations, as the local people have always been blamed for unfavourable fires in the park. It turned out that fire doesn't need to be a source of tension in the park because all the stakeholders actually agree on best practice.

Our study revealed how today's fire management policies have roots deep in human history. Until recently, local burning knowledge and practices have been largely unrecognised by national government officials in southern Africa.

Important traditional knowledge

We found that the Khwe-San's knowledge of traditional burning practices has been passed down over many generations. Fires started early in the dry season (April to July) encourage the growth of edible plants, an important food resource. Fires were also used by the Khwe-San for healing ceremonies, to open up dense stands of vegetation that could harbour dangerous wild animals, to remove parasites, control diseases and sustain habitat for medicinal plants. Importantly, these early season fires help to prevent large late-season fires that cover wider areas and burn more intensely.

Figure 2: A Khwe-San woman collects false mopane seeds for the pot from a tree above a burnt patch of grass (Glynis Humphrey)

The Mbukushu people use fires early in the dry season to regenerate grasses for livestock, and late season (August to November) fires to prepare fields for growing vegetables in the rainy season. Not all fires are perceived as good, as sometimes fires used in crop fields cause "runaway" fires in the park. But the use of fire in the late season is a critical component of food security for people living in the park. Fire in the late season is necessary for growing crops but negatively affects wild food resources in the park.

Today, controlled fire is generally accepted as an ecological tool to manage vegetation and help determine where and when wildfires happen. As the Khwe and Mbukushu people know, burning off patches of grass in the early dry season reduces the spread of hot fires late in the season when the grass would be very dry and ignitable, and ambient temperatures are high.

Modern scientific studies have also found that cooler fires in the early season result in partially combusted grass and therefore release less carbon into the atmosphere. This means they can potentially lessen the contribution of fires to global climate change.

Our study highlights the often-neglected importance of indigenous knowledge in fire management. The hope is that traditional practices are respected and properly acknowledged by policy-makers and managers in the future.

It is also important to understand and acknowledge the history and cultural dynamics of fire, alongside the reasons people use fire. This is critical for managing fires in the future.

Overberg farmers open hearts to conservation of renosterveld

Farmers in the Overberg Wheatbelt who previously viewed renosterveld as wasteland are now conserving it for future generations

Dian Spear

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According to Dr Odette Curtis-Scott, it is estimated that "less than 5% of renosterveld vegetation remains". This vegetation type, which is part of the highly diverse Cape Floristic Region "has borne the brunt of the plough on an extreme scale", says Curtis-Scott.

Many people may not know renosterveld is considered to be "the richest bulb habitat on earth", she explains. In addition to the habitat being destroyed for the planting of crops, it is also threatened by being fragmented into small areas surrounded by monoculture and affected by pesticides and other chemicals, unnatural fire regimes, alien vegetation, illegal ploughing, overgrazing and the destruction of watercourses.

Due to the sad state of affairs, active management is necessary to save what remains of this special habitat. However, getting people to care about renosterveld is difficult.

"It looks like an homogenous, grey, drab shrubland and is considered the ugly sister of fynbos, and it has been overlooked, understudied and under-conserved forever," Curtis-Scott explains. Farmers often refer to it merely as uitvalgrond (surplus ground) or bossieveld (shrub veld) and perceive it as worthless.

Curtis-Scott laments that the renosterveld ecosystem in the Overberg is so degraded that it does not provide any ecosystem services that can be assigned a monetary value, so this cannot be used as an argument for its conservation.

"Most of the water that goes through the system is brackish, which can't be used for farming, and we are bringing in bees in hives to pollinate canola. We are not using natural pollinators. There aren't enough of them left in the landscape."

Figure 1: Endagered *Moraea comptonii* © Odette Curtis-Scott

Figure 2: Grey rhebok © Odette Curtis-Scott

So, how has the Overberg Renosterveld Conservation Trust (ORCT) changed the perception of farmers towards renosterveld?

Curtis-Scott explains that the way to get farmers to care about nature is by "making them feel something in their hearts", adding, "The way we have won over all these landowners we are working with today is through showing them what they have and getting them to fall in love with it.

Figure 3: Horsefly on *Tritonia deusta* © Odette Curtis-Scott

Figure 4: *Aristea biflora* © Odette Curtis-Scott

Figure 5: *Nemesia barbata* © Odette Curtis-Scott

Figure 6: *Moraea atropunctata* © Odette Curtis-Scott

"The incredible diversity of gems is mostly only apparent at burnt sites the first or second spring after fires, when renosterveld is in its full glory, and this doesn't happen very often. And if you don't get down on your hands and knees and see what's going on in a system you may miss out on a lot of information and the gems that you would otherwise be able to enjoy there."

Curtis-Scott continues: "Despite the horrendous fragmented state, renosterveld has an incredible diversity of plants, insects, birds, mammals and reptiles still hanging in there."
With the agreement of farmers, the ORCT starts by undertaking field surveys, recording all the plants and animals found. Then, farmers are given a report with colourful photographs showing the rare and special species detected.

"This is the first step in opening their eyes to what is actually in their veld and shows that it is not just a grey, drab shrubland, but there is actually more to it and an incredible amount of diversity," says Curtis-Scott.

Over time, the ORCT further builds relationships with farmers and, when the farmers seem open to it, they discuss the possibility of committing to a "voluntary conservation servitude with title-deed restrictions in perpetuity, which makes sure that the veld is safe for future generations".

So far, nearly 3,000ha have been signed up — all on account of getting farmers to care about unique and special stretches of land.

The ORCT assists landowners with alien vegetation clearing, ecological burning at the correct time, putting up fences to control livestock access, watercourse management and erosion control.

Curtis-Scott and five co-authors have recently published Field Guide to the Renosterveld of the Overberg, which she says "is a wonderful tool to show that it is not just bossieveld, uitvalgrond or renosterbos veld, but there is actually a whole lot more to it". The book details more than 980 plant species, 140 creatures — from invertebrates to mammals, management guidelines, ecological information, conservation issues, red listing and the names of some of the farming champions.

Curtis-Scott quotes John Sawhill saying, "A society is not only defined by what it creates but what it refuses to destroy."

Dr Dian Spear is a freelance science editor and writer focusing on wild nature and sustainability. She has a PhD in zoology from Stellenbosch University and has published scientific papers in the fields of biodiversity conservation and adaptation to climate change.

It's not magic: Mysterious 'fairy circles' are built by grasses

Stephanie Pappas

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Fairy circles might finally make sense. These regular barren patches that pop up in grasslands in Australia and Namibia have long created controversy, with some researchers arguing that they might be the result of underground termite activity. But now, the most detailed monitoring effort ever shows that fairy circles are engineered by the grasses themselves.

The research, published Sept. 21 in the Journal of Ecology, reveals how harsh, dry conditions in Australia, punctuated by occasional heavy rainstorms, create a hostile crust of clay that makes up the barren part of the fairy circles. But water runs off this crust, creating a relative oasis at its edges where grasses can make a home. It's a self-fulfilling cycle: Where there are no plants, weathering from rain and sun makes the soil ever more inhospitable, while areas where grass has managed to grow become a safe haven, where the vegetation cover lowers the soil temperature by up to 77 degrees Fahrenheit (25 degrees Celsius), traps water and allows new seedlings to take root.

"This is the positive feedback, where plants do 'self-organized patch formation:' They do ecosystem engineering to benefit as much as possible from the limited water in this harsh environment," study lead author Stephan Getzin, an ecologist at the University of Göttingen and the Helmholtz Centre for Environmental Research in Germany, wrote in an email to Live Science.

Self-organizing patterns

Getzin and his colleagues had previously theorized that fairy circles are an example of what's called a Turing mechanism. This is a type of pattern formation first identified by English mathematician Alan Turing, in which spotted or striped patterns arise naturally from the interaction of two substances.

But to clinch this explanation for the

Figure 1: The active formation of nearly circular grassland gaps (fairy circles), as seen from a helicopter. © S Getzin, University of Göttingen

Figure 2: A drone image of the weather station and a fairy circle from above. All cables of temperature and soil-moisture sensors have been buried underground. © S Getzin, University of Göttingen

bizarre speckled pattern in arid grasslands, the researchers needed hard evidence. They hauled 175 pounds (80 kilograms) of drone equipment and environmental monitors 745 miles (1,200 kilometres) to Newman, Australia, a remote outpost in Western Australia. They used the drones to get a bird's-eye view of the arrangement of the fairy circles outside of town, where the air temperature can reach 118 °F (48 °C) in the summer.

