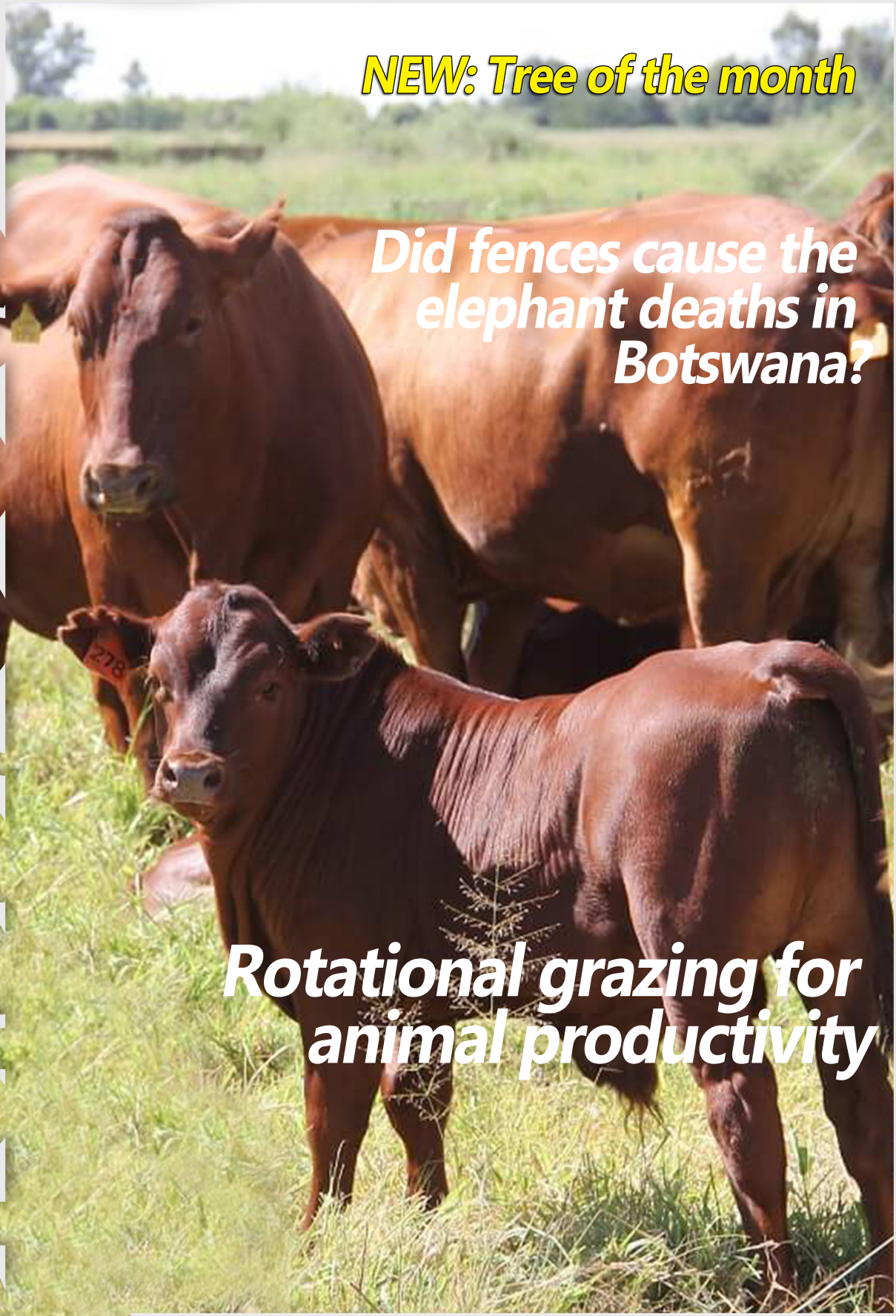
March 2021
Volume 21
Number 1

Grassroots

Newsletter of the Grassland Society of Southern Africa



NEW: Tree of the month

Did fences cause the elephant deaths in Botswana?

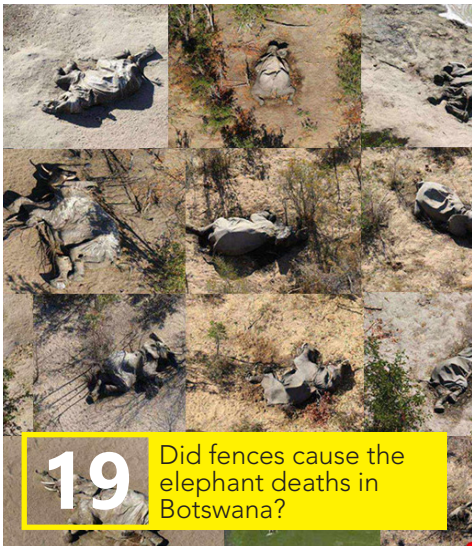
Rotational grazing for animal productivity

Earth hotter than at least 120 centuries

Advancing Rangeland Ecology and Pasture Management in Southern Africa

ISSN: 10166122

In this issue



From our editor

Dear reader, welcome to the first Issue of Grassroots for 2021.

The Grassroots team wishes all our readers a prosperous 2021. May we all make use of the opportunities that come our way and create new opportunities where possible.

Highlights of this issue

We kick-off this issue with a new series, "Tree of the month", by our sub-editor, Marnus Smit. *Vachellia erioloba* is the first tree under the spotlight. The grass and pasture of the month is *Dactyloctenium australe* and *Avena sativa*. In our feature article, Kelly Bernard focusses on birds as agents of restoration in the Albany Thicket Biome of the Eastern Cape province.

The reason for the death of 350 elephants in Botswana is once again a talking point after questions were raised as to why only elephants died from cyanobacterial poisoning. It is believed that fences played a major role in causing these deaths. On the other side of the world, the possibility of fenceless grazing for cows and wildlife is being explored with the use of GPS collars developed by a Norwegian company, Nofence.

Some good news is that South Africa achieved a crucial milestone for ecosystem research and that abundant rainfall in Namibia has turned this country green.

Make sure to check out a few of the interesting websites, webinars and podcasts on page 39 and some exciting upcoming events in 2021. If you would like to become a member of the GSSA, please see the options on page 52. Abstract submission is open for Congress 56, please submit your abstract before 3 May 2021.

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

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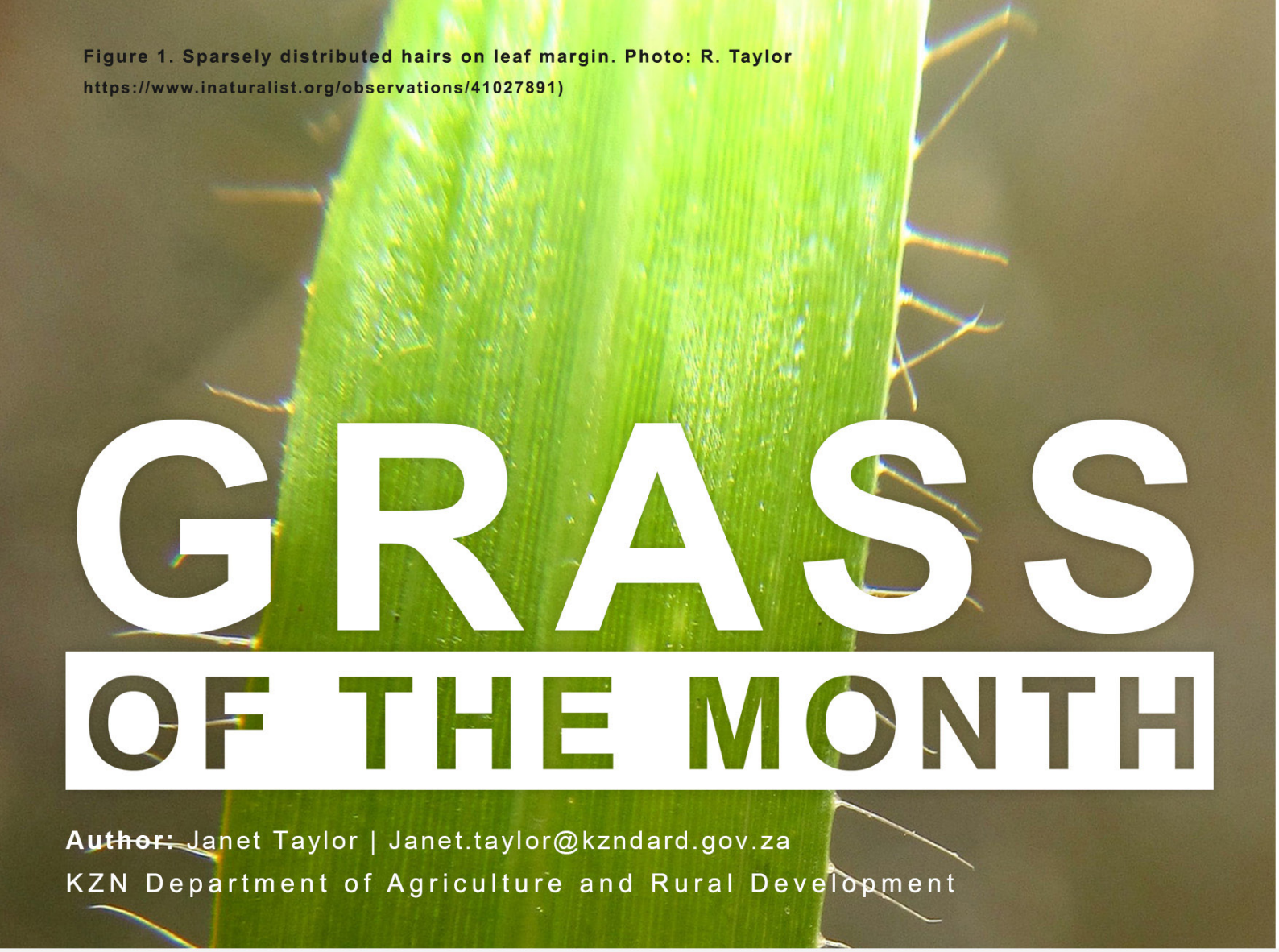

Figure 1. Sparsely distributed hairs on leaf margin. Photo: R. Taylor https://www.inaturalist.org/observations/41027891)

GRASS OF THE MONTH

Author: Janet Taylor | Janet.taylor@kzndard.gov.za
KZN Department of Agriculture and Rural Development

Dactyloctenium australe

The name Dactyloctenium australe is derived from the Greek words *daktylos*, meaning finger and *ktenion* (a little comb) which describes the digitate structure of the grass's inflorescence. The Latin derivation of the species name, *australe*, means "of the South".

This grass species is an evergreen stoloniferous grass that grows under a variety of environmental conditions in the warm tropical and subtropical regions of the country. *Dactyloctenium* is found in the Eastern Cape, Gauteng, KwaZulu-Natal, Limpopo and Mpumalanga. It is an increaser II grass species: these species tend to become dominant in the veld when it is overgrazed for a long period. It may not necessarily indicate that the area was utilised by too many cattle for long periods, but could indicate selective overgrazing of the palatable species for short, critical periods.

Distinguishing features:

- Mat-forming stoloniferous species
- Ranges in height from 130-810 mm
- Flowers between January and May
- Inflorescences are digitate/sub-digitate with 2-3 (6) spikes (hence the common name of "crowfoot")
- Leaves are dark green with hairs on the margin
- Found mostly on sandy soils

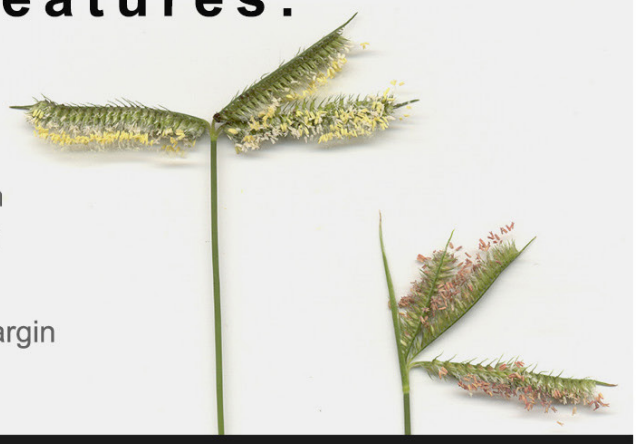

Figure 2. Digitate inflorescence of *D. australe*. Photo: R. Ward
https://www.inaturalist.org/observations/28991605

Economic use:

- Average grazing species and has an average grazing value of 4 (out of 10)
- Very popular lawn grass
- Erosion control: the stolons assist in holding the soil together

Figure 3. Stoloniferous character of *D. australe*
Photo: R. Taylor
https://www.inaturalist.org/observations/41027891

D. australe is one of the most popular lawn grasses in South Africa. It is known to have the highest shade tolerance of all the grass species, although it manages with growing in sun as well. *Dactyloctenium* has a moderate traffic tolerance and is slow-growing – which means that it doesn't need to be mown as regularly as other lawn species. It is not tolerant to frost. *D. australe* generally takes 4 weeks, with very little disturbance, to establish. In the first two weeks after planting, the grass needs a good soaking of water daily. It is a fairly hardy grass and, after establishment, requires far less frequent watering.

References:

Fish, L., Mashau, A.C., Moeaha, M.J. and Nembudani, M.T. 2015. Identification guide to southern African Grasses. An identification manual with keys, descriptions and distributions. Strelitzia 36. South African National Biodiversity Institute. Pretoria.Van Oudtshoorn, F. 2002. Guide to grasses of Southern Africa.

Briza Publications. Pretoria
Grass Factory: https://grassfactory.co.za/lm-grass-basics/
AusGrass: https://keys.lucidcentral.org/keys/v3/AusGrass/key/AuGrass/Media/Html/DACTYLOC/DACAUS.HTML

PASTURE OF THE MONTH

Figure 1. *Avena sativa* (https://hayandforage.com/article-1434-reap-livestock-returns-from-oats.html)

Author: Malissa Murphy | malissam@elsenburg.com
Elsenburg Agricultural Training Institute, Western Cape Agriculture

Avena sativa – Good Old Oats

Eng: Oats / Afr: Hawer

The first thing that comes to mind with the mention of oats is breakfast cereal. Although it has been a popular breakfast in households for many years, the majority of oats are produced for the animal feed market (it might even be safe to say that we indirectly consume oats for lunch or dinner too). Nowadays this pasture grass is also incorporated into crop rotation systems to suppress soil-borne diseases, like take-all, and is commonly used as a cover crop.

Avena sativa is an annual grass species and grows well in temperate climates. It is usually grazed in winter and spring when it is green and palatable. Thereafter it can be cut at the soft dough stage and used to make hay. *Avena sativa* also makes good quality silage. It works well in a mix with legumes such as clovers, peas, vetch and medics.

Figure 2. Oats make good quality pasture. (https://forages.osu.edu/news/harvesting-and-grazing-forages-following-frost)

Figure 3. Oats make good quality hay. (https://www.agric.wa.gov.au/hay-production/oats-hay-quality-export-and-domestic-markets)

Some more characteristics:

- Performs best under irrigation and can yield 15 ton of DM per ha per season.
- It is also relatively drought tolerant.
- Grows well in most soil types and tolerates a broad pH range.
- It has an extensive root system and high biomass production – hence making it a good cover crop.

What do oats look like?

- Tufted grass and can grow to nearly 1.5m tall.
- The leaves are flat, narrow and veined.
- The inflorescence consists of several branches (racemes) and spikelets (20-150 per plant) which usually contain three florets.

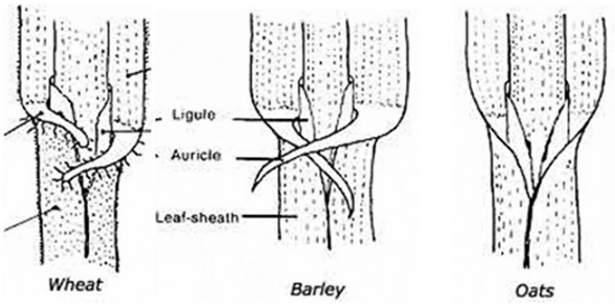

Figure 4. The difference between wheat, barley and oat is the presence of auricles.

How to distinguish oats from wheat and barley before the inflorescence is visible?

- Wheat and barley have auricles, whilst oats have no auricles.
- Oat-leaves twist anti-clockwise, whilst the leaves of wheat and barley twist clockwise.

Figure 5. The inflorescence of oats consists of several branches and spikelets which usually contain three florets. (https://newdrugapprovals.org/2014/07/28/oat-straw-avena-sativa-helpful-in-calming-the-nerves-of-those-who-are-detoxing-from-drug-or-alcohol-addiction-and-can-even-help-curb-nicotine-cravings/)

References:

ARC Guideline for production of small grains in the winter rainfall area, 2020. Oat Production, pg. 90. Reed K, Pastures Australia, 2009. https://keys.lucidcentral.org/keys/v3/pastures/Html/Forage_oats.htm
Snyman, 2012. Gids tot volhoubare produksie van weiding. Landbouweekblad en landbou.com

TREE OF THE MONTH

Author: Marnus Smit | zmsmit.denc@gmail.com
Northern Cape Department of Environment and Nature Conservation

Vachellia erioloba

Photo: Marnus Smit

Eng: Camel thorn tree; Afr: Kameeldoring | RSA Tree No. 168

The camel thorn is an unmistakable tree that is so often associated with many of Southern Africa's arid landscapes. This slow-growing tree generally reaches heights of 6-9 m but can grow up to 22 m. It occurs in deep sandy soils and is extremely hardy. The species is widespread and can be found from Angola to Zambia, through Zimbabwe, Botswana and Namibia and southwards into the Northern Cape, North-West, Free state and Limpopo provinces.

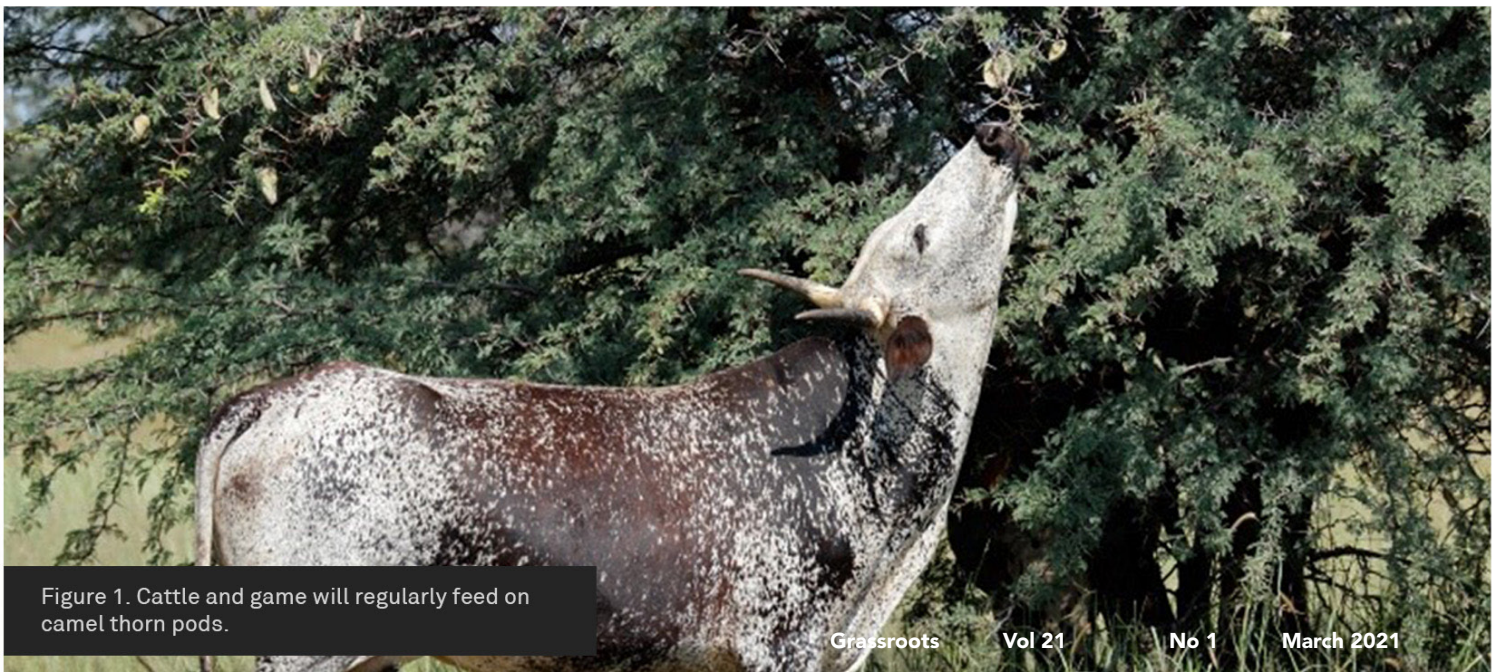

Figure 1. Cattle and game will regularly feed on camel thorn pods.

Figure 2. (a) Example of the pod; (b) Spines with thicken base; (c) A tree in flower; (d) Bark of a larger tree. (Photos: Marnus Smit)

Diagnostic features:

- Pods are large, crescent-shaped and covered with velvety-grey hair.
- Spines are large, straight, paired and often thickened at the base.
- Young branches are distinctly shiny red to purple to grey and angled between each pair of thorn.
- Flowers are orange-yellow.
- The brownish to grey coloured bark is deeply furrowed.

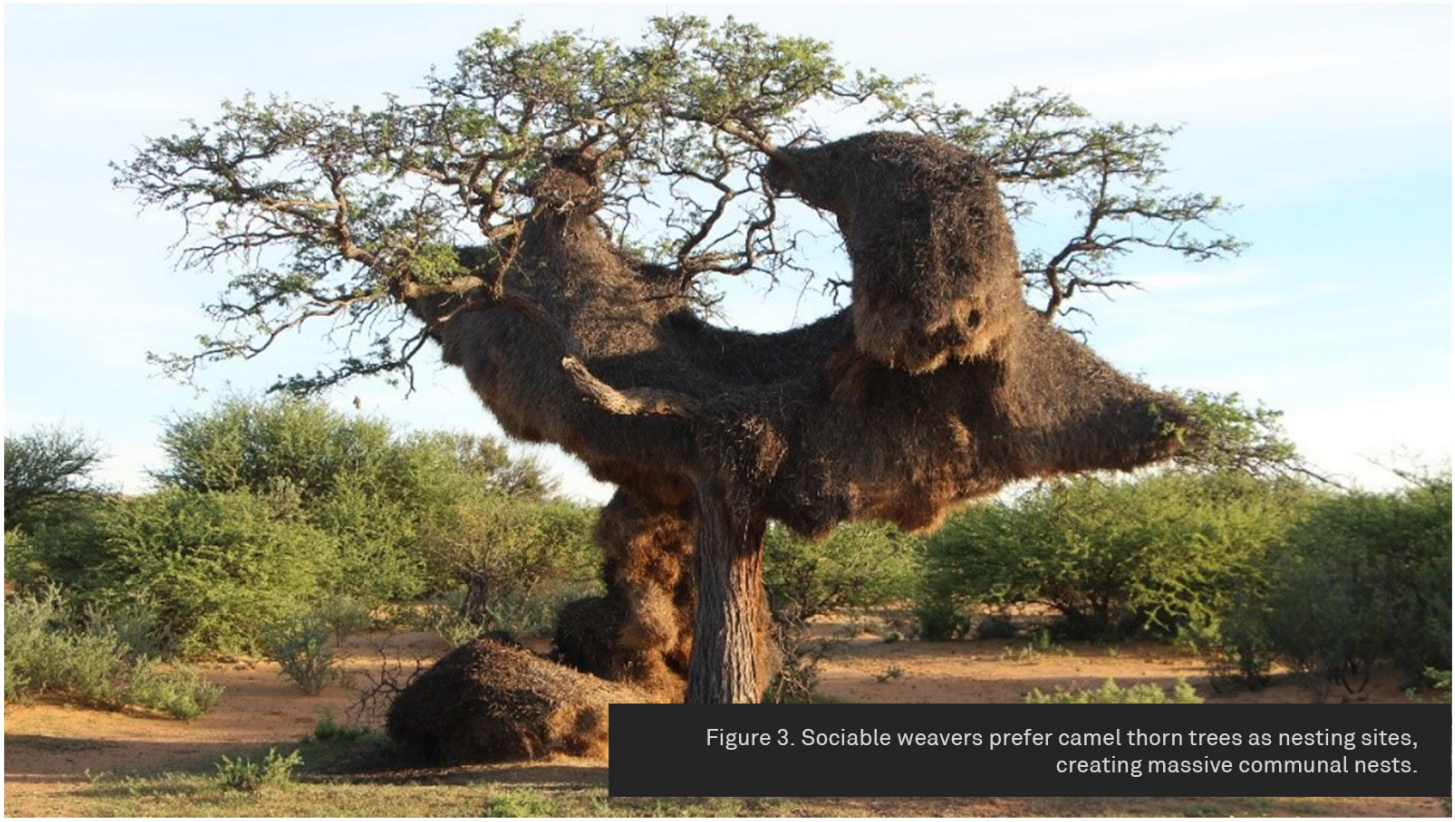

Figure 3. Sociable weavers prefer camel thorn trees as nesting sites, creating massive communal nests.

Ecological value and uses:

The pods are often used as fodder for cattle and are well utilised by game. Leaves are eaten by browsers and a preferred food species of giraffe. In many parts where it occurs, it is an important shade provider. The trees are also an important nesting site for many bird species, like the sociable weaver. The wood is hard and highly prized for firewood, making the species especially susceptible to overutilization. The seeds can be roasted and used as a substitute for coffee or grounded to make a form of porridge. The gum is also eaten by humans as well as animals.

References:

Smit, GN. 2008. F*ield Guide to the ACACIAS of South Africa*. Briza publishers, Pretoria.
Van Rooyen, N & Van Rooyen, G. 2019. *Flowering Plants of the Southern Kalahari.* novus print, Somerset West.

Birds as agents of restoration

Kelly Bernard

Current Address: Rhodes Restoration Research Group,
Department of Environmental Science, Rhodes University
E-mail: kellymonicatandi@gmail.com

Worldwide, land degradation, which results from land-use change, has affected about 30% of the total land area resulting in loss of biological diversity, changes in soil structure and health, and a decrease in ecosystem goods and services. According to future global scenarios, land-use change is expected to be the strongest driver of biodiversity loss by the year 2100. The xeric regions of the Albany Thicket Biome (ATB) in the Eastern Cape Province of South Africa have experienced land-use change with the transformation of intact thicket into land for livestock grazing, resulting in dense intact thicket being broken up into a mosaic of bushclump and open habitat, changing the assemblage of species and the interactions between them such as fruit removal by birds.

Once land has been degraded by land-use change it is possible to employ restoration initiatives to restore a healthy functioning ecosystem and bring back species that will help to promote the establishment of intact habitat. One way to do this in the ATB is to harness the natural functions of fruit-eating birds to promote the redistribution of thicket species in mosaic and degraded habitats. Fruit-eating birds play an important role in the distribution of the ATB by consuming and then dispersing fruit to viable microclimates allowing for seedling establishment and growth, promoting the maintenance or reestablishment of intact Albany Thicket.

A project conducted by a Rhodes University Honour's student used artificial feeding trays to assess whether birds were more likely to feed on indigenous fruit of the small knobwood tree and crow-berry tree in bushclump habitat than in open habitat in the ATB. A second goal of the project was to assess whether artificial feeding trays would be a viable technique in the promotion of the redistribution of woody thicket species by birds in degraded areas of the ATB.