They also monitored the fairy circles on a detailed scale, setting up a weather station and soil-monitoring equipment about an inch beneath both barren and vegetated parts of the landscape. The desert outside of Newman is dominated by a single group of grasses in the genus Triodia. This is key to the formation of the fairy-circle patterns, Getzin said, because if there were more grass species around, they would take advantage of different ecological niches and likely cover the barren spots.

The monitoring showed that brief, intense rainfall pounds the coarse sand on the surface into fine silt and clay. The clay acts like a plug between the grains of sand, sealing off the surface. It only takes a couple of hard rains to create this crust, Getzin said. After that, the rainwater runs off rather than penetrating the ground.

Circles of life

However, Getzin said, this runoff also creates the potential for plants to survive in gaps between the barren zones. The remarkably regular, honeycomb-style pattern of 13-foot-diameter (4 meter) fairy circles forms because the plants are availing themselves of as much of this gap space as possible; the barren circles in between end up as far from each other as they can be. The regular, circular structure benefits the plants, too, because each gap's runoff is taken in by the maximum number of plants.

The soil monitoring also showed that the soil under the vegetation is much, much cooler than that in the barren patches. Getzin and his team once measured the top centimetre of the barren crust at 167 °F (75 °C), well into egg-frying territory. The new study, which measured soil temperatures 2 centimetres down, found that vegetation lowered the soil temperature dramatically in the midafternoon when temperatures were highest. The cooler soil temperature makes it possible for seeds to germinate and seedlings to grow, Getzin said.

The field monitoring happened to coincide with a wildfire that cleared the desert of grasses, but the same patterns re-emerged when the grasses started again from zero, the researchers found.

"We could show for the first time with many and very detailed field investigations that Turing's theory and all the assumptions in the model/theory are indeed met in nature," Getzin wrote in his email.

Getzin and his team are now doing a similar project in Namibia, where the fairy circles look similar but grow in sandy, rather than clay-rich soil. The different soils mean that the mechanisms for the formation of the circles must be different, Getzin said, but they are still almost certainly forced by the limits on water in the arid environment.

"How else can, in Namibia, perfectly circular grass rings form if it is not the competition of the grasses?" Getzin said.

Figure 3: Drone image of the Australian fairy circles, taken at a flying altitude of 130 feet (40 meters). © S Getzin, University of Göttingen

Pasture-based dairy: what is possible?

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Many dairy farmers in South Africa are very progressive. In my experience, farmers have done well to push for greater efficiency in their systems. It could leave some people asking, is there still room for much more improvement? My answer, absolutely!

The Challenge of sustainability

Sustainability is not something that can be achieved and then you sit back. It is a constant pursuit of ensuring long-term profitability, reducing environmental impact and being socially responsible. It is an ever-evolving goal.

I am looking at the question of what is possible in the future for pasture-based dairy farms through the lens of sustainability. Most importantly, for this article, I want to focus on the influence that reduced input costs have on long-term resilience. Reduced input costs mean a farmer is less subject to availability and cost of feed, fertiliser, electricity, and fuel. Not only do reduced inputs lead to resilience, but also reduced environmental impacts. The production of these inputs has associated greenhouse gas emissions, as do the use of fertiliser and fuel.

Reduced inputs sound great, but I am sure the question you are all asking is, what about production? Well, that is a good question.

Optimising Production

One of the points I always like to emphasise about sustainability is that it is about optimising production, not maximising it. The problem with optimising is that it differs between contexts, and therefore from farm to farm. There is no one formula for figuring out how to optimise production with any given set of inputs. This is something each farmer must figure out for themselves.

That said, what we can do is look at some of the principles which assist in the optimisation of production. The main ones I will focus on in this article are:

- Improving soil health – healthier soil supports more abundant and better-quality pasture growth, with lower fertiliser inputs.
- Improving pasture quality – improved pasture quality supports higher milk production, and a higher percentage of pasture in the total diet, i.e. better-quality pasture leads to a smaller need for concentrates.
- Decreasing heifer replacement rates – a decrease in the number of heifers required to replace culled cows each year results in a need to rear less heifers, where an emphasis can be placed on optimally rearing only the best heifers.

Levers

There are many factors on a farm which farmers have no control over. This in-

Figure 1: Dairy cattle grazing on pasture.

Factors	Normal	Conservative	Progressive	Ultimate
Irrigated area (ha)	226.2	226.2	226.2	226.2
Irrigated dry matter production (tons/ha)	19.9	19.9	19.9	20.9
Dryland area (ha)	226.2	226.2	226.2	226.2
Dryland dry matter production (tons/ha)	14.1	14.1	14.1	15.8
Pasture quality (NDF %)	47.9	43.5	41.3	40.2
Cows in milk (herd size)	1 100	1 000	1 000	1 075
Dry cows (herd size)	187	170	170	183
Heifers (herd size)	770	700	630	640
Stocking rate (total animals/ha)	4.5	4.1	4.0	4.2
Milk production (total litres)	7 700 902	5 923 770	6 664 242	7 482 463
Milk production (l/ha)	17 022	13 094	14 731	16 539
Milk production (l/cow/day)	19.2	16.2	18.3	19.1
Milk production (l/100 kg liveweight)	1 300	1 100	1 238	1 293
Concentrates fed to CiM (kg/CiM/day)	5	0.5	0.5	0.5
Concentrates fed to CiM (g/l)	260.4	30.9	27.3	26.2
Nitrogen fertiliser (kg/ha)	170	119	101	89
Nitrogen fertiliser (kg/ton pasture DM)	10.0	7.0	5.9	4.9
Carbon footprint (kg CO2e/kg FPCM)	1.29	1.24	1.11	1.05
Nitrogen use efficiency (%)	51%	79%	102%	125%

Table 1: Four different farm scenarios, showing the impact of changes in management practices

Changes made relative to Conservative scenario	Progressive	Ultimate
Decrease NDF	5.0%	7.5%
Increase herd size	0.0%	7.5%
Increase milk production	12.5%	17.5%
Decrease heifer replacement	10.0%	15.0%
Decrease fertiliser	15.0%	25.0%
Decrease electricity	15.0%	25.0%
Decrease diesel	15.0%	25.0%
Increase irrigation growths	0.0%	5.0%
Increase dryland growths	0.0%	12.5%

Table 2: Changes in factors between the conservative scenario and the progressive and ultimate scenarios

cludes the weather, the milk price, and the prices of concentrates, fertiliser, fuel, and electricity. Although these are things farmers need to be aware of, it is pointless agonising over them. A farmer's energy is better served focussing on things which they can control.

These include the principles which I mentioned above. You could think of various management practices on a farm as levers. When these levers are applied according to the principles, production is optimised. For example, by implementing no-till practices, multispecies pastures, smart fertilisation strategy and ideal grazing management, soil health and pasture quality can be improved. Another example is that by improving herd management that leads to healthier animals, therefore greater longevity, and by obtaining higher fertility rates, lower heifer mortality and better heifer rearing the number of heifers needed each year can be reduced.

The impact of applying these levers

I would like to use a theoretical farm in the Tsitsikamma as an example of the impact that applying the levels in the correct way can have on the sustainability of a farm. I have created a model farm based on averages of data from 23 farms on the Trace & Save database. These are all mixed irrigation and dryland farms.

I have used four different scenarios, where the levers discussed have been applied to different extents. The first scenario is a relatively normal, productive farm under current circumstances. The other three scenarios show the effects of some big changes to the way pasture-based dairy farms are thought about and managed. The three are categorised as conservative, progressive, and ultimate in terms of the level to which these changes have been implemented.

The four scenarios have been laid out in Table 1 below. Factors which were kept constant were the size of the farm (452.5 ha), the size of the cattle (450 kg cows in milk), butterfat (4.4%), protein (3.6%) and the type of inputs used. Everything else was subject to the changes brought about by applying the various levers.

Fundamental change in thinking

The two most important changes in these models were the absolute minimisation of concentrates, and the reduction in nitrogen fertiliser. Most farmers will probably look at the concentrate and nitrogen figures and say that these milk productions and pasture growths are not possible under these scenarios. And I get why you would say that – these figures have never been achieved. But they are theoretically possible.