It was predicted that birds would remove more fruit in bushclump habitat where there was more protection from predators, more branches to perch on and more indigenous fruiting species than in open habitat. Artificial feeding trays were designed to allow only birds to feed and exclude feeding by small mammals and ants and were placed in both bushclump and open habitats.

Figure 1: A typical bushclump patch setup with three feeding trays set close together to assess the effect of fruit type on fruit removal by birds. The control tray is set to the side of the feeding trays and is covered with a 6.3 mm hardwire mesh to stop fruit removal by birds to account for the weight loss of fruit due to dehydration. Raisins were excluded from analyses as they were removed by Vervet Monkeys (*Chlorocebus pygerythrus*).

Figure 2: A typical bushclump patch with an average height of 3 meters and a circumference of 36 meters.

Figure 3: A typical open patch setup with one camera trap per patch, facing one feeding station. Open patches also had an average circumference of 36 meters.

Figure 4: A Cape Robin-chat (*Cossypha caffra*) recorded on the camera trap visiting open patch 6.

Figure 5: A Southern Boubou (*Laniarius ferruginius*) recorded on the camera trap removing fruit of *Zanthoxylum capense* from a fruit removal tray at open patch 4.

The results showed that birds removed the fruit from artificial feeding trays in both bushclump and open habitats, suggesting that feeding trays could be used to help with restoration initiatives in the ATB. The woody diversity of the nearby bushclump habitat at the site and the visibility of feeding trays in the open habitat probably explain why fruit-eating birds were attracted to remove fruit in the nearby open habitat. The data indicate that bushclump habitat is important for birds, as most of the fruit removal took place in bushclumps. This suggests that keeping patches of intact thicket may be an important determinant in keeping fruit removal rates high and this should be developed further in future studies. Birds in this study removed more fruit of the small knobwood tree, which is red in colour, compared to the fruit of the crow-berry tree, which is yellow in colour, and previous studies suggest that red-coloured fruit may be more visible to birds than yellow-coloured fruit. Future studies should further assess what types of indigenous fruit are most likely to attract fruit-eating birds to help aid the distribution of intact habitat in the ATB and increase the success of restoration initiatives of this kind.

It was further predicted that generalist and opportunist bird species may be more willing to feed from artificial feeding trays, especially in the open habitat compared to specialist bird species. The results from the experiment were in line with this prediction as fruit removal was mostly by generalist and opportunist feeders like the Southern Boubou and the Cape Robin-chat both in bushclump and open habitats.

The results suggest that thicket degradation may affect the diversity of frugivorous, forest specialist bird species like the Cape White-eye and Bar-throated Apalis, and their fruit dispersal abilities, and this should also be researched further in future studies to get a better understanding of the effects of land-use change on different bird species and the ecosystem processes that they provide.

This study has shown that birds and particularly generalist and opportunistic feeders such as the Southern Boubou will feed on indigenous fruit from artificial feeding trays in both bushclump and open habitats. In light of the increasing land-use change for grazing and agriculture within the ATB, these findings suggest that artificial feeding trays may be used in restoration initiatives to help promote the distribution of thicket species by birds and could be a way to mitigate the negative effects of land-use change in years to come.

For further reading materials and more information contact Kelly Bernard, Rhodes Restoration Research Group, Rhodes University, Makhanda, South Africa 6139. Email kellymonicatandi@gmail.com, tel. +27 (0)83 565 5733.

All images (excluding camera trap records) were taken by the author, Kelly Bernard.

Karoo research update: Progress, gaps and threats

M Timm Hoffman[1], Richard M Cowling[2,3], Hana Petersen[1] & Cherryl Walker[4]

Current Address: [1]Plant Conservation Unit, Department of Biological Sciences, University of Cape Town, Cape Town, South Africa; [2]Department of Botany, Nelson Mandela University, Port Elizabeth, South Africa; [3]African Centre for Coastal Palaeoscience, Nelson Mandela University, Port Elizabeth, South Africa
[4]DSI/NRF SARChI Chair in the Sociology of Land, Environment and Sustainable Development, Department of Sociology and Social Anthropology, Stellenbosch University, Stellenbosch, South Africa
Reprinted from: S Afr J Sci. 2021;117(1/2), Art. #8695. https://bit.ly/38u36Xd

It has been more than three decades since the conclusion of the Karoo Biome Project (KBP).[1] At its height in the late 1980s, the KBP coordinated the efforts of nearly 100 research projects across a range of mainly ecological and agricultural disciplines. In this brief update we examine the research that has occurred in the Nama-Karoo and Succulent Karoo biomes since then and describe the relative contributions made by different disciplines to this body of knowledge. We also highlight efforts to synthesise knowledge across the disciplinary divides. Finally, we identify notable gaps in the research, especially considering the major land-use changes that are occurring across the Karoo. We conclude that new questions should be asked and that significantly greater collaboration between disciplines should be fostered in order to address the pressing challenges facing the Karoo more effectively. This necessitates a far more coordinated response than has been the case to date. Institutional leadership and additional funding will also be required to achieve this.

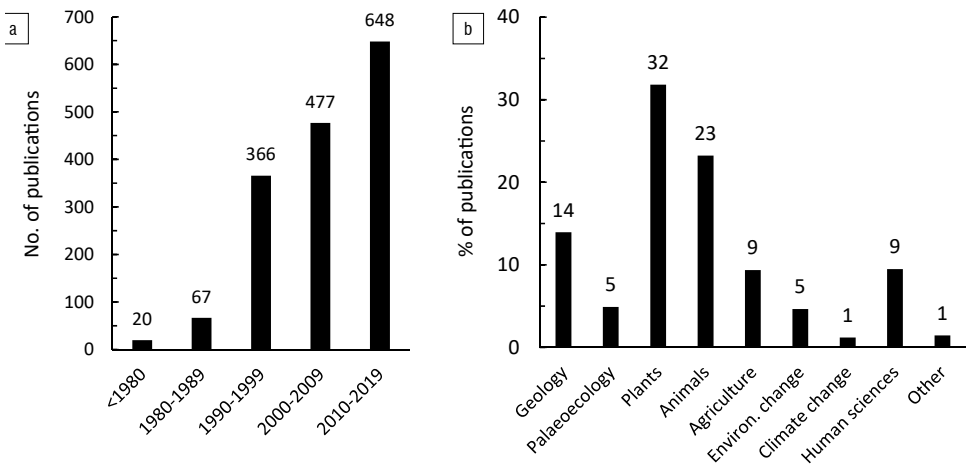

Figure 1: (a) The number of articles (N=1578) concerned with Karoo research and which are listed in the Web of Science for the period 1946–2019. (b) The percentage of publications on the Karoo according to their main disciplinary focus.

Growth and disciplinary focus in the published Karoo literature

To identify the research that has taken place in the Karoo, we searched the Web of Science for all articles using the words Karoo, Karroo, Namaqualand, Richtersveld, Sperrgebiet, Bushmanland, Knersvlakte or Augrabies in their titles, keywords or abstracts. The 5277 articles identified from this search were then reviewed separately by two of the authors (M.T.H. and H.P.). Articles which extended beyond the Karoo region, narrowly defined as the Nama-Karoo and Succulent Karoo biomes[2], were not considered further. Articles for which an abstract was not available were also excluded. The remaining 1578 journal articles (~30% of the original list) were then each assigned a keyword to reflect the primary disciplinary focus.

The selection criteria for our bibliography meant that several important books, book chapters, articles in non-peer reviewed journals, field records and short research notes that are either not indexed in the Web of Science or do not meet our full selection criteria fell out of the analysis. While this is a limitation, particularly with respect to the human sciences, we nevertheless consider that this database provides a broadly indicative and useful overview of the state of Karoo studies, one which can be expanded through follow-up work.

Results show that there has been a steady increase over time in the number of publications concerned with the Karoo (Figure 1a). The last decade of the 20th century was a clear turning point for Karoo research. More than four times the number of articles were published in the decade 1990–1999 than had been produced in all the years since 1946. The momentum created by the KBP undoubtedly contributed to this surge in publications. The number of publications has increased by 30% or more in each subsequent decade. This suggests an ongoing and vibrant research interest in the Karoo which shows little sign of abating.

Research output is, however, not evenly distributed across disciplines (Figure 1b). For example, the geological and palaeosciences together comprise 19% of all articles in our database while the human sciences (primarily anthropology, sociology and archaeology) make up just 9.5%. Most research (~70%) forms part of a broad environmental focus which includes articles in the biological, agricultural and geographical sciences. Evidently, the study of Karoo environments, their biology, their dynamics and how they are used and have changed over time is where the largest research effort has been expended.

Given our selection criteria, the disciplinary emphasis should be interpreted with some caution. Many non-environmental disciplines are not fully represented in the database. This is not only because of the database (Web of Science) and list of keywords used in the initial search, but also because of the additional criteria for inclusion that were applied to the initial selection. Several journals in the human sciences, for example, do not require abstracts with their articles and were excluded. So too were several articles in the geological and palaeoecological sciences which consider deposits and features over regions far larger than our more narrowly defined Karoo study area. Despite these shortcomings, the list of journal articles examined here is revealing of broad trends, both in terms of the increase in overall output and the relative distribution of disciplines.

Integration: Noteworthy syntheses of Karoo research

The bibliographic analysis highlights the progress that has been made in Karoo studies in specific research disciplines. What effort has been made to synthesise these findings and to integrate knowledge across disciplinary divides? To answer this question, we drew on our own scholarly engagement with Karoo studies spanning several decades.

Two edited book collections (neither of which was captured in our database) and three special issues of peer-reviewed journals have attempted this since 1999, albeit at somewhat different levels of disciplinary integration. The first comprehensive book on Karoo ecology[3] built on the research that had emanated from the KBP. The focus was primarily on a synthesis of what was known about the natural environment at the time. It comprised 20 chapters concerned with the physical environment, the biogeography of the biota as well as the form and function of key plant and animal groups. Chapters on ecological dynamics and the impact of people on the environment were also included. It remains the most important synthesis of the ecology of the entire region to date and several chapters have been cited over 100 times.

The 15 papers in the special issue of *Plant Ecology*, also published in 1999, took Karoo ecological research in a relatively new direction, into the Namaqualand, Richtersveld and Knersvlakte areas of the Greater Cape Floristic Region for the first time.[4] The emphasis was on the diversity, biogeography, physiology and conservation of the flora of the Succulent Karoo biome in relation to key environmental gradients. The impact of grazing and long-term changes in vegetation in response to climate and drought were also included. This was the largest single collection of peer-reviewed ecological research to cover this internationally recognised biodiversity hotspot. It laid the foundation for the subsequent explosion of interest in the region's conservation.

These two syntheses were followed in 2007 by another collection of articles dedicated to the winter rainfall Namaqualand region, published in a special issue of the *Journal of Arid Environments*.[5] Its focus, however, was less on the extraordinary biodiversity of the region and more on pressing management and social issues such as land reform and the contribution of agriculture, remittances and state grants to household livelihoods. The 20 papers in this special issue reflected a relatively new multidisciplinary focus for Karoo studies, with the history, ecology, and sociology of the communal areas in Namaqualand addressed in a single volume for the first time.

One of the longest-running research programmes in the Karoo is BIOTA (Biodiversity Monitoring Transect Analysis) Southern Africa. This initiative was supported by the German Federal Ministry of Education and Research (BMBF) over the period 2000–2010. Its primary focus was on the assessment and monitoring of biodiversity at 37 observatories along a 2000-km transect in South Africa and Namibia. A synthesis of the many outputs of this project by German and southern African scientists is contained in a three-volume set of books, which is freely available online.[6] Measurements at some of the observatories have extended beyond the lifespan of the project to provide valuable insights into long-term changes in plant diversity, especially in response to unusual events such as major droughts.[7]

The need for greater integration of the natural and social sciences has become a regular call in Karoo studies. The most recent synthesis of Karoo research[8] provides the clearest effort to date to understand the region's complex social-ecological systems more holistically. The 22 papers in the special issue of the *African Journal of Range and Forage Science* cover both the Nama-Karoo and Succulent Karoo biomes. Although the natural sciences still dominate, there is a notable presence of the human sciences, with nearly a quarter of the articles drawn from history, archaeology, sociology and anthropology.

Gaps and threats

One important research gap identified through our bibliographic analysis concerns the impact of climate change. Only 20 articles in our database are on this theme, nearly all of which address either changes in climate directly (50%) or the potential impact of future climate change on vegetation (40%). The potential impact of climate change on animals and agriculture is very poorly represented, with only one article listed for each, while broader social impacts are not covered at all. These are critical gaps given the cross-cutting impacts that have been projected for the arid parts of southern Africa as a result of climate change.[9]

Many researchers have also yet to fully appreciate the magnitude of the land-use changes in the Karoo over the last few decades and the need to adjust their research foci accordingly. For example, while commercial agriculture still dominates the landscape, livestock production has declined significantly since the early 1980s. Farm sizes have also increased, and wildlife farming has become more prominent. Relatively little is known about the full extent of such changes and their intersecting social and ecological impacts. The Karoo has also become a major location for the installation of wind and solar energy developments, with some 4% of the combined area of both biomes designated for renewable energy installations.[10] Concerns have been raised about the potentially harmful consequences for biodiversity[11]; their significance for South Africa's energy mix and local social impacts are just beginning to be studied.

Another set of pressures on the Karoo concerns the mining industry's interest in heavy metals and uranium extraction, as well as the targeting of the Nama-Karoo by the fracking industry as a potential source of shale gas. The two main syntheses which address concerns over fracking[12,13] highlight the paucity of information about the likely impacts of this industry on Karoo hydrology and environments. The effect of habitat fragmentation and noise, light and dust pollution created by the preparation and establishment of fracking sites is

likely to be extremely consequential for the biota of the Karoo, while the local jobs created are expected to be largely unskilled and short term. Unfortunately, little of the published literature on the Karoo is helpful when trying to predict the impact of such large-scale disturbances on the environment; these developments present unique pressures which demand new studies.