The feed provided in these scenarios is sufficient to support the milk productions mentioned. The caveat is that the pasture quality needs to be at the specified levels. To achieve that we need high quality, multispecies pastures.

We also know that these levels of pasture growth are possible with such low fertiliser inputs (Growing pasture with minimal nitrogen fertiliser). The caveat here is that we need healthy soils to achieve this. Practices which improve soil health should be prioritised.

The challenge is then to take advantage of improved soil health. This is where I think many farmers still have a mental block. To achieve this level of progress, we need to change the way we think about fertiliser and the way we manage pastures. It is a huge mental shift.

To achieve these levels of production using such low concentrates it is also imperative that we calculate stocking rates intending to maximise pasture intake. Conventional wisdom says that a cow can take in 1.2% of their body weight in NDF each day. We have found this factor to be closer to 1.5%, especially in smaller cattle. For this exercise I used 1.4% and stocked the farm so that cattle would eat the maximum amount of grass (and silage) every day. By improving pasture quality, therefore reducing the NDF and increasing the energy, cows can eat more pasture and produce more milk from pasture.

The changes mentioned above were the basis for the change between the normal and other three scenarios.

Economic factors	Normal	Conservative	Progressive	Ultimate
Milk production (total litres)	7 700 902	5 923 770	6 664 242	7 482 463
Milk income	***R38 504 508***	***R29 618 852***	***R33 321 209***	***R37 412 313***
Concentrates (CiM tons)	2002	183	183	196
Concentrates (DC tons)	68	12	12	13
Concentrates (Heifer tons)	369	146	131	133
Concentrates cost	R11 009 035	R1 555 229	R1 486 609	R1 561 239
Fertiliser (LAN tons)	275	192	163	144
Fertiliser (K2SO4 tons)	73	51	44	38
Fertiliser (lime tons)	792	792	792	792
Fertiliser cost	R2 545 625	R1 874 160	R1 640 538	R1 484 790
Electricity (kWh)	808 081	808 081	686 869	606 061
Diesel (litres)	59 259	59 259	50 370	44 444
Fuel cost	R1 611 044	R1 611 044	R1 369 387	R1 208 283
Costs	***R15 165 704***	***R5 040 432***	***R4 496 534***	***R4 254 312***
Profit on costs included	**R23 338 804**	**R24 578 420**	**R28 824 675**	**R33 158 001**
Profit/ha	**R51 589**	**R54 329**	**R63 715**	**R73 294**

Table 3: Income versus costs of the four scenarios considered using the model farm

Going beyond the fundamental change

The progressive and ultimate scenarios require a huge leap in thinking and practices from the current convention. Table 2 shows the changes that were incorporated in the model between the conservative, progressive and ultimate scenarios.

From the normal to the conservative scenarios, focus was placed on increased pasture quality (i.e. decreased NDF) and improved soil health (i.e. decreased fertiliser). The other big difference is in concentrates fed. The goal of this exercise is to fundamentally challenge the current thinking on dairy production. The biggest variable costs on dairy farms is concentrates. By feeding minimal concentrates (i.e. 0.5 kg/CiM/day), this completely changes the dynamic of current thinking.

The impact of feeding such little concentrates under the conservative scenario is that stocking rate and milk production must decrease. Table 3 below shows the impact this all has on the profitability between the systems. I know many farmers who would still choose the normal system, because it has higher production, but the conservative system is more profitable per hectare. I understand that the real world of dairy farms is a lot more complex than this, but I think this should give farmers something to think about.

When we start considering the changes made to get to the progressive and ultimate scenarios, it creates what I hope dairy farmers would find an interesting, and exciting prospect. The key is the further improvement in pasture quality (i.e. decreased NDF). The lower the NDF gets, the greater the pasture intake. This initially supports increased milk production (progressive scenario) and then supports increased stocking rate as well (ultimate scenario).

The change in heifer replacement is linked to what was discussed above with regards to improvements to herd management. This is necessary to contribute to the increase in cows in milk, and therefore increase in milk production per hectare.

The change in fertiliser, with an associated increase in growths under the ultimate scenario, is associated with improved soil health. This is the part that will take concerted, consistent effort and focus from farmers to get right. It is also something that needs to be earned on a farm, it will not happen overnight. Improved soil health means a thriving, balanced soil food web which efficiently cycles nutrients in the soil. It also means a balanced soil fertility, linked to the thriving soil life. Further to that, it means a well-structured, aerated soil which allows for movement of air and water, creates ideal habitat for soil microorganisms and allows for easy root growth and development. Achieving this level of soil health will drastically decrease a farms reliance on fertiliser. It will also lead to an increase in consistent growth of high-quality pastures.

The decreases in electricity and diesel are associated with overall improvements in farm efficiency. Most notably, with improved soil health, irrigation will be a lot more efficient, therefore saving on electricity. A decrease in fertiliser usage will also lead to a decrease in diesel, as diesel for fertiliser is a big contributing factor. Improved soil health should also lead to a general decline in work needed on pastures, for example spraying pesticides and ripping.

The economics

I completely understand that I have not included all the costs on a dairy farm in this exercise, but I have included the most important variable costs. Many of the costs which I have not included would remain constant, or potentially decrease with the more progressive scenarios. Table 3 gives an overview of the income versus costs of the different scenarios.

Once again, I would challenge farmers to think about profit per hectare as the most important indicator of economic success. It seems obvious, land is the main limiting factor to growth, and therefore it is the common denominator with which to assess the profitability of an operation.

That said, it is so often that I come across an emphasis on total production, or production per cow, or total turnover as the focus.

Based on turn-over, you would choose the normal scenario, even though this is the least profitable. Based on production per cow, you would also choose the normal scenario. It takes a different approach, and new way of thinking, to appreciate that the conservative approach is better (more profitable) than the normal approach. And the progressive and ultimate scenarios are just building further on this.

It is a process

It should be emphasised that it is a process to reach the ultimate scenario. I do not expect farmers to see this and change their systems overnight. I am challenging farmers to think differently about how their farm systems are set up, especially in terms of their reliance on concentrates and fertiliser inputs. There is an alternative approach to the current convention.

I encourage farmers to assess their current farm system. What are the opportunities on the farm? If you want to move away from the normal, to the more progressive systems, what do you need to change? Where is the best place to start?

Trace & Save can help you with these questions, and with measuring your progress along the way. Improving a farm is a constant, adaptive process. Every farm is different, and the situation is ever-changing. Only by measuring the correct indicators can we identify opportunities and adapt farm systems accordingly.

One of the world's driest deserts is the focus of a new study on our changing climate

Arizona State University

Current Address: South Africa
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Carbon, one of the main building blocks for all life on Earth, cycles among living organisms and the environment. This cycle, and how it works in one of the driest places on Earth, is the subject of a new study recently published in the journal Plant and Soil with lead author and Arizona State University (ASU) scientist, Heather Throop.

While the natural carbon cycle should be balanced each year, with about as much carbon taken out of the atmosphere as is released back by natural processes, humans are upsetting this balance through carbon dioxide additions to the atmosphere, both through changing land use that releases carbon stored in soils and from burning fossil fuels.

In an effort to understand what controls the release of carbon dioxide from soils in deserts, Throop and a team of university students from Namibia conducted fieldwork in the Namib Desert, one of the world's driest regions that stretches more than 1,200 miles along the Atlantic coasts of Angola, Namibia, and South Africa.

What Throop and her team ultimately determined from their research is that subtle differences in surface topography and erosion have big influences on microorganisms in the soil and these differences ultimately affect carbon cycling. Even in the driest places, they found signs of life influencing carbon cycling.

"The amount of carbon dioxide in the atmosphere affects our climate, so understanding what affects the release of carbon from soils is important predicting how climate will change in the future," says Throop, who is an associate professor in the School of Earth and Space Exploration and the School of Life Sciences.

To conduct their analyses, the research team chose six locations that differed in yearly rainfall. At each site they carried out 48-hour sampling campaigns, working continuously day and night to collect data. At each location, the team analyzed the landscape structure and plants and selected representative locations to sample. Then, they simulated rainfall and used gas analyzers to measure carbon dioxide release from soils, to determine how carbon cycling responded as soils dried after the simulated rain.

"It's really an incredible amount of data to collect manually," says Throop. "And having a crew of dedicated and enthusiastic students made this work possible. Often for remote fieldwork like this, we just get a snapshot of what is happening at one or two sites or at a few points in time. It was exciting to be able to collect the data continuously for a few days and at six different sites."

Figure 1: University students Ruusa Gottlieb (left) and Priscilla Mundilo measure carbon dioxide release from the soil at one of the high rainfall sites in the Namib Desert. Photo: Heather Throop/ASU

Figure 2: University students Theopo Iita, Vimbai Marufu, Priscilla Mundilo characterize plant and landscape features at one of the driest sites in the Namib Desert research study. Credit: Throop/ASU

The students participating in this research came from the University of Namibia and the Namibia University of Science and Technology. They were each participating in the Summer Drylands Program, an intense research experience where students plan, execute, and report on an experiment within a short timeframe.

"The ability of technology to record soil carbon was outstanding," says co-author and student researcher Vimbai Marufu, who is now in graduate school at the Namibia University of Science and Technology. "What I treasure the most from the experience is what it means to work on an interdisciplinary team and the unexplainable satisfaction of being close to nature."

And there are plans to continue additional fieldwork in the Namib Desert with a recent grant from the National Science Foundation to ASU. This grant will provide support for U.S. students to conduct research in the Namib Desert in collaboration with Namibian researchers. "We hope to use this work to help us in understanding how deserts respond to a changing climate," says Throop.

"How biological processes function in the extreme dryness of the Namib Desert will give us clues about how relatively wet deserts will behave under drier conditions."

Figure 3: University students Rosalia Tshikesho (L) and Etuna Iyambo (R) simulate a rain shower prior to making measurements of soil carbon dioxide release in the Namib Desert. Credit: Throop/ASU

Here's How Bees and Butterflies See Flowers: No Wonder They Love Them!

Sara Burrows

Reprinted From: https://bit.ly/340q5a1

Humans are blind to ultraviolet light, but bugs can see it, and boy are they lucky! Ultraviolet florescence photography gives us a hint of how flowers look to pollinators.

Insects see the world very differently from how humans see it. They can't see red light like we do but can see ultraviolet wavelengths invisible to the human eye.

We'll never be able to see the world exactly as they do, but a special type of photography called ultraviolet-induced visible fluorescence photography can give us a hint at how awesome the world looks to bugs… especially the world of flowers, which emit their own florescence after being exposed to ultraviolet light.

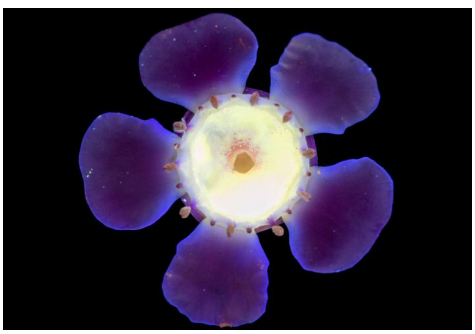
California photographer Craig Burrows has done some amazing work with this type of photography, soaking the flowers in ultraviolet light, turning it off, and then snapping a photo of the flowers emitting the light they've just absorbed with a special lens filter.

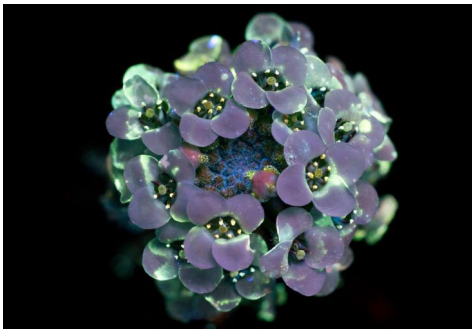
It's obviously not exactly as bugs would see the flowers, as they are seeing the UV light reflected off the flowers under the sun, not fluorescing in the afterglow of a darkened room, but it gives you an idea.

A 2019 study found the parts of the flowers that reflect UV light are important advertisements for attracting pollinators.

The UV reflecting vs UV absorbing (UV dark) parts of the flower, help the bees navigate between petals and pistils (or stamens), helping them find the pollen, a 2009 study found.

Figures: © Craig Burrows





Global map of bees created in conservation first

Helen Briggs

Current Address: BBC Environment correspondent
Reprinted From: https://bbc.in/36Zj4lk

Scientists have mapped the distribution of all 20,000 bee species on earth.

The new global map of bees will help in the conservation of the insects we rely on to pollinate our crops, say researchers in Singapore and China.

Bee populations are facing pressure from habitat loss and the use of pesticides.

Yet little is known about the array of species living on every continent save Antarctica, ranging from tiny stingless bees to bees the size of a human thumb.

Bees provide essential services to our ecosystems and are the major pollinators of many of our staple foods, said Dr Alice Hughes of the Chinese Academy of Sciences in Yunnan.

Yet, until now, we have not had the data to show where on the planet most species are.

"Here we combine millions of records to create the first maps of global bee richness, and understand why we see these patterns," she told BBC News.

"These maps, and our framework, can then form the basis of future work, enabling us to better understand patterns of bee richness and ensure that they are effectively conserved into the future."

Some bee populations, such as bumblebees in Europe and North America, are well studied.

But in other regions, such as large parts of Asia and Africa, documentation has been sparse.

While there remains a lot to learn about what drives bee diversity, the research team hopes their work will help in the conservation of bees as global pollinators.

Dr John Ascher of the National University of Singapore said by establishing a reliable baseline we can characterise bee declines and "distinguish areas less suitable for bees from areas where bees should thrive but have been reduced by threats such as pesticides, loss of natural habitat, and overgrazing".

Facts about bees

- There are over 16,000 known bee species in seven recognised families.
- Some species, such as honeybees, bumblebees and stingless bees, live in colonies, while others are solitary insects
- Although some groups, such as bumblebees, are well studied, the vast majority, more than 96% of bee species are poorly documented
- Many crops, especially in developing countries, rely on native bee species, not honey bees.

Figure 1: There are thousands of bee species, both little and large. © Zestin Soh

How was the map made?

To create their map, the researchers compared data about the occurrence of individual bee species with a checklist of over 20,000 species compiled by Dr Ascher.

This gave a clearer picture of how the many species of bees are distributed around the world.

The study has confirmed that unlike other creatures, such as birds and mammals, more bee species are found in dry, temperate areas away from the poles than in tropical environments nearer the equator. There are more in the Northern Hemisphere than the Southern, with hotspots in parts of the US, Africa and the Middle East.

There are far fewer bee species in forests and jungles than in desert environments because trees tend to provide fewer sources of food for bees than plants and flowers.

Why do we need to keep track of insect populations?

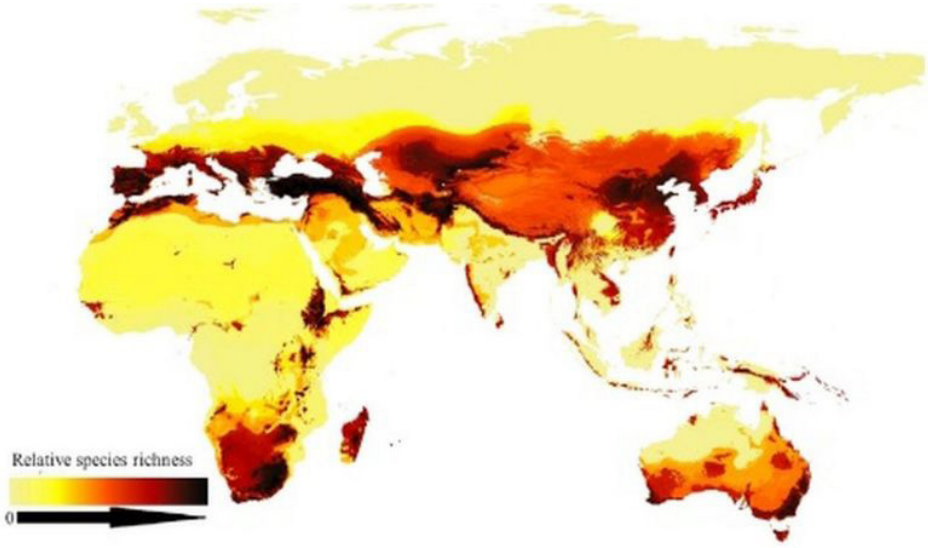


Figure 2: Relative bee species richness in the world.

The reported plunge in some insect populations has caused alarm, with calls for better monitoring. The sheer number of insect species on the planet - upwards of 900,000 - makes this is a monumental task, with millions of specimens awaiting identification in museums.