The wide-open spaces and relatively unpolluted skies of the Karoo have also caught the attention of astronomers. The Southern African Large Telescope opened outside Sutherland in 2005 while the world's largest radio telescope, the Square Kilometre Array (SKA), is being constructed near Carnarvon. The environmental impacts are likely to be broadly positive, with the establishment of a national park around the SKA adding considerably to the area under conservation protection in the Nama-Karoo. However, assessing the impact on local social and economic dynamics of the regulatory controls associated especially with radio astronomy is a more complex undertaking.[14]

Final thoughts

There has been an increasing flow of research outputs for the Karoo since 1986. While the interest has been primarily within the environmental sciences, a greater emphasis on the human sciences and interdisciplinary studies is becoming evident. However, much research underestimates the extent to which and significance of how land-use changes have reconstituted the Karoo's social and ecological environments. In this context, knowledge about rangeland ecology and the impact of domestic livestock has relatively limited reach. The new research questions that are emerging also underscore the need for more inter- and cross-disciplinary collaboration.

Even though the Karoo appears peripheral to the major centres of power, it is an historically and ecologically important region that features increasingly prominently in national development plans. Greater investment in Karoo research is urgently needed to advance our understanding and inform policy debates. To be effective, such research needs better coordination and stronger support by stakeholders across the disciplines.

Acknowledgements

This work draws in part on the research supported by the South African Research Chairs Initiative of the Department of Science and Innovation and National Research Foundation of South Africa (grant no. 98765).

Any opinion, finding and conclusion or recommendation expressed in this material is that of the authors and the NRF does not accept any liability in this regard.

Competing interests

We declare that there are no competing interests.

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The long shadow of colonial forestry is a threat to savannas and grasslands

Susanne Vetter

Current Address: Associate Professor in Plant Ecology, Rhodes University

Reprinted From: http://bit.ly/3rn4mTo

Tree planting to restore forests, capture carbon and improve the land has gained strong momentum in recent years. The Bonn Challenge and its offshoots such as AFR100, initiatives focused on forest restoration, have persuaded developing countries to commit millions of hectares of land to these projects. Funding for AFR100 has been secured from international donors with more than a billion US dollars pledged over the next 10 years.

This is a potential threat to drylands, grasslands, savannas and the rangelands they support.

Large areas targeted for forest restoration in Africa, Asia and South America are covered by savanna and grassland. These open ecosystems are incorrectly mapped as degraded forest in the publicly accessible Atlas of Forest and Landscape Restoration Opportunities.

They are in fact ancient, productive and biodiverse and support millions of livelihoods. They also provide many important ecosystem services, which would be lost if converted to forests.

Savanna and grassland store up to a third of the world's carbon in its soils. They keep streams flowing, recharge groundwater, and provide grazing for livestock and wildlife.

Grasslands can store carbon reliably under increasingly hot and dry climates. The same conditions make forests vulnerable to die-back and wildfires. Restoring grasslands is also relatively cheap and has the highest benefit-to-cost ratio of all the world's biomes.

Instead of providing guidance on how to restore healthy grasslands and savannas, documents guiding forest landscape restoration focus entirely on increasing tree cover. Rangelands and grassy biomes are barely mentioned on the websites of the Global Partnership on Forest and Landscape Restoration, the Bonn Challenge and AFR100.

Figure 1: Grasslands can store carbon reliably under increasingly hot and dry climates. (Photo: Shutterstock)

A recent review of forest landscape restoration projects in Africa found no examples of grassland restoration. Projects instead focused on afforestation – planting trees where they didn't previously occur – regardless of vegetation type. This threatens the biodiversity of grasslands and savannas, which is rapidly lost under dense tree cover and is slow and difficult to restore.

Forest targets that aren't based on science

Meeting the international targets for forest restoration requires large-scale afforestation. Nearly half the land pledged for forest restoration is earmarked for plantations, mostly of fast-growing exotic species. These provide a fraction of the ecosystem services of the natural vegetation they replace. And they store 40 times less carbon than naturally regenerating forests.

Forest restoration initiatives tend to be driven by targets, with little regard for local ecological context. This commitment to fixed areas of forest cover encourages tree plantations in ecologically inappropriate sites and conditions.

For example, Malawi has reportedly pledged 4.5 million hectares to forest restoration. This is over a third of the country's total area.

Planting trees and restoring community woodlots, plantations and riverbanks are presented as addressing food and water insecurity and restoring biodiversity. Yet studies have shown that Malawi's vegetation has been mostly savanna and grasslands for thousands of years.

The National Mission for a Green India aims to put a third of the country's area under forest cover, no matter what natural vegetation existed originally. Large areas of natural grassland-forest mosaics have been replaced with commercial plantations. In many areas these species have become invasive and difficult to control.

Why does forest restoration continue to ignore the local ecological context? What is the science that underpins these massive schemes?

The colonial roots of tree planting

Historical research shows that the fascination with tree-planting has its origins in colonial forestry. This in turn was rooted in the centuries-old (and now disproven) theory that forests bring rain and deforestation cause areas to dry up. The colonial forestry approach was to plant trees to make up for deforestation caused by local people. The latter often lost control over their land in the process.

Initially applied in Algeria, this approach was adopted throughout Francophone Africa, Madagascar, and eventually also the British colonies in East Africa and India. Since historical forest cover of Europe was estimated at roughly one-third, this became the target in other places too.

This led to over two centuries of planting forests as a solution for a variety of ills, including drought, warming temperatures, soil erosion and lost biodiversity. It's remarkable how today's science-policy platforms continue this narrative.

Promoting appropriate solutions

Forest landscape restoration has become a powerful instrument for guiding global efforts and funding. Its proponents have a responsibility to ensure that the framework is scientifically sound.

Rather than setting ambitious but ecologically flawed targets for planting trees, landscape restoration should be appropriate for local social and ecological contexts.

No amount of ecosystem restoration will solve the climate crisis if its underlying causes are not addressed.

The clearing of forests and other ecosystems for commodity agriculture and timber urgently needs to be regulated. Emissions from burning fossil fuels need to be drastically reduced.

Rather than targeting developing – and rapidly urbanising – countries for afforestation, incentives should aim to reduce fossil fuel emissions, convert to renewable energy and build energy-saving infrastructure.

On a farm near Prince Albert – Assessing drought impact on Karoo vegetation (Photo by Janet Taylor)

Scientists address myths over large-scale tree planting

Helen Briggs

Current Address: BBC Science correspondent
Reprinted From: http://bbc.in/3qnogw2

Tree planting is a brilliant solution to tackle climate change and protect biodiversity, but the wrong tree in the wrong place can do more harm than good, say experts at the Royal Botanic Gardens, Kew.

The rules include protecting existing forests first and involving locals. Forests are essential to life on Earth.

They provide a home to three-quarters of the world's plants and animals, soak up carbon dioxide, and provide food, fuels and medicines.

But they're fast disappearing; an area about the size of Denmark of pristine tropical forest is lost every year.

"Planting the right trees in the right place must be a top priority for all nations as we face a crucial decade for ensuring the future of our planet," said Dr Paul Smith, a researcher on the study and secretary-general of conservation charity, Botanic Gardens Conservation International, in Kew.

A raft of ambitious tree-planting projects is underway around the world to replace the forests being lost.

Boris Johnson has said he is aiming to plant 30,000 hectares (300 sq km) of new forest a year across the UK by the end of this parliament.

An African-led movement to plant a 5,000-mile (8,048 km) forest wall to fight the climate crisis is set to become the largest living structure on Earth, three times the size of the Great Barrier Reef.

However, planting trees is highly complex, with no universal easy solution.

"If you plant the wrong trees in the wrong place you could be doing more harm than good," said lead researcher Dr Kate Hardwick of RBG Kew.

All too often natural forests teeming with plants, animals and fungi are replaced by commercial plantations with row upon row of timber trees, which will be harvested after a few decades, she told BBC News.

"What we're trying to do is to encourage people, wherever possible, to try and recreate forests which are similar to the natural forests and which provide multiple benefits to people, the environment and to nature as well as capturing carbon."

The review of research, published in the

Figure 1: Trees must be able to cope with projected climate change (Photo: ALEXANTONELLIRBGKEW)

Figure 2: It takes at least a century to restore damaged forests (Photo: RBGKEW)

Figure 3: Undamaged old-growth forests are major long-term carbon sinks (Photo: RBFKEW)

journal Global Change Biology, found that in some cases, planned tree planting does not increase carbon capture and can have negative effects.

The 10 golden rules are:

1. Protect existing forests first

Keeping forests in their original state is always preferable; undamaged old forests soak up carbon better and are more resilient to fire, storm and droughts. "Whenever there's a choice, we stress that halting deforestation and protecting remaining forests must be a priority," said Prof Alexandre Antonelli, director of science at RGB Kew.

2. Put local people at the heart of tree-planting projects

Studies show that getting local communities on board is key to the success of tree-planting projects. It is often local people who have the most to gain from looking after the forest in the future.

3. Maximise biodiversity recovery to meet multiple goals

Reforestation should be about several goals, including guarding against climate change, improving conservation and providing economic and cultural benefits.

4. Select the right area for reforestation

Plant trees in areas that were historically forested but have become degraded, rather than using other natural habitats such as grasslands or wetlands.

5. Use natural forest regrowth wherever possible

Letting trees grow back naturally can be cheaper and more efficient than planting trees.

6. Select the right tree species that can maximise biodiversity

Where tree planting is needed, picking the right trees is crucial. Scientists advise a mixture of tree species naturally found in the local area, including some rare species and trees of economic importance, but avoiding trees that might become invasive.

7. Make sure the trees are resilient to adapt to a changing climate

Use tree seeds that are suitable for the local climate and how that might change in the future.

8. Plan ahead

Plan how to source seeds or trees, working with local people.

9. Learn by doing

Combine scientific knowledge with local knowledge. Ideally, small-scale trials should take place before planting large numbers of trees.

10. Make it pay

The sustainability of tree re-planting rests on a source of income for all stakeholders, including the poorest.

Watch the video:
https://bbc.in/3edzykn

How satellites are stopping deforestation in Africa

Chelsea Gohd

E-mail Address: cgohd@space.com

Reprinted From: http://bit.ly/30gcY22

Satellites are helping to reduce deforestation across Africa. Thanks to the help of Earth-orbiting satellites, deforestation, which creates significant carbon emissions and is a major contributor to climate change, has decreased significantly in 22 African countries, researchers found in a new study.

In these countries, organizations subscribed to a free service that sends out alerts about decreases in forest cover in the tropics from a new service that uses up-to-date satellite data. When there is a drop in forest cover, these automated warnings send high-resolution satellite data and alert messages to those in local governments and others interested in decreasing deforestation (anyone can sign up for the messages). These messages are delivered as part of the Global Land Analysis and Discovery system (GLAD) on the free, interactive web interface Global Forest Watch, which was initially launched in 2016.

This new study, led by Fanny Moffette, a postdoctoral researcher in applied economics at the University of Wisconsin-Madison, looked at the effects of these alert messages on deforestation. Moffette and their team observed an 18% drop over two years in 22 African countries. The carbon emissions avoided with this reduction could be saving anywhere between $149 million and $696 million in economic damages, University of Wisconsin-Madison officials said in a statement.

Global Forest Watch covers the globe and this study aimed to show how subscriptions to GLAD affected deforestation in Africa, South America and Asia. Now, while the team didn't see a decrease in deforestation in South America or Asia in satellite data from over a 2-year period, they saw this drastic decrease in African countries where people subscribed to the system. But only countries in which organizations and officials subscribed to the alerts saw this decrease.

It is not yet clear exactly why some have chosen to subscribe while others are not subscribed, if it is due to personal choice or a lack of access to reliable internet and technology to keep up with these alerts.

The system can provide alerts about forest cover as often as every eight days (if the skies are clear enough that satellites are able to fully monitor a region). Subscribers get warning messages when concerns about forest cover arise and weekly emails that include exact geographic coordinates of areas where increasing deforestation appears concerning. Anyone can subscribe for the free alerts, check out GLAD on Global Forest Watch here.

While this program is fairly new, the team hopes to continue to study the effects of this subscription system and how access to this satellite data can impact deforestation rates long term.

"Now that we know subscribers of alerts can have an effect on deforestation, there are potential ways in which our work can improve the training they receive and support their efforts," Moffette said in the same statement.

This work was published Jan. 4 in the journal Nature Climate Change.

"We think that we see an effect mainly in Africa due to two main reasons," Moffette said in the statement. "One is because GLAD added more to efforts in Africa than on other continents, in the sense that there was already some evidence of countries using monitoring systems in countries like Indonesia and Peru. And Colombia and Venezuela, which are a large part of our sample, had significant political unrest during this period."