Insects are often overlooked in global assessments of biodiversity, in favour of mammals, birds, reptiles and amphibians.

The research is published in the journal Current Biology.

Figure 3: Many crops rely on native bee species for pollination © Zestin Soh

Pastoralists push for recognition at the UN

A call for an International Year for Rangelands and Pastoralists is an effort to better recognise half of the world's land and the people who have historically taken care of it – and would particularly benefit communities in South Asia

Rosamma Thomas

Reprinted From: https://bit.ly/36Yharv

Since September 28, the Committee on Agriculture of the United Nations' Food and Agriculture Organization has been conducting its 27th session virtually. For this session, people from across the world have come together to petition the UN to declare 2026 an International Year for Rangelands and Pastoralists (IYRP).

Nearly half the land area of the Earth is classified as rangeland. The proposal states that an IYRP would "raise awareness on the importance of rangelands and pastoralists for livelihoods, healthy ecosystems and other relevant dimensions of sustainable development." The decision could also pressure governments to implement policies that stop pastoralists' political marginalisation, and ensure they are consulted on management of the land.

The government of Mongolia took the lead, and the governments of Ethiopia, Afghanistan and Spain have sent letters in support of the proposal. So far, 12 governments and 133 organisations have supported it. In South Asia, groups of pastoralists are mobilising behind the idea. Voting on the proposal was scheduled for October 1.

"Pastoralism is just not recognised," said Hanwant Singh Rathore, director of the Lokhit Pashu-Palak Sansthan (Society to Aid Pastoralists) based in the Pali district of the Indian state of Rajasthan. He has been working with the camel-herding Raika community for 30 years and has observed that governments behave as though the herders do not exist.

In 1988, the Kumbhalgarh Wildlife Sanctuary was created in Rajasthan over about 600 square kilometres of land. When the Raika moved with their herds along the routes they had been taking for generations, they were told they could no longer allow their animals to graze in those lands – the forest area

Figure 1: Herders ride their ponies to work in Kashmir © Alamy

Figure 2: Yurt belonging to semi-nomadic pastoralists in the Pamir region in Kyrgyzstan © Alamy

was "protected" from their animals. No prior notification had been given to them, and they were not consulted. Because the Raika are on the move for about nine months a year, they are hard to contact – even for policymakers.

But aside from this logistical difficulty, the neglect of pastoralists stems from a lack of understanding of their role in maintaining ecosystems, which is only now being documented. The herds that pastoralists tend have been found to reduce the chance of forest fires by reducing biomass; similarly, the services of pastoral communities in seed dispersal, soil fertility and biodiversity is only beginning to be understood.

Their customs often emphasise striking a balance with nature, because their lives are dependent on the ecosystem. For example, among the Changpa – a community that herds the famous pashmina goats on the India-China border – water is carefully conserved. Water used to wash hair is carefully saved to be reused; nothing is ever wasted and everything is a "resource".

Dinesh Rebari works with the Maldhari Vikas Sangathan in Gujarat, India, a non-governmental organisation working on issues affecting pastoral communities. A pastoralist himself, he said these traditional practices and the knowledge behind them should ideally feed into government policymaking. "We need easy access to common lands and rangelands, we need to be able to use these resources, and our voices should be heeded in their management. These are not demands that would serve only the pastoral communities, these are demands that would conserve these rangelands and help us preserve them for generations to come," he said. He said he hoped that the UN will declare a special IYRP.

A range of problems

At a meeting of pastoral communities in Gujarat in 2015, Anu Verma, who works with the South Asia Pastoralist Alliance, reported that such communities across the world are under stress. Many are forced to withdraw from traditional livestock keeping as the lands they earlier had free access to have been acquired by governments or privatised. Mechanised technology in agriculture has meant a vast expansion in settled agricultural production, to the detriment of rangelands.

For communities that migrate across national boundaries, there are additional worries. The Maldharis of Afghanistan used to move into Pakistan in the winter, but war and instability have limited this. Their route is now heavily policed,

Figure 3: A camel herder drives a herd through the Thar Desert towards Pushkar for the annual trade fair, Rajasthan, India © Alamy

Figure 4: Adaptive practices of pastoralists rarely make it into the books of "official knowledge" © Ilse Köhler-Rollefson

and documents such as passports and identity cards are required for crossing the border, which pastoral people often do not have.

Many South Asian pastoral communities travel from the cold Himalayan deserts to the drylands of the arid southern deserts. They raise and live with, camels, yaks, buffaloes, sheep, goats, horses and donkeys. In recent years, groups of pastoralists from India, Afghanistan and Nepal have started to collaborate, comparing notes and attempting to collectively pressure their national governments to draft policy in their favour. This group, which has come together under the umbrella of the South Asia Pastoralist Alliance in the past two years, has begun mapping rangelands and the pastoralists in these areas. It is set to expand to include members from Bhutan and Bangladesh.

The Alliance estimates that 173 million acres in India is rangeland, and up to 75% of India's rural population depends on such lands. In the past three decades, non-recognition of the traditional rights of pastoral communities and indigenous peoples has caused such lands to be taken over for other purposes.

A 2011 judgement of India's Supreme Court mentioned this loss of common grazing lands: "What we have wit-

nessed since Independence, however, is that in large parts of the country this common village land has been grabbed by unscrupulous persons using muscle power, money power or political clout, and in many States now there is not an inch of such land left for the common use of the people of the village, though it may exist on paper. People with power and pelf [money] operating in villages all over India systematically encroached upon communal lands and put them to uses totally inconsistent with its original character, for personal aggrandizement at the cost of the village community."

Ilse Köhler-Rollefson, a scientist, researcher and activist who has worked with the camel herders of Rajasthan for over two decades, noted that pastoralism is poorly documented in India. Unlike in Africa, for instance, where pastoral people from distinct tribes, the pastoral communities of India are often intertwined in social interactions with caste groups.

This often means their specific needs are overlooked. During the abrupt lockdown imposed by the Indian government in March to prevent the spread of Covid-19, these communities were especially affected. It is also pastoral nomads who are most impacted when hostilities break out between nations over border disputes. The recent clashes between India and China occurred during the breeding season of the goats that produce pashmina wool, and Changpa herders of Ladakh found their flocks depleted as they were pushed out of traditional herding grounds.

Invisible to the government

Government provisioning for the poor does not include nomadic pastoral people; most documents for access to government services require a fixed address. The mobile nature of their lives also means that schooling becomes difficult, with pastoral communities have lower levels of literacy than others.

Despite their marginalisation, though, researchers have documented the resilience of their social structures and the close ties that help them through hard times. Nandita Chaudhary is a former academic at the University of Delhi's Department of Human Development and Childhood Studies.

Writing about the Changpa shepherds, Chaudhary noted how children in the community closely bond with the animals, often snuggling up with the goats for warmth. Such communities have also developed their own medicinal practices for the animals they live in close contact with. These are often based on herbs found in the rangeland, but they are not documented or recognised by standard veterinarians.

The populations of pastoral communities in India have not been counted for decades. Pre-independence census records documented the numbers of some groups that were recorded as caste groups. However, the caste census was discontinued after independence; it was undertaken again in 2011, but pastoral communities were not counted as part of this. There are thus no estimates of the number of people engaged in pastoral activity in India.

Pastoralists and academics say that the IYRP could open up more conversations and that both government policy and long-term nature conservation can be informed by the traditional practices and knowledge of communities. It seems as if governments are listening: 13 governments have supported the initiative, and on September 28 Ulrich Seidenberger, the German permanent representative to the FAO, tweeted support on behalf of both Germany and the EU.

Figure 5: Pastoralists are poorly documented in India © Ilse Köhler-Rollefson

Botany PhD student rediscovers 'extinct' plant in Piketberg

Riaan Grobler

Web Address: News24
Reprinted From: https://bit.ly/3n4yIYu

A PhD Botany candidate, while travelling to Piketberg to do field work, has rediscovered a plant thought to be extinct.

The great rediscovery of the "extinct" (common names: Versveld Pass Cape Gorse or Versveldpassteekertjie) was made on 24 October by Brian du Preez.

According to the South African National Biodiversity Institute (Sanbi), was one of over 300 species belonging to the same genus of plants as South Africa's world renowned and popular Rooibos tea.