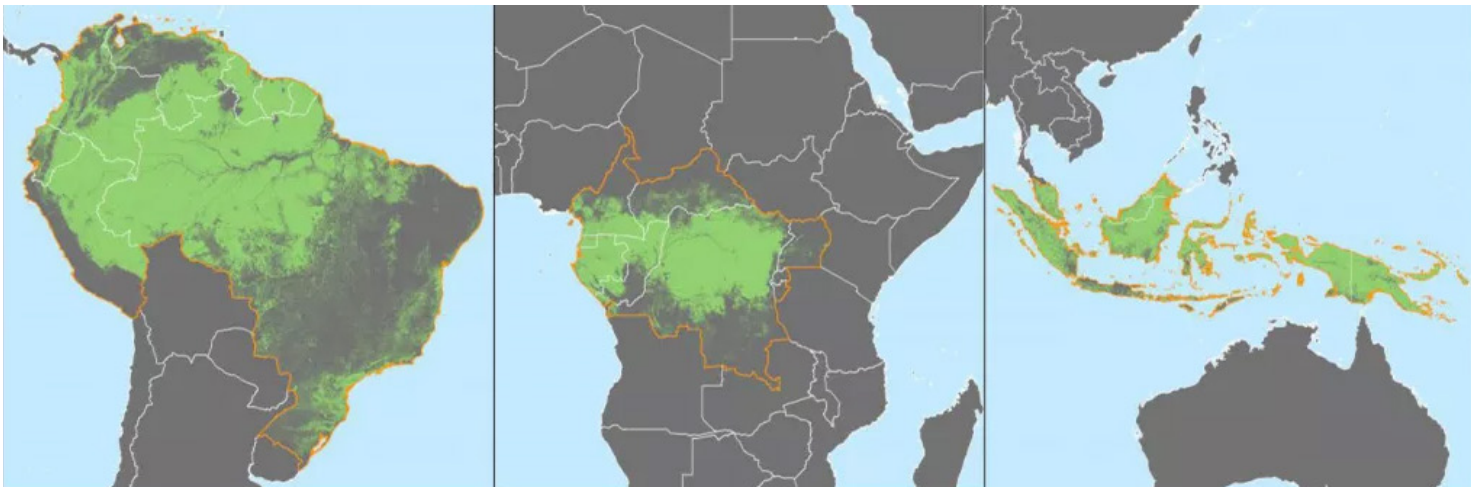

Figure 1: A new study has shown how satellite data can help to reduce deforestation. This image shows forest cover (shown in green) in Africa, Asia and South America. (Image credit: Fanny Moffette / University of Wisconsin-Madison)

Did fences cause the elephant deaths in Botswana?

Did fences in northern Botswana cause the mysterious death of hundreds of elephants in 2020? News media have been quick on the draw to blame fences, after the release of a recent report suggests a strong link. But, as is often the case, the situation is nuanced and requires pragmatic analysis rather than finding simple solutions to complex problems.

Team Africa Geographic

Current Address: Africa Geographic, Decoding Science
Reprinted From: http://bit.ly/3sYG2aX

Between March and June 2020, a mysterious illness claimed the lives of 330 elephants in the Seronga district of Botswana's Okavango Delta. Now, a new study has shed light on the broader ecological implications of these elephant deaths and how a complex interplay of natural and anthropogenic factors (including fences) all played a role.

Scientists have used previous research on elephant movements in the area to interpret the wider conservation implications of these deaths. In particular, their conclusions highlight three main aspects significant for the management of elephant populations, not just in Botswana but throughout Africa:

1. **The impact of fences** on conservation – data from collared elephants indicates that the combination of the Okavango River and fences

Figure 1: Elephant carcasses in Northern Botswana, May/June 2020 (Photo: Africa Geography)

have prevented the elephant population in Seronga from dispersing under unfavourable conditions;

2. **The overlap between natural and unnatural factors** – the elephants were likely more susceptible to natural diseases/toxins due to anthropogenic restrictions and, potentially, stress due to human-wildlife conflict;

3. **Land-sharing between people and elephants** becomes superficial when the elephants' access to resources is restricted, and they are prevented from dispersing naturally.

Their recommendation to mitigate future mass die-offs is to remove or realign certain fences around the Seronga district of Botswana.

The background

As would be expected, the deaths of such large numbers of elephants fuelled considerable concern and significant media speculation, though investigating authorities ruled out poisoning, poaching, and anthrax.

Samples were sent for testing in Zimbabwe, the United States and South Africa's Faculty of Veterinary Science at the University of Pretoria, though COVID-19 restrictions delayed the process significantly. In September, Botswanan officials announced that the deaths had resulted from poisoning by cyanobacterial toxins caused by a bloom of cyanobacteria in the available waterholes. These bacteria are naturally occurring, and 'blooms' happen when conditions are suitable.

The recently published (11 January 2021) report was written in October 2020, just after the Botswana government's announcement regarding the cause of death. However, the authors note that other carcasses, including domestic animals, would have been expected had the pans been contaminated by cyanobacteria. They state that the "restriction of freshwater supplies that force elephants to use pans as a water source possibly polluted by blue-green algae blooms is a possible cause, but as yet not supported by evidence."

Most of the elephant carcasses were found within an area administratively known as NG11, along the Panhandle region of the Delta – a region where human-wildlife conflict is rife. Neither NG11 nor neighbouring NG12 have protected status and are designated for subsistence agriculture.

These regions neighbour the Kavango-Zambezi Transfrontier Conservation Area that extends over five countries

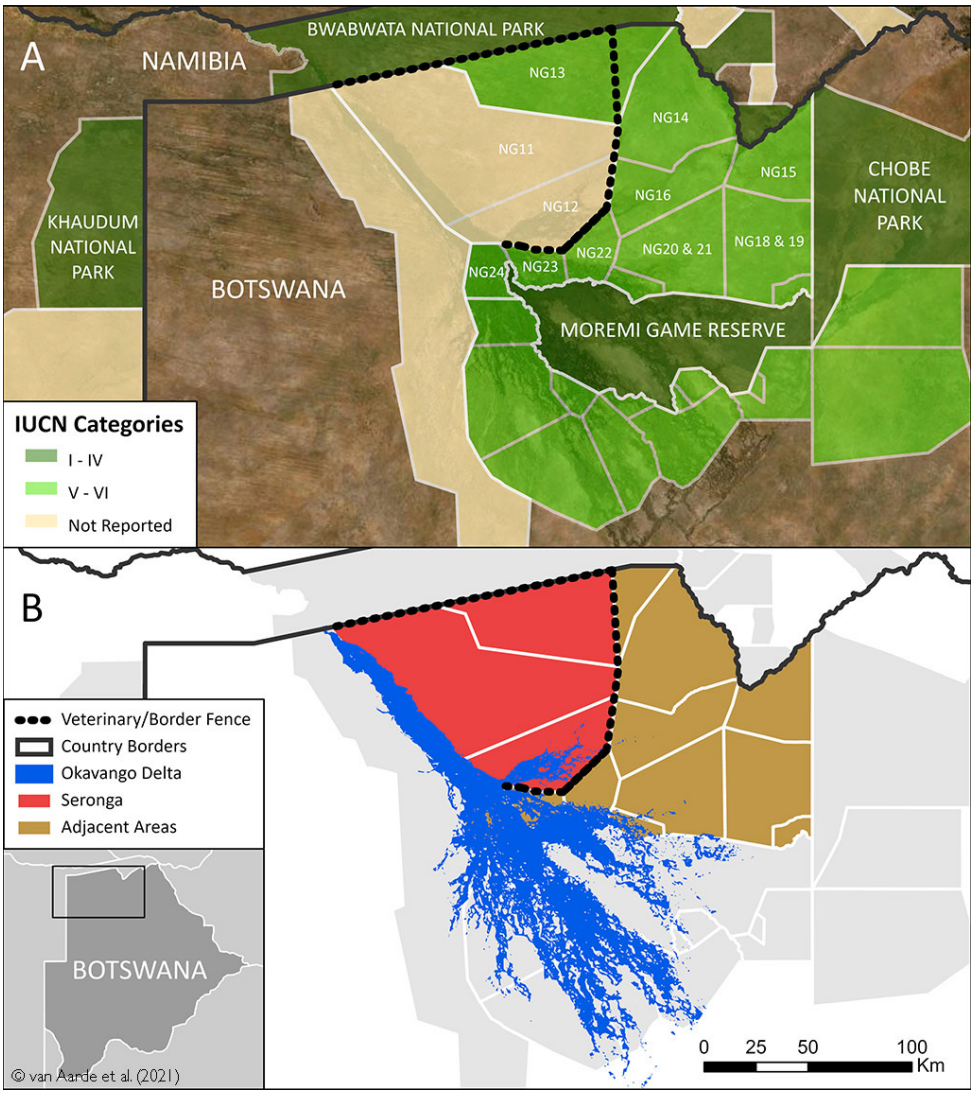

Figure 2: NG11 and NG12 administrative blocks have no protected status (A). The Seronga area (NG11, NG12, and a part of NG13) is cut off from the surrounding landscape by either deep water of the Okavango River and Delta (blue) or veterinary or border fences (dashed lines) (B). The shapefiles for the protected areas were sourced from the World Database on Protected Areas (https://www.protectedplanet.net/en) and for the Okavango Delta from the ESA Climate Change Initiative (Land Cover project 2017).

and is home to the largest population of African bush (savanna) elephant in Africa.

The research

The study was authored by members of the Conservation Ecology Research Unit in the Department of Zoology and Entomology at the University of Pretoria and the Nicholas School of Duke University Environment. Their previous research included a long-running research programme in the region, tracking the movements of ten collared elephants within NG11 for several years and those of elephants in neighbouring blocks.

Their research indicates that the elephants within NG11 are restricted by the Okavango River to the west and international border and veterinary fences to the north, east and south. As a result, the elephants cannot disperse when numbers are too high or when environmental conditions are harmful. The population growth rate for the Seronga area since 1995 is exceptionally high, and elephant numbers in NG11 and NG12 are significantly higher than those in neighbouring blocks, though densities are comparable. The report concludes that while a disease is a likely explanation for the mass die-off, this would have been caused by several forces acting in concert, exacerbated by both natural and artificial factors. The restricted movements have resulted in high densities of elephants and, at the same time, confined the death-causing agent to one specific region.

It is also possible that poaching, conflict with people and restricted access to the Okavango Region forced elephants to rely on stagnant water. Increased stress

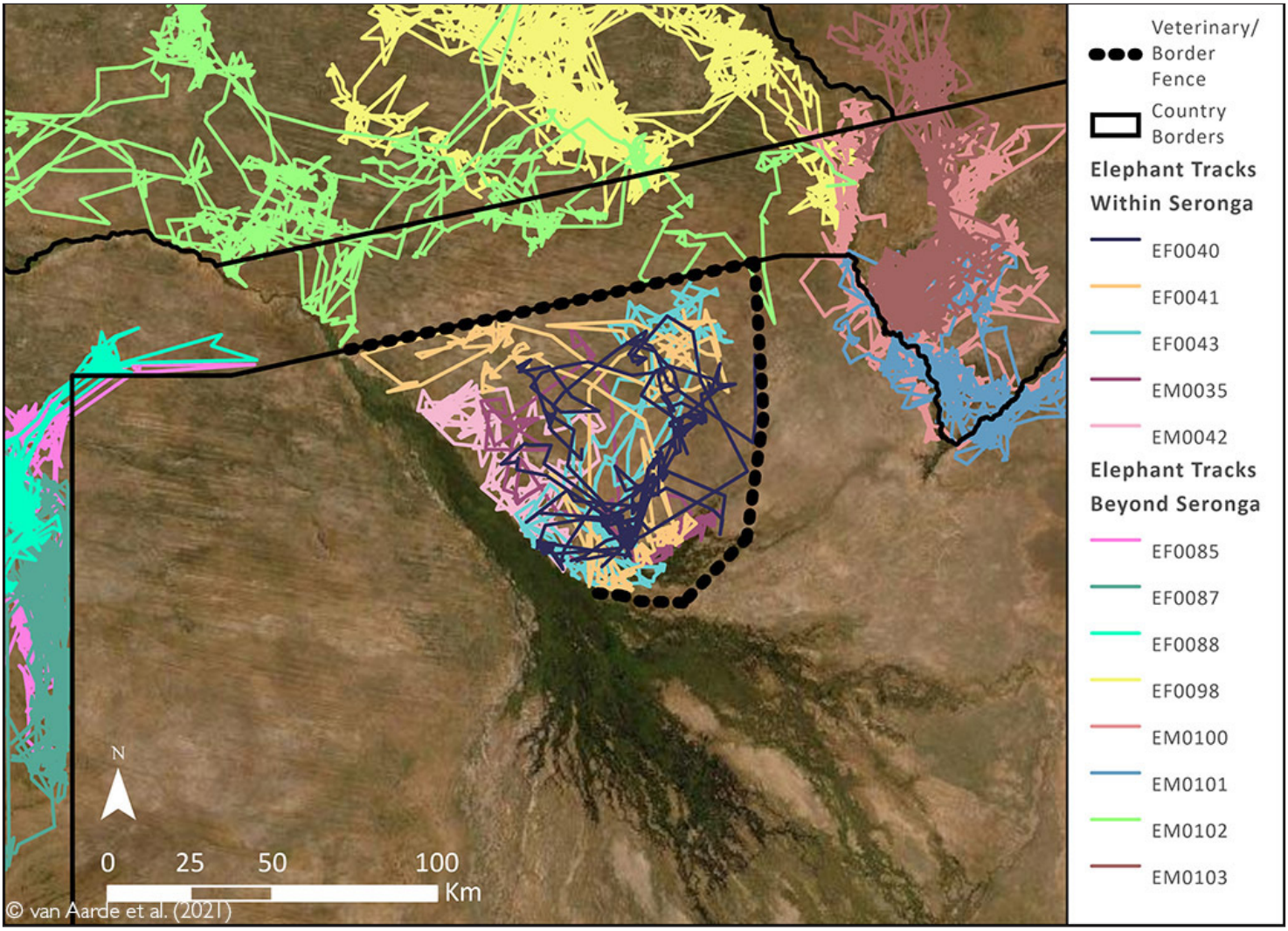

Figure 3: The pathways of five elephants in the Seronga area (NG11, NG12, and NG13) from October 2003 to November 2006 and eight elephants roaming beyond Seronga that we tracked from November 2004 to March 2010. The elephants in Seronga did not cross the veterinary fence (dashed lines) or the Okavango Panhandle. Neither did the elephants beyond the boundaries separating Seronga and the adjacent areas in Botswana, Namibia, Angola, and Zambia. Basemap Source: ESRI, MAXAR.

levels may also have increased their susceptibility to disease. Thus, the article suggests that "such a complex chain of events consisting of multiple causes makes communication complex and policy actions intricate."

The implications

These complexities highlight several aspects for deeper consideration. The first is the impact of fences on the broader African conservation landscapes and how, historically, veterinary fences have contributed to the declines of antelope species such as sable and tsessebe, and zebra and wildebeest numbers.

According to the authors, the restriction of elephant movement and dispersal in Seronga adds more evidence of the potential hazards of fencing. However, they acknowledge that this is area-specific and there are areas, like South Africa, for instance, where fencing may benefit conservation.

The second is what kind of management response is required, given that the causes were likely a combination of natural and anthropogenic ones. Diseases are not unnatural, and mass die-off events are not without precedent. However, the barriers that prevent dispersal and access to the permanent river are unnatural.

The third aspect centres around the discussion of the human-wildlife coexistence (or lack thereof). Essentially, the question of land-sharing, as opposed to land-sparing in the case of national parks, becomes superficial when access to resources is restricted, and artificial barriers prevent dispersal, allowing for the spread of contagious disease.

The land is not "shared" with them. Here, the authors recommend a discussion around realigning veterinary fences.

In essence, the deaths of 330 elephants will have little impact on the region's overall population and represent just 2% of the total estimated 15,000 elephants in the Seronga region.

The event that caused their death, whether contagious disease or poisoning by cyanobacterial toxins, is almost certainly natural.

However, the circumstances that made it more likely to occur are due to human restrictions on both movement and access to freshwater.

The authors conclude that "we must not allow our predilections for simple answers to interfere with reasoned analysis and discussing the broader significance."

The full study can be accessed here: "The 2020 elephant die-off in Botswana", van Aarde RJ., Pimm SL., Guldemond R., Huang R., Maré C., (2021), PeerJ

A moo-ving target: fenceless grazing widens possibilities for cows and wildlife

GPS collars that alert cows when they reach a boundary are helping to improve habitats and boost biodiversity

Patrick Barkham

Current Address: The Guardian
Reprinted From: http://bit.ly/3kQKwgS

There is something missing from the bucolic upland scene of shaggy, bracken-coloured cattle grazing between young trees on the Cumbrian hillside: fencing.

When the Highland-cross cows reach a certain point, the blue plastic medallion dangling from their necks plays a melody like a mobile phone ringtone. The cow turns around, and the invisible GPS fence has done its job.

Fenceless grazing is being hailed as revolutionary by conservationists and farmers, particularly in beautiful, sensitive or rough upland landscapes that are impractical, expensive or undesirable to fence.

The technology is being embraced by rewilders who want cows to mimic the grazing of extinct wild herbivores such as aurochs and move through wider landscapes in a natural way, ensuring their grazing creates mosaics of habitat and boosts rare flora.

"This is a gamechanger for us," said Charlie Burrell, of the rewilded Knepp estate, which is keen to embrace the technology. "If we can restrict or move grazing animals through the landscape without fences or wolves, it's just bloody brilliant. We can use animals as tools to encourage biodiversity and we simply use an app to draw a line around sensitive areas where we don't want the animals to spend any time."

In Cumbria, 19 cows on the RSPB reserve of Geltsdale have successfully trialled the £300-per-collar technology as part of a North Pennines AONB Partnership project funded by the National Lottery Heritage Fund.

David Morris, of the RSPB, said: "The habitat change we've seen has been absolutely fantastic. The cows have got into the coarse vegetation areas and broken it up, diversifying and improving the habitat. The technology has allowed us to do that in a really smart and sustainable way."

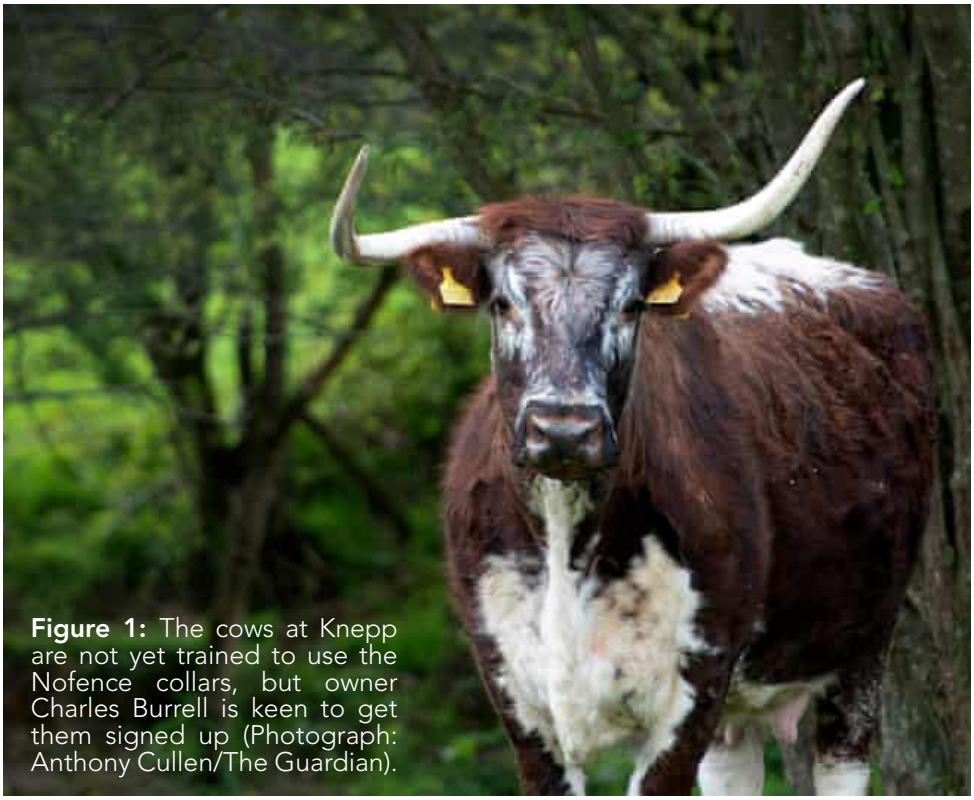

Figure 1: The cows at Knepp are not yet trained to use the Nofence collars, but owner Charles Burrell is keen to get them signed up (Photograph: Anthony Cullen/The Guardian).

The cows have been fenced away from springs so they won't pollute the watercourse, and they can even be fenced away from individual wildflowers such as orchids or ground-nesting birds if required.

Emma Wright, of the North Pennines AONB, said that since the RSPB's successful trial at Geltsdale, other Cumbrian landowners were keen to use the technology as hill-farmers looked for more wildlife-friendly alternatives to intensive sheep-grazing.

"These collars allow us to get larger animals such as cows that create a perfect variety of sward into this really difficult upland terrain, and help manage grassland and wood-edges for really picky species such as ring ouzel and black grouse," said Wright. "Fences in the uplands can also be a problem for species such as black grouse, which die when they collide with them."

The technology has also been used in Wanstead Park and Epping Forest, for

Figure 2: In Cumbria, 19 cows on the RSPB reserve of Geltsdale have successfully trialled the £300-per-collar technology (Photograph: Courtesy of RSPB).

Figure 3: Other Cumbrian landowners are reportedly keen to use the technology as hill-farmers look for more wildlife-friendly alternatives to intensive sheep-grazing (Photograph: Courtesy of RSPB).

long a pioneer in fenceless systems, to ensure grazing animals can mix with large numbers of visitors, and it is being rolled out in several dozen locations around Britain.

The fenceless grazing system was devised by a Norwegian company, Nofence. Landowners simply draw a map on their phone app of the area they want fenced. The solar-powered GPS collars play a melody to alert the animals when they approach the invisible fence line. If they cross it, the collar administers a small electric pulse, like an electric fence. After a short training session with the collars, the cows swiftly learn to turn away when the melody plays on.

Nofence has delivered collars to landowners grazing cows, sheep and goats in Norway, Spain, France, Germany, Belgium and Italy, as well as 25 customers in Britain.

According to Synne Foss Budal, of Nofence, individual cows have caused the warning melody to begin 400 times but are smart enough never to receive a shock. The fact that cows use hearing to detect the invisible fence rather than sight means they don't blunder into it in the dark, as they do with conventional electric fences.

A National Trust trial of fenceless grazing at Studland Bay, Dorset, found that the collar system delivered just 1-2% of the electric pulses that a conventional electric fence gave to livestock.

Foss Budal said the technology helped ensure that if cows got into trouble in remote areas – falling into a ravine, for instance – farmers could rapidly locate them via the GPS collar and help them.

She said: "I've had farmers in Norway who for the first time in 15 years have gone on holiday because they can monitor their animals on the app. We're trying to increase farmers' welfare as well as animal welfare."

Livestock's role in a changing climate

The grazing of livestock stores carbon in the soil

Raylene Nickel

Current Address: SuccessfulFarming
Reprinted From: http://bit.ly/3uW7qli

Edward Bork's research surrounding how livestock grazing affects soil carbon has made him a believer in the beneficial role cattle can potentially play in a changing climate.

"Because their grazing contributes to the concentration of carbon in the soil – a helpful process – livestock can be a tool to help reduce atmospheric carbon and thus mitigate climate change," says Bork, director of the Rangeland Research Institute, University of Alberta.

Cattle critics say otherwise, calling for decreases in numbers or even elimination of ruminants as a means of reducing the greenhouse gases contributing to climate change. They point to the methane cattle emit as a key polluter of the atmosphere. Methane is a potent greenhouse gas that ruminants put out

Figure 1: The grazing of livestock stores carbon in the soil.

as part of their digestive process.

Bork calls for a balanced view, one that weighs the drawbacks against the benefits.

"Pointing the finger at methane emissions of livestock is a convenient excuse people use," he says. "It's a red herring to claim that cattle are destroying the planet and ignores the fact that these grasslands evolved with grazing – and even depend on it to exist. Discussions of cattle and climate change should not talk solely about methane but should also include a full accounting of the role livestock play in storing carbon in the soil as well as in enhancing biodiversity."

Grazing increases carbon

The natural carbon cycle in soil begins as plants take in carbon dioxide (CO_2) from the air. Plants use the carbon to make roots, shoots, and leaves. With the help of soil microbes, plants then transfer carbon to the soil through roots and decomposing residue. The stable storage of this carbon below ground builds soil organic matter, and it reduces levels of atmospheric carbon. The process is called carbon sequestration.

While the carbon cycle occurs naturally with varying degrees of efficiency in croplands as well as in grasslands – with or without grazing – grazing at moderate levels tends to increase the amount of carbon sequestered in grassland soils.

Drawing from her research and the research of other scientists, North Dakota grassland ecologist and science application educator Rebecca Phillips says, "We are finding plants put more carbon below ground as a result of the grazing of livestock. A well-managed grazing system stores more carbon in the soil than grasslands that are not grazed.

"The key is the activity in the plant roots," she says. "Their response to grazing is to produce more roots and more exudates through the roots. Exudates feed the microbial population in the soil. In turn, microbes process the root materials, transforming them into forms used by microbes stored in soil – effectively improving the health of the soil to support plant growth. Grazing is one key to supporting healthy microbial communities in soil."

Phillips cites results of a study published in *Global Change Biology*, where the average mass of plant roots harvested from grazed grasslands was more than 2,400 pounds per acre. In comparable ungrazed grasslands, the average mass of plant roots was 740 pounds per acre.

The greater root mass produced in grazed grassland partially explains why grazing tends to concentrate more carbon in the soil. Bork's research bears this out. He and his team measured soil carbon at more than 100 grassland sites spanning six distinct climate subregions in Alberta. Each site included an area of long-term grazing as well as one that was not grazed.

"We found moderate grazing enhanced soil organic carbon concentration by 12% in the upper 15 centimeters of soil," Bork says. "Total carbon stocks – most of which was in the soil – within the grazed areas weighed from 20 tons per acre to 80 tons per acre."

The wide, site-specific range in the levels of carbon potentially stored in soil as a result of grazing causes ranchers to wonder what level of carbon their systems are storing. Phillips says, "Increasing organic carbon from 3% to 4% in the top 4 inches of the soil profile is approximately equivalent to storing an additional 11 tons of carbon per acre."

This gives producers a seat-of-the-pants yardstick of how much carbon regenerative grazing systems potentially draw out of the atmosphere. This, set against the backdrop of Bork's measurement of vast stores of carbon stocks in grasslands, suggests the stakes are high in the debate over cattle's role in climate change.

Movement of this large mass of sequestered carbon back into the atmosphere, as occurs under cultivation, could result from a swing in consumer demand away from beef and toward plant-based replacements. Economic-driven changes in land use could result, and the upshot could be significant new emissions of CO_2 from the soil back into the atmosphere. This CO_2 would contribute to global warming.

Ongoing land-use changes could intensify as ranchers are forced to convert grassland to cropland in an effort to replace income lost from displaced beef sales. Conversion typically involves using chemicals to kill grass and may also include tillage to break up sod, in the process reducing biodiversity.

Much of North America's "mixed-grass prairie should never have been plowed in the first place due to poor agronomic conditions," Bork says. Original plowing of the prairie resulted in an explosion of stored CO_2 into the atmosphere. Some researchers estimate soils of the Great Plains region have lost as much as 50% of their carbon-loaded topsoils after decades of farming.

"There's a significant environmental penalty to pay," Bork says. "Yet grassland is still being converted to cropland in western Canada and many other regions of the globe. This conversion results in a 30% to 50% loss in soil carbon, released as CO_2 into the atmosphere. Restoring soil carbon takes years.

"Everything is at stake when grassland is converted," he says. "A broad suite of goods and services provided by grasslands to society at little cost is lost, and it's much more than carbon sequestration. Grasslands provide water purification, flood mitigation through reduced runoff, and habitat for birds and wildlife."

The whole picture

Public criticism of livestock because of methane emissions picks away at one piece of a much larger holistic puzzle. "It's taking a very limited view of the carbon balance," Phillips says. "There needs to be a greater understanding of the whole picture."