This species was first collected in 1934 at the base of the Versveld Pass, just outside of Piketberg.

The species had subsequently not been located since the initial collection, despite numerous searches of it in the surrounding area.

The species was likely still endangered due to its supposedly small distribution range, including being a habitat specialist within this small area.

Although only two plants were spotted by Du Preez, the plants were likely to be more prevalent after a much-needed ecological burn of the slopes on Piketberg Pass.

The true extent of the population would only be determined approximately three years post-fire when they would have regenerated and started flowering

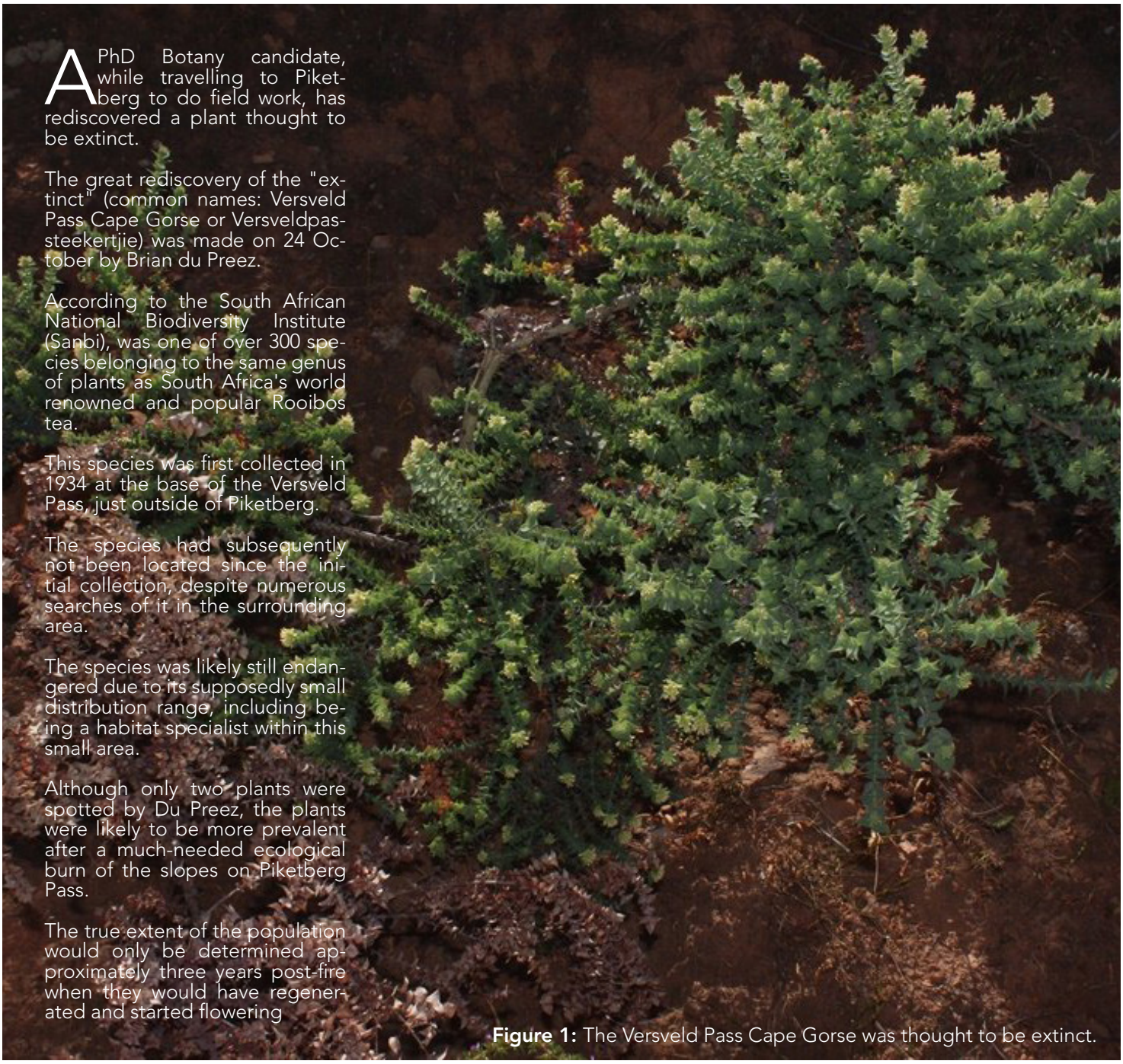


Figure 1: The Versveld Pass Cape Gorse was thought to be extinct.

Researchers find new grass species in Maloti-Drakensberg area

Leonie Bolleurs

Current Address: University of the Free State
Reprinted From: https://bit.ly/33Tq2Nh

In their search to learn more about the impact of humans and climate change on grasses in the Drakensberg Mountain Centre (DMC), one of the most studied mountain systems in the region, a group of scientists found a new grass species, which they named *Festuca drakensbergensis* (common name unknown; herein could be designated the 'Drakensberg Alpine Fescue').

The team who is working on the project includes Dr Vincent R. Clark, Head of the Afromontane Research Unit at the University of the Free State (UFS), Prof Steven P. Sylvester from the Nanjing Forestry University in Nanjing, Jiangsu, China, and Dr Robert J. Soreng, working in the Department of Botany at the Smithsonian Institution in Washington DC.

The discovery

The species, that was discovered in March 2020, was found during extensive fieldwork and herbarium research across the 40 000 km^2 Maloti-Drakensberg area. The DMC has a very high endemic plant diversity, says Dr Clark.

He goes on to say that the DMC has a Montane Sub-Centre (below 2800 m) and an alpine sub-centre (above 2800 m). "It is the only mountain system in Africa south of Mt Kilimanjaro with an alpine component," he adds.

Prof Sylvester says the species was easily recognisable during their fieldwork, being found fairly common throughout the Afro-alpine landscape. Although at that point they only knew it to be a distinct taxon, they realised that the species was new to science when they tried to identify it and compared it with other closely related *Festuca* taxa.

Besides this discovery, the team also reinstated two varieties of *Festuca caprina* and rediscovered the overlooked *F. exaristata*, all of them endemic to the DMC. Prof Sylvester believes that this discovery highlights the importance of these high-elevation ecosystems as harbours of unique biodiversity that require focused conservation efforts.

Figure 1: A team of international researchers discovered in March 2020 a new grass species, *Festuca drakensbergensis*, during extensive fieldwork in the 40 000 km^2 Maloti-Drakensberg area.

Although grasses are a *dominant* species that control the ecosystem function in the Afro-alpine grasslands, they are the least known of all plant species found in these ecosystems. Up until now, there has been a lack of focused research on Afro-alpine grasses.

"We provide a taxonomic reappraisal of the *Festuca caprina* complex that will aid future ecological and biogeographical research in the DMC and allow us to better understand the complexities of these ecosystems and how to conserve and manage them," says Prof Sylvester.

"This discovery highlights the importance of these high-elevation ecosystems as harbours of unique biodiversity that require focused conservation efforts." - Prof Steven Sylvester

Adding value

According to Dr Clark, the species contributes to the grazing and rangeland value of the Maloti-Drakensberg. "It also has functional value in terms of maintaining ecosystem integrity and associated water production landscape value in the area," he says.

"The species seems fairly robust to pressures from grazing and burning, being found in both heavily grazed areas and semi-pristine areas, and may prove a useful species as part of a seed mix of native grasses for reseeding degraded Afro-alpine slopes and ski slopes," mentions Prof Sylvester regarding the benefits of this indigenous species to the region.

The species is very common in Lesotho in Bokong Nature Reserve, Sehlabathebe National Park, and Sani Pass, and at Tiffendell and AfriSki ski resorts. Dr Soreng believes the species is likely to have a wider distribution range across the Maloti-Drakensberg, than what was documented before the research was cut short due to the COVID-19 pandemic.

Next steps

According to Prof Sylvester, this taxonomic research feeds into a large-scale ecological study looking at the response of Afro-alpine ecosystems to different grazing and burning regimes that is being run in collaboration with Dr Clark at the ARU and Dr Soreng of the Smithsonian Institute, Washington DC.

"While our research has uncovered interesting novelties and provided a greater understanding of the taxonomy of grasses from high elevation Maloti-Drakensberg, there is still much to be done with regards taxonomic research of cool-season grasses in southern Africa," says Prof Sylvester.