She estimates, based on a study by Francis Kelliher and Harry Clark in 2010, enteric methane produced today on the Great Plains by 40 million cattle amounts to "13 pounds of carbon as methane per acre per year." This amount is dwarfed by Bork's and others' measurements of total carbon stored in grassland soils – carbon that would be at risk of release back into the atmosphere if the grassland became cropland to produce plant-based protein.

The amount of methane emitted by cattle also needs to be balanced against the natural processes built into grassland ecosystems that scrub methane from the atmosphere. "Studies are showing grasslands can be a net sink for methane because there are microbes in the soil that break down methane," Bork says. "Because of these little scrubbers, healthy grassland soils are able to offset a portion of the methane produced by cattle."

The holistic circle of benefits grazers provide includes consumers. "Plants, grazers, and microbes all work together to build healthy soils while converting grass to a healthy source of protein for people," Phillips says.

Rotational grazing for animal productivity

Izak Hofmeyr

Current Address: Stockfarm
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The term 'rotational grazing' is very often misinterpreted and has become closely aligned with a very rigid system where decisions based on actual veld condition are rarely considered. This is according to Prof Kevin Kirkman, professor in grassland science at the University of KwaZulu-Natal in Pietermaritzburg.

The priority of veld management, he says, should be the production of veld-grazing animals. "For animal production to be high, animals need to eat short, actively growing grass throughout the summer. As soon as you allow the grass to grow too tall, it loses its quality very quickly, especially in the sourveld regions of the country. However, it may also affect the sweetveld areas to some extent."

Tall-growing grass that has started going to seed, he explains, has already declined in quality, which means that animal performance will also decrease.

"If one looks at many of the continuous grazing approaches, animal production is generally quite good, unless the stocking rate is too high. The reason is that the animal can move around and select the high-quality, actively growing plants. Yet a continuous grazing system is probably not very sustainable. My approach would therefore be to take the best the continuous grazing system has to offer, and make it sustainable by allowing plants to recover from grazing."

Rotating between camps

Prof Kirkman suggests that producers use rotational grazing to graze their animals during summer in a way that will enhance performance. He uses a so-called Long Tom beer can as indicator of when a camp should be grazed and when the animals should be removed from that camp.

"Let's say you have ten camps per herd. At the start of the growing season, you start grazing camp 1 until the veld is as high as a Long Tom beer can lying on its side. Then you move to camp 2, followed by camp 3. You continue this way until the grass in camp 1 is the same height as an upright beer can. Then you move back to camp 1.

"You follow this approach right through summer, no matter how many times you go back to camp 1. If for some reason another camp is ready for grazing before camp 1, you go back to that camp. It is important not to follow a fixed rotation, but to base decisions on actual veld condition. This way you will have

Figure 1: A dynamic rotational grazing system is a good way of determining the correct stocking rate for a particular farm.

Figure 2: The camp on the right has been grazed to the height of a Long Tom beer can lying on its side. The grass in the camp on the left, however, has had an opportunity to start growing again.

a gradient of forage volume as well as quality in your camp system."

Prof Kirkman emphasises that, in mixed veld, producers need to use palatable species in order to measure growth. Once these species reach beer can height, they can go back to that camp. The quality of short grass is high, such as in the first paddock, but the quantity low. At the other end of the available paddocks, camps 6 to 10 for example, the grass would have grown quite tall, leading to low quality but abundantly available grass.

"Should there be a dry spell during summer, with little growth, you have those tail-end camps available. Although the quality will be low, you will at least have feed available for the animals."

Navigating winter veld

When planning fodder flow for the year, the main thing to determine is the amount of feed the animals will require during winter. Ideally, livestock should not graze the camps set aside for winter during the summer.

"These winter camps will not have high-quality grazing, but enough of it will be available. Because there is no regrowth during winter, producers do not need to follow the same dynamic rotation system employed in summer. They can start in one camp and when the grazing is finished move to the next one until the last of the winter camps is reached. At the end of winter, they can move back to the summer veld."

Although not always practical, Prof Kirkman says, it would be ideal to switch winter and summer veld every year. A more viable alternative is to move the first summer camp forward every year in the rotational grazing system.

"Next summer you start in camp 2 and come back to camp 2 every time the grass has reached Long Tom height. Camp 1 becomes the last camp of the winter veld. The following summer, camp 3 becomes the first camp, and so on. The implication is that every camp in a ten-camp system will be the first camp that is grazed every ten years. Camps will therefore have the opportunity to rest for a full growing season for a good half of those years."

This system offers the best of two worlds. From an animal production point of view, producers can provide high-quality veld throughout summer, while abundant veld is available in winter. From an ecological perspective, producers are improving their veld because they are not treating a particular camp the same way year after year. The grass can grow out, replenish its root system, and produce seed. It can continue its full growth cycle without being interrupted.

Fodder flow planning

As every year is different, it is critical to timeously assess the amount of feed that will be available in winter, while taking into account the amount of feed the animals will require.

"Let's say that you normally move over to your winter grazing on 1 April. During a dry summer, it might be that you have to start grazing the first winter camp in March. This means that you would be a month short in terms of winter grazing. However, because production during summer was less than optimal, you need to move through the winter veld much quicker than usual as well. This could mean that you will be two or more months short in terms of winter veld. This offers an advantage, though, in that you will be able to determine with some accuracy how much extra feed would be needed."

Based on this assessment, producers can decide which measures to implement to alleviate the problem. "Producers can either reduce their livestock numbers, buy in feed or lease extra land. The point is that it gives a few months warning before they run out of feed, which means they can plan accordingly."

The correct stocking rate

In a rotational grazing system that utilises a number of summer camps and a number of winter camps, it becomes much easier to determine the carrying capacity of a farm.

"If you run short of summer grazing in most years, you know that you are carrying too many animals. If, on the other hand, your animals can be comfortably moved onto winter grazing at the planned time, you know that the stocking rate is correct for the farm. If you have grazing left over in the summer areas at the start of winter, you know that you can carry more animals."

This dynamic rotational grazing system is a good way of determining the correct stocking rate for a particular farm. It is also a good way of planning for drought. Producers will also find that veld rested for a full growing season is more productive the following growing season, Prof Kirkman says. This system will thus improve the farm's carrying capacity over time.

For more information, send an email to Prof Kevin Kirkman at kirkmank@ukzn.ac.za.

Figure 3: Winter veld is low in quality but high in quantity.

Grass farms its own microbes

The Grass is Greener on the Udder Side

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I once came across two studies that stopped me abruptly in my cognitive tracks. Both studies showed that plants were not just passive recipients of the multitudinous goods and benefits that soil microbes provide to promote their growth (most importantly, nitrogen) and general health.

Rather, plants are active cultivators of the microbial communities in and around their roots (their rhizosphere), tending them carefully to ensure they thrive and provide the plant just what it needs.

The first study was on, *Poa pratensis*, a grazing-tolerant grass common in the Yellowstone National Park where bison and elk graze the grassland heavily in places, at times.

The study by Hamilton and Frank done in 2001 measured the effect on soil microbes and plant growth of exudates produced by roots of Poa pratensis plants that were clipped (to simulate defoliation) compared to unclipped control plants.

In short: when grasses plants were clipped, they released extra, hard-earned, carbon-rich exudates from their roots, which greatly stimulated the microbial community in their rhizosphere to break down organic nitrogen to a form that could be taken up by the plant.

As a result, the clipped (grazed) plants grew back faster and had higher nitrogen (better forage quality) in their leaves than uncut plants - a virtuous positive feedback cycle which probably enables Poa pratensis to tolerate chronic heavy grazing.

The second study (by Zhalnina et al. 2018) carefully tracked changes in the kinds of chemicals exuded by roots of *Avena barbata* (slender oat) into the soil over its annual growth cycle, in California.

Figure 1: *Poa pratensis*

Figure 2: Bison grazing at Yellowstone National Park

They found that young slender oat plants produced a cocktail of root exudates (notably high in sugar) that stimulated the development of a community of rhizosphere microbes that produced the kinds of chemicals that the young plant needed for fast growth.

At later developmental stages, the exudates were higher in organic acids and aromatic compounds, which changed the specific microbial community structure to favour the older plant, while also protecting it (via allelopathy).

This ability to cultivate different soil microbe communities at different times appears to be genetically programmed.

Do grasses in southern African grassland (such as *Themeda triandra*) also actively farm beneficial soil microbes. Nobody seems to have investigated this.

Figure 3: *Avena barbata*

Figure 4: *Themeda triandra*

How one badass grass thrives at the thermal limits of eukaryotic life

Sejarah Poaceae

Current Address: "Life among the grasses"

Reprinted From: http://bit.ly/2PFtDdy

It's not an exaggeration to say grasses as a family have adapted amazingly well to most habitats on earth. But there is at least one species that takes that adaptability to new levels.

Living in the active geothermal areas of Yellowstone National Park takes some major adaptations. It is an extreme and hostile environment with rhizosphere temperatures exceeding 40°C. Many proteins denature above 41°C and in people a body temperature at 43°C or above normally results in death or at the least serious brain damage and cardio-respiratory collapse.

In such an extreme environment, there are only nine vascular plants that have managed to successfully colonize this habitat. Chief among them are the grasses, which are both the most prevalent and most heat-resistant species in the area. But the award for the most extreme plant goes to *Dichanthelium thermale* (formerly a subspecies of *D. lanuginosum*), which was flourishing in soils with an average of 44°C and a recorded maximum of 57°C! (Stout and Al-Niemi, 2002)

When researchers studied *D. thermale*, they found that it was even more amazing than they initially thought. This grass species had little problem living at the absolutely mind-boggling temperature of 65°C for days on end, and they discovered that this ability was the result of symbiosis with a new endophytic species of the fungal genus *Curvularia* (Redman et al, 2002).

Curvularia protuberata was found in the roots, leaves, crowns, and seed coats of *D. thermale*, and neither the grass nor the endophyte could survive on its own above 38°C. But when endophyte-free grass was inoculated with the fungus, it regained its remarkable thermotolerance.

Figure 1: *Dichanthelium thermale* (formerly a subspecies of *D. lanuginosum*) (James St. John, Wikipedia).

The researchers surmised that this protection from heat could be the result of several possible mechanisms. One possibility is that the fungal endophyte produces cell wall melanin that may dissipate heat along the hyphae and/or complex with oxygen radicals generated during heat stress. Another possibility is that the endophyte may act as a "biological trigger" that allows the symbiotic *D. thermale* to activate stress response systems more rapidly and strongly than non-symbiotic plants. The symbiosis became even more complex when researchers announced that they had found a third party in the relationship several years later. It turns out that the fungal endophyte was infected with a double-stranded RNA virus, and that its ability to confer thermotolerance on *D. thermale* was dependent on this infection!

Endophyte-free *D. thermale* that was inoculated with the fungus+virus survived in heated environments, whereas endophyte-free *D. thermale* inoculated with the fungus without the virus did not survive in the same environment (Márquez et al, 2007).

The unravelling of this complex symbiotic relationship could even have applications in agriculture. When tomato plants were inoculated with the wild-type fungus *C. protuberata*, their tolerance to heat was improved, albeit only slightly, indicating that the mechanism behind this thermotolerance may be conserved among many different plants.

But this potential novel application in the future would not have been thinkable if it were not for the humble *D. thermale* in Yellowstone and other geothermal parks. So as we marvel with awe at such an intricate and beautiful example of symbiosis, be sure to also give a respectful nod at this one badass thermotolerant grass and its fungal and viral partners!

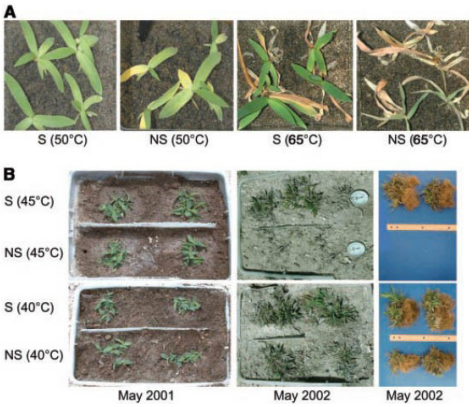


Figure 2: Representative symbiotic (with *Curvularia sp.*) and nonsymbiotic *D. laguninosum* plants with rhizosphere temperatures of 50°C for 3 days or 65°C for 8 hours/day for 10 days under laboratory conditions (A) and in 40°C or 45°C soil field conditions (B) (Redman et al, 2002).