Dr Clark supports this notion and states that there is a major need for a better holistic understanding of the alpine zone in the Maloti-Drakensberg, given immediate pressures from over-grazing, land-use transformation, invasive species, and climate change. "This is because the Maloti-Drakensberg is the most important water tower in southern Africa, providing water for some 30 million people in three countries. As the Maloti-Drakensberg is dominated by natural grasslands, understanding grass diversity and ecological behaviour is a primary need in the face of immediate human impacts and global change," he says.

Figure 2-6: A few photos taken during the research team's fieldwork in the Maloti-Drakensberg area.

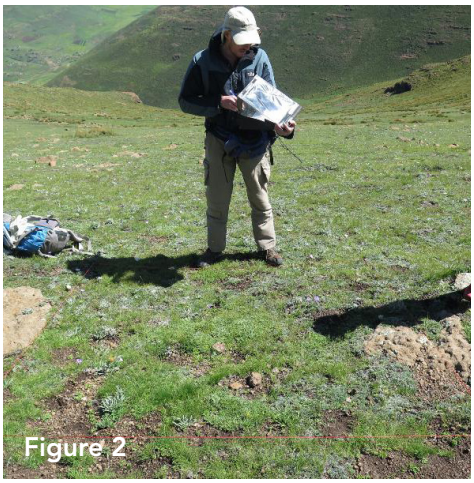


Figure 2

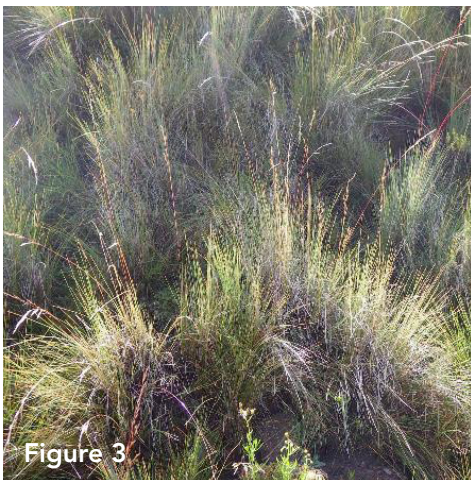


Figure 3


Figure 4


Figure 5


Figure 6

Mobile Application for Karoo Plant Identification

Loraine van den Berg

Current Address: Grootfontein Agricultural Development Institute
Web Address: http://gadi.agric.za

Ever walked in the veld and suddenly come across a "bossie" flowering profusely with beautiful yellow flowers, and wondered to yourself... What species is this? Do my sheep/goats/cattle eat it? Is it poisonous? Is it an indication that I am overgrazing the veld? And with the best intentions in the world, you pick off a piece, put it in your pocket or bakkie for later identification in your office, where you have plant identification books. But we all know that by the time you get back to your office all thoughts of identifying plants will be out the window because there will probably be lots more important issues to take care off.

Wouldn't it have been nice to have an easily accessible resource available right there in the veld to assist you in identifying the plant? With the technology available today the answer lies right there in your hand – a mobile application on your cell phone. Grootfontein Agricultural Development Institute (DALRRD – GADI), in conjunction with the Endangered Wildlife Trust (EWT) and TurtleTech Pty., has developed a mobile application for identifying and providing information on common grazing plants occurring in the Nama-Karoo biome of South Africa.

Three phases are included in the development process:

- Phase 1 (already completed) - this phase includes the provision of an electronic guide to approximately 250 plant species commonly occurring in the Nama-Karoo biome, including Trees, Shrubs, Dwarf shrubs ("bossies"), Grasses, Succulents and Ephemerals ("Opslag"). There is also an option to create a list of all the species that you have observed. The information provided for all species includes Common names, Photos, General description, Grazing value, Toxicity, Invasiveness, Medicinal value, Ethnobotanical value and a Distribution map within the Nama-Karoo biome

- Phase 2 (not available yet) – this phase will entail the development of a neural network by which the application would be able to "learn" to identify a species through a photo taken by the user. A mechanism for reporting unidentified species would also be provided if the application is not able to identify the plant, or if the species is not included in the application. There will also be more information provided on the control of invasive species, as well as the effect of poisonous plants on livestock. The "location" function of the cell phone will be incorporated into the "My plants" function of the application to provide a mechanism to create a species list for a specific farm or area.

- Phase 3 (not available yet) – this phase will focus on using information captured by the user to determine veld condition at a specific point. This function would allow the user using the application to conduct a quick vegetation survey, after which the application will calculate the veld condition score. This veld condition score could be used to manage veld more sustainably. Information on various grazing systems commonly used in the Nama-Karoo biome will also be provided.

Phase 1 of the mobile application is currently available for download on the Google Play Store and iOS platforms at no cost.

Once installed the application does not need internet connectivity and can therefore be used in the veld even if there is no signal.

To download the application use "Nama-Karoo Plants" in the search field on both these platforms.

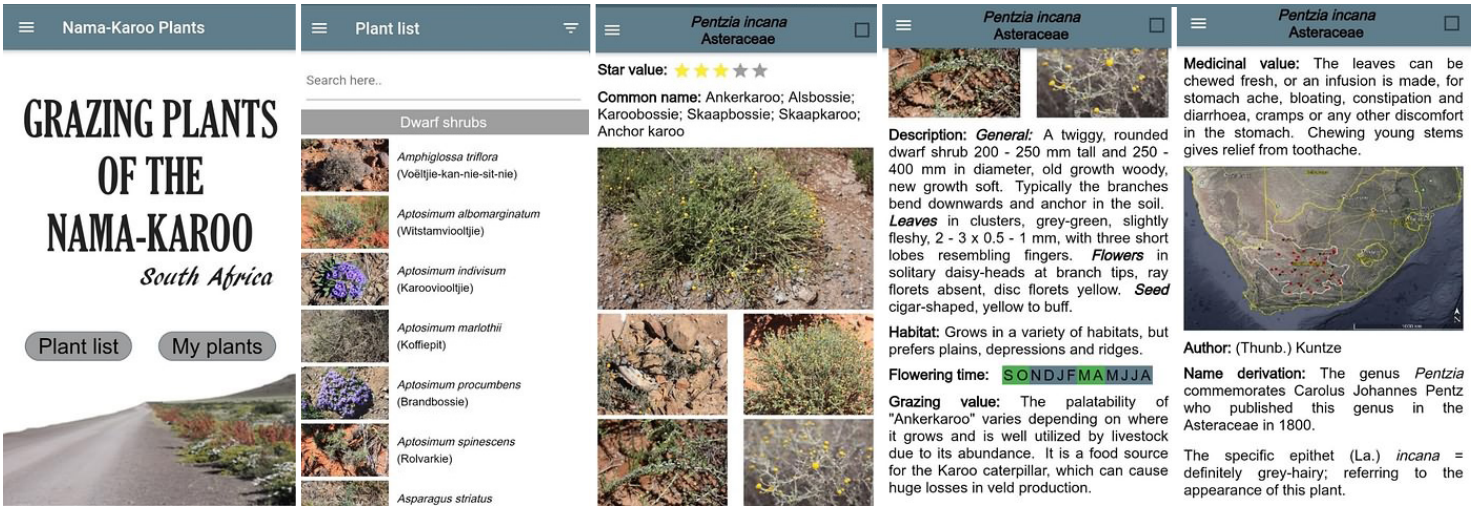


Figure 1-5: Screenshots of the new "Nama-Karoo Plants" application available on Google Play Store and iOS platforms.

'David Attenborough: A Life on Our Planet' Review: Ruin and Regrowth

Natalia Winkelman

Current Address: The New York Times
Reprinted From: https://nyti.ms/37I1aJe

The majestic documentary "David Attenborough: A Life on Our Planet" opens with its title subject standing in a deserted location. It's the territory around the Chernobyl nuclear plant, a once buzzing area that was evacuated after human error rendered it uninhabitable. Only later will the directors, Alastair Fothergill, Jonnie Hughes and Keith Scholey, pull their camera back to reveal that the territory, in its vacancy, has grown into a lush wildlife paradise.

Calling the film (streaming on Netflix) his "witness statement" for the environment, David Attenborough goes on to trace his more than 60-year career as a naturalist, mapping how steeply the planet's biodiversity has degenerated before him. Global air travel was new when he began his work, and footage of him as a young producer encountering exotic flora and fauna lends a moving, even haunting, note to his plea to restore ecological balance.

Astonishing nature photography accompanies his retrospective. To illustrate the emptying of oceans, the directors intercut thriving coral habitats with images of large gutted fish, frozen and stacked for the market. Equally upsetting is the loss of rain forests, showcased through the stark cutoff between flourishing vegetation and uniform rows of oil palms planted for profit. Such cinematic juxtapositions are persuasive: A dying planet is an ugly one, while healthy ecosystems please the eye and the earth.

The most devastating sequence finds Attenborough charting the disasters we face in future decades — global crises that he, as a man now in his 90s, will not experience. Yet he finds hope by extrapolating small successes. Sustainable farming in the Netherlands has made the country one of the worldwide leaders in food exports. Fishing restrictions around the Pacific archipelago nation of Palau enabled marine life to rebound. The film's grand achievement is that it positions its subject as a mediator between humans and the natural world. Life cycles on, and if we make the right choices, ruin can become regrowth.

Video: https://youtu.be/64R2MYUt394

Figure 1: The naturalist David Attenborough in the documentary "A Life on Our Planet." (Netflix)

Nestlé to develop SA's first net zero dairy farm

Business Report Online

Web Address: www.iol.co.za
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Nestlé has launched the Skimmelkrans Net Zero Carbon Emissions Project, to create the company's first carbon-neutral dairy farm.

The farm which will be located in George, South Africa and Nestlé has committed that by 2023 the dairy farm will be carbon net zero.

"The Skimmelkrans project is a positive step in our sustainability journey. In the context of yesterday's global announcement by our CEO, Mark Schneider around redoubling efforts to combat climate change, we have committed to reaching a waste-free and zero net emission future within Nestlé by 2050, building on decades of work already done to reduce greenhouse gas emissions. The project will scale the quality production of our dairy products therefore enhancing our consumer experience," said Saint-Francis Tohlang, Corporate Communications and Public Affairs Director at Nestlé East and Southern Africa Region (ESAR).

The Skimmelkrans Net Zero Carbon Emissions Project forms part of the Nestlé's broader sustainability platform called RE.

Through the RE platform, the company has committed to RETHINK, REDUCE AND REPURPOSE. These three pillars will come into play on the Skimmelkrans farm.

"Net zero is achieved when emissions created by the farm are displaced by removing the same amount of emissions from the atmosphere. While there are many ways to create more sustainable operations for dairy farms, Skimmelkrans sets itself apart through the soil work, water conservation, feed management and manure processing, where some of the biggest reductions of greenhouse gases occur," stated Hoven Meyer, Agricultural Services Group Manager at Nestlé East and Southern Africa Region (ESAR).

Cow manure produces methane: one of the most harmful greenhouse gases. At Skimmelkrans, cow manure is collected while they graze and then goes into a press that separates the solids from the liquids.

This ensures that there is no moisture left in the finished product: the solids are released back into the soil as compost, and the liquids go back into the pastures as irrigation, meaning that less methane is released into the air. In April 2021, the soil will be tested, screened, and analysed by soil experts and the results will determine how much closer the farm is to the net zero carbon emissions goal.

Skimmelkrans operates in a biodiverse ecosystem which results in better care and nutrition for the cows on the farm, as well as better nutrition in the milk products produced, giving consumers a safe, environmentally friendly product. Products that will benefit from these initiatives include Nestlé Milo, Nestlé Nespray and other milks.

Figure 1: Nestlé announces the Skimmelkrans Net Zero Carbon Emissions Project, to create the company's first carbon-neutral dairy farm.

The bugs are back on the Hartbeespoort Dam

The Centre for Biological Control (CBC) at Rhodes University once again visited the Hartbeespoort Dam last weekend to bring more of their hyacinth-eating bugs to control the hyacinth infestation this summer.

Kormorant

Web Address: www.kormorant.co.za
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Prof Julie Coetzee and her team delivered the *Megamelus scutellaris* planthopper bugs to the Harties Foundation that is currently busy with a mass-rearing project in order to continuously release the little insects on the invasive water plant.

"We work in collaboration with the Harties Foundation that has constructed a facility to propagate the bugs. We visited the dam over the weekend and delivered the insects that will be released by die foundation as the numbers grow," she said.

"The success of the biological control of the hyacinth is fantastic. We are really pleased."

Biological control agents in the form of plant specific bugs have been instituted on the Hartbeespoort Dam since the 1980's but due to periodic herbicide application, their population has been inhibited.

However, biological control, in the form of weevils, was once again instituted on the dam in 2018 by the Rhodes University in conjunction with the Department of Environmental Affairs, and since no herbicides have been used since then, a mass die-off of hyacinth took place.

Currently six different kinds of insects can be found on the hyacinth but most of the success is ascribed to the planthopper that has been continuously and intensively introduced since last year.

"The two most noticeable insects are the *Neochetina* weevils, and the water hyacinth plant hopper, *Megamelus scutellaris*, which come from South America too. These insects have been thoroughly studied in South Africa, and elsewhere, including the USA and Australia, over many years to make sure that they are safe (i.e., only feed on water hyacinth) and effective in controlling water hyacinth."

Figure 1: Prof Julie Coetzee and Keneilwe Sebola of the CBC

Figure 2: *Megamelus scutellaris* released on the Hartbeespoort Dam

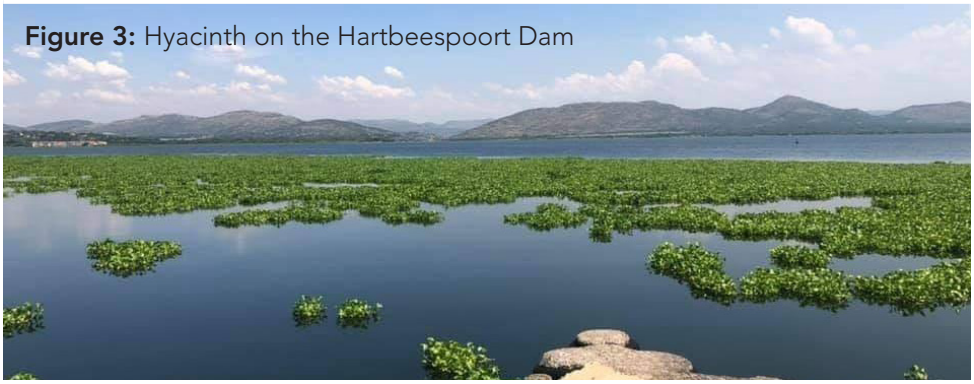

Figure 3: Hyacinth on the Hartbeespoort Dam

Deadlines for

Newsletter of the Grassland Society of Southern Africa

Grassroots

submissions 2021:

Issue 1: 20 January 2021
Issue 2: 20 April 2021
Issue 3: 20 July 2021
Issue 4: 20 October 2021

Please visit
www.grassland.org.za/publications/grassroots/submit-to-grassroots-now
for submission guidelines.

Advancing Rangeland Ecology and Pasture Management in Southern Africa
ISSN: 10166122

Upcoming events

7 - 9 April 2021

AGBIZ CONGRESS
Sun City. Agbiz Congress is themed as Building resilient and sustainable agri-food ecosystems and it will provide the key forum for identifying the critical developments needed over the coming decades to ensure agri-food value chains are managed sustainably for the benefit of current and future generations. For more information visit www.agbiz.co.za

5 - 10 September 2021

SAWMA 2021: 50th Anniversary Conference
Berg-en-Dal, Kruger National Park.
For more information see
https://sawma.co.za/conference-2020/
or contact Elma Marais at elma@mweb.co.za.

6 - 10 September 2021

MEDECOS will be held at Club Mykonos, Langebaan, Western Cape are now inviting proposals for symposia and workshops for the 15th Conference on Mediterranean-type ecosystems.
You can direct any questions on symposia and workshops to Karen Esler (kje@sun.ac.za) and Nicky Allsopp (allsopp@saeon.ac.za).
See http://medecos2020.org/ for more details.

October 2021

Joint XXIV International Grassland (IGC) and XI International Rangeland (IRC) congresses to be held in Nairobi, Kenya. The theme is 'Sustainable Use of Grassland/Rangeland Resources for Improved Livelihoods'.
Information is available here: http://bit.ly/Kenya2020

If you would like to advertise your upcoming event, please contact us and we will include it in our next edition.

Grassland Society of Southern Africa

• CONGRESS 56 •

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