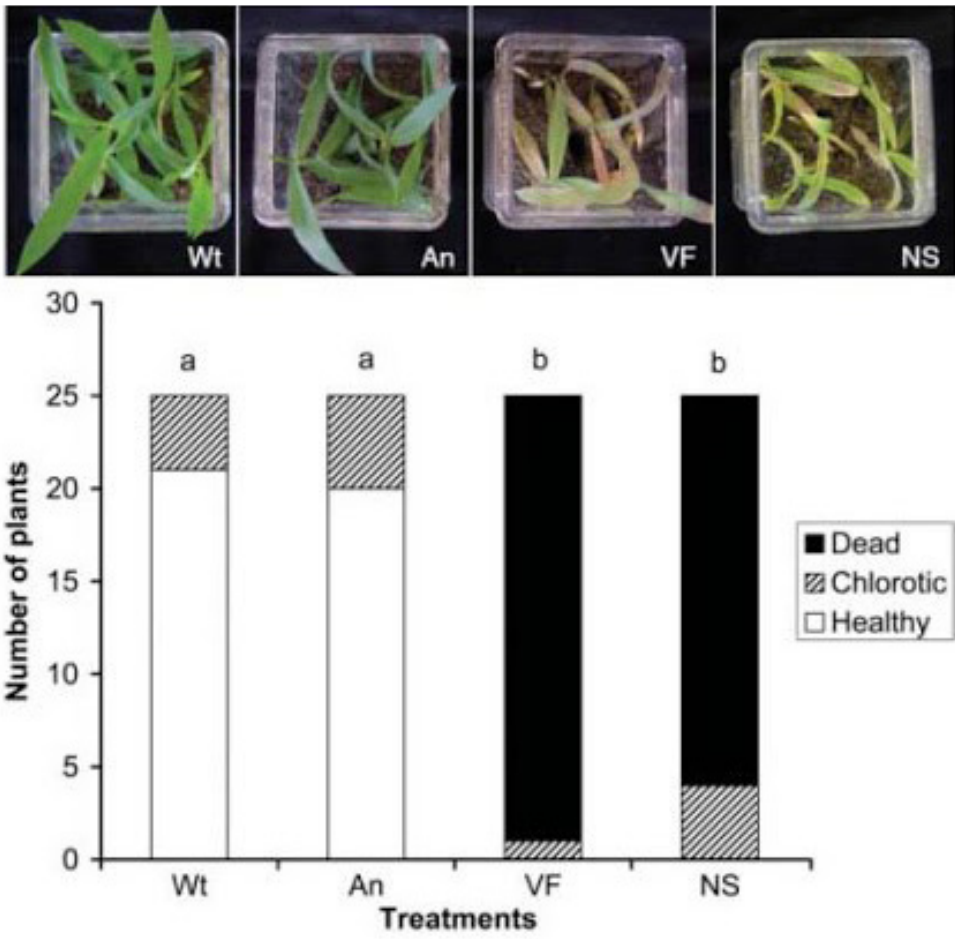
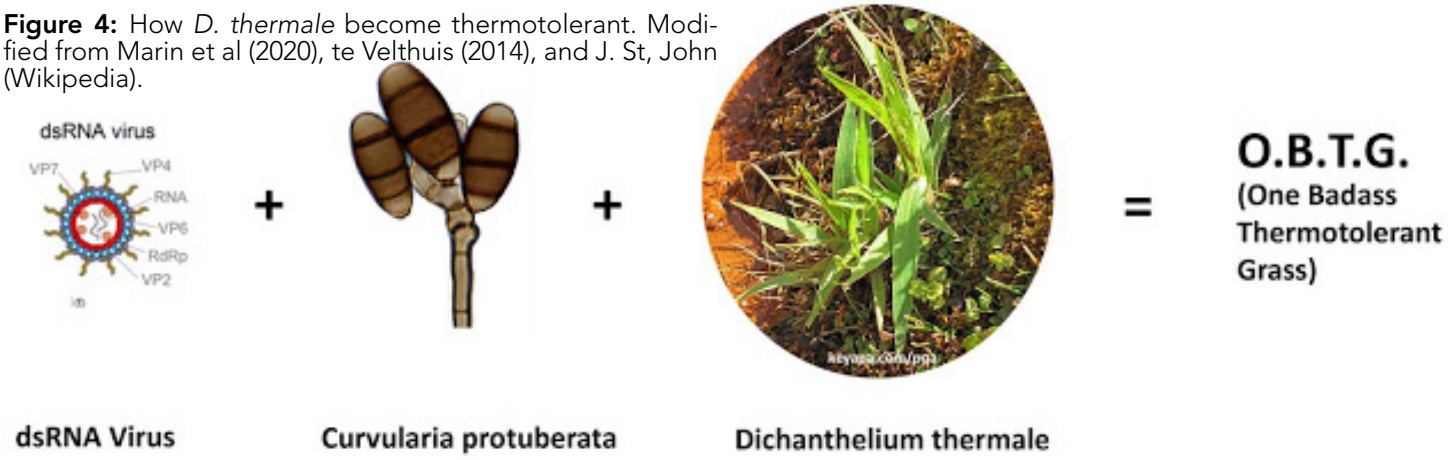


Figure 3: (**Top**) Representative *D. lanuginosum* plants after the heat-stress experiment with thermal soil simultors. Rhizosphere temperature was maintained at 65°C for 10 hours and 37°C for 14 hours/day for 14 days under greenhouse conditions. Plants were nonsymbiotic (NS) and symbiotic with the wild-type virus-infected isolate of *C. protuberata* (Wt), the hygromycin-resistant isolate newly infected with the virus through hyphal anastomosis (An), or the virus-free hygromycin-resistant isolate (VF). (**Bottom**) The histogram presents the number of plants chlorotic, dead, and alive at the end of the experiment. The small letters on top of the bars indicate statistical differences or similarities (chi-square test, $P < 0.01$) (Márquez et al, 2007).

Figure 4: How *D. thermale* become thermotolerant. Modified from Marin et al (2020), te Velthuis (2014), and J. St, John (Wikipedia).



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Researchers reveal switch used in plant defense against animal attack

Decades of pursuit uncovers receptor, the product of an evolutionary arms race for survival, used by plants to sense herbivores

ScienceDaily

Current Address: University of California – San Diego
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For decades, scientists have known that plants protect themselves from the devastation of hungry caterpillars and other plant-munching animals through sophisticated response systems, the product of millions of years of evolution.

The biological mechanisms underlying this attack-counter defense paradigm have been vigorously pursued by plant biologists given that such details will help unlock a trove of new strategies for improved plant health.

From countering crop pest damage to engineering more robust global food webs, such information is valuable for ensuring sustainable and reliable yields.

Now, researchers at the University of California San Diego and their colleagues have identified the first key biological switch, or receptor, that sounds an alarm in plants specifically when herbivores attack.

The discovery is described in the online publication of the *Proceedings of the National Academy of Sciences*.

Animals such as humans, cows and insects are heterotrophs that derive their energy either directly or indirectly through the consumption of autotrophs, such as photosynthetic plants. This basic foundation shapes biological interactions across planet Earth.

More than 30 years ago plant biologists came to understand that plants can sense an attack from herbivorous animals in a way that is distinct from damage caused by hail storms or falling tree branches.

Similar to how human immune defenses counter an attack from viruses, plants have been shown to respond to danger from plant-eating animals through an intricate immune system of receptors.

Using a method of pinpointing genetic variants, called forward genetics, research led by Adam Steinbrenner, Alisa Huffaker and Eric Schmelz of UC San Diego's Division of Biological Sciences enabled discovery of the inceptin receptor, termed INR, in bean plants.

The receptor detects conserved plant protein fragments accidentally released as digestive products during caterpillar munching, thereby enabling plant recognition of attack.

"INR represents the first documented mechanism of a plant cell surface receptor responsible for perceiving animals," said Schmelz, whose work was accomplished by deconstructing and leveraging the active evolutionary arms race between plants and herbivores.

"Our work provides some of the earliest defined mechanistic insights into the question of how plants recognize different attacking herbivores and activate immunity to animals. It is a fundamental question in biology that has been pursued for 30 years."

Beyond beans, the finding raises interest in using INR, and potentially other receptors that remain to be discovered, as a way to boost defenses in essential agricultural crops.

"A key lesson is that plant perception mechanisms for herbivores can be precisely defined and moved into crops to afford enhanced protection," said Schmelz. "We have shown one example but it's clear that hundreds if not thousands of opportunities exist to identify and stack key traits to enhance crop plant immunity to herbivores."

The complete list of the study's authors: Adam Steinbrenner, Maria Muñoz-Amatriaín, Antonio Chaparro, Jessica Montserrat Aguilar Venegas, Sassoum Lo, Satohiro Okuda, Gaetan Glauser, Julien Dongiovanni, Da Shi, Marlo Hall, Daniel Crubaugh, Nicholas Holton, Cyril Zipfel, Ruben Abagyan, Ted Turlings, Timothy Close, Alisa Huffaker and Eric Schmelz

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Crucial Milestone for Ecosystem Research in South Africa

SAEON

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Extensive consultation with a wide range of stakeholders has led to the selection of six ecosystem research sites located across the country for the Expanded Freshwater and Terrestrial Environmental Observation Network (EFTEON), a large research infrastructure that is being developed under the South African Research Infrastructure Roadmap (SARIR) programme of the Department of Science and Innovation. EFTEON is hosted by the South African Environment Observation Network (SAEON), a national facility of the National Research Foundation (NRF).

Each of the six selected ecosystem research sites represents a large landscape in one of the major biomes in South Africa and includes areas representing human-transformed ecosystems such as urban areas and agricultural systems. Research programmes performed within the designated EFTEON landscapes will broadly cover the status and observed dynamics of the carbon and water cycles; climate and air quality; ecosystem condition and productivity; biodiversity; and water quality and supply.

"Despite the distressing impact of Covid-19 on normal business processes, a thorough step-wise selection process was followed to identify the most appropriate EFTEON landscapes," says Dr Chris Moseki, Chair of the EFTEON Advisory Panel.

An open call for the nomination of potential landscapes was extended nationally to initiate the process. A subcommittee evaluated the 57 nominations received and developed a shortlist of nominations that, in some instances where geographic overlapping was evident, proposed collaboration between the affected parties.

A total of 19 regional virtual workshops involving nearly 500 participants were held with the teams of shortlisted proponents to clarify EFTEON's expectations. This resulted in 19 excellent landscape proposals and a tough competition that took two days for the subcommittee to

Figure 1 (a and b): Two of the six selected ecosystem research sites.

Figure 2: One of the selected research sites.

Figure 3 (a and b): High-tech ecosystem research equipment are being installed at the six research sites.

evaluate and rank the proposals in order of excellence.

"The EFTEON Advisory Panel duly considered and endorsed the final report as the result of an open, just and defensible process," says Dr Moseki.

"South Africa's investment in EFTEON is a major advancement towards improving our national capacity to understand critical ecological processes and how they support and respond to the societies depending on them," says Dr Molapo Qhobela, Chief Executive Officer of the NRF.

He explains that the thematic focus of the EFTEON programme is on ecosystem processes, the state of the environment and the quality and quantity of ecosystem services. Social systems, including economic systems, fundamentally rely on their ecological contexts to sustain and improve human well-being.

EFTEON manager, Dr Gregor Feig, describes the design of EFTEON as a modular research infrastructure consisting of an array of ecosystem research sites and high-tech ecosystem research equipment.

"The long-term impact of EFTEON will be through sophisticated people-nature observations and experimentation to clarify the complex relationships between societies and ecosystems in diverse environments under climate change as a pervasive driver of change," says Dr Feig.

According to SAEON Managing Director, Johan Pauw, the designated EFTEON landscapes are supported by central coordination through SAEON and data management facilities (shared with the two other SARIR-funded Environmental Research Infrastructures, these being the Shallow Marine and Coastal Research Infrastructure (SMCRI) and the proposed South African Polar Research Infrastructure (SAPRI) and general SAEON operations).

Final selection of EFTEON Landscapes:

- **Greater Cape Town** (Western Cape): This Landscape links the Atlantic Ocean to the peaks of the Boland Mountains Strategic Water Source Area, covering steep climate gradients and a hyperdiverse mix of lowland (strandveld and renosterveld) and upland (mountain fynbos) major vegetation formations of the Fynbos Biome, interspersed with pockets of Southern Afrotemperate Forest. This environmental template supports and interacts with a diverse socio-econo-cultural mix, inhabiting a tapestry of urban, agricultural and natural land use/land cover types. The landscape offers a direct link to a number of SARIR research infrastructures including the Shallow Marine and Coastal Research Infrastructure (Two Oceans Sentinel Site), the BioGrip Cape Point Atmospheric Monitoring Site (Global Atmospheric Watch) and two nodes (UCT and SUN), and the Cape Town South African Population Research

Infrastructure Network (SAPRIN) site.

- **KIMTRI** (Kimberley area, Northern Cape and Western Free State): This is the most arid of the landscapes selected and is located in the transition zone between the Nama Karoo, Arid Savanna and Grassland Biomes. Urban developments in the city of Kimberley as well as land-use change resulting from developments in the agriculture, energy and mining sector are a feature of this landscape. Hydrologically the area is important as it is trisected by major river systems draining the interior of the country. Close links to the newly promulgated Sol Plaatje University and the University of the Free State are expected.
- **Garden Route Gateway** (George, Western Cape): This landscape provides access to a large number of biomes such as Fynbos, Southern Afrotemperate Forest, Succulent Karoo and Coastal Thicket. Hydrologically this landscape has river systems draining the Karoo region and short-course high-energy systems draining the Cape Fold Mountains. This area is home to coastal wetlands and exhibits an excellent source-to-sea opportunity. The area is undergoing rapid urbanisation and agricultural intensification. Strong links have been developed in this concept to a number of satellite sites, extending the footprint of the infrastructure into the surrounding biomes.
- **Northern Maluti-Drakensberg** (Cathedral Peak and surrounds, KwaZulu-Natal): This landscape lies in the northern sections of the Maluti-Drakensberg escarpment in the headwaters of the Tugela River where complex socio-ecological issues are emerging. It builds on the historical research site at Cathedral Peak and extends the research infrastructure out of the World Heritage Site into areas of both subsistence and commercial agriculture in the headwaters of the Tugela River. This area is of value as a high-altitude location with C3/C4 grassland, and grassland/savanna transitions.
- **Maputaland** (Northern KwaZulu-Natal): This is the most tropical of the selected landscapes and is an important region for observing changes in the impact of tropical meteorological systems. The system presents a valuable hydrological research site as it is a groundwater-driven system exhibiting strong responses to land use and climatic influences and abstraction resulting in significant social and ecological consequences.
- **Lowveld** (Mpumalanga): This landscape links the extensive historical social and ecological research infrastructure across land tenure and conservation systems. The landscape comprises conservation lands use (Kruger National Park and private conservation areas) that are well studied, with adjacent lands under traditional authority management and with villages that are well studied through the SAPRIN Agincourt Research infrastructure. The landscape is bisected by a number of rivers that pass through the different land use systems.

Footnote

Dr Gregor Feig is the Manager for the Expanded Freshwater and Terrestrial Environmental Observation Network. For more information, contact Dr Feig on gregor@saeon.ac.za or 073 980 8164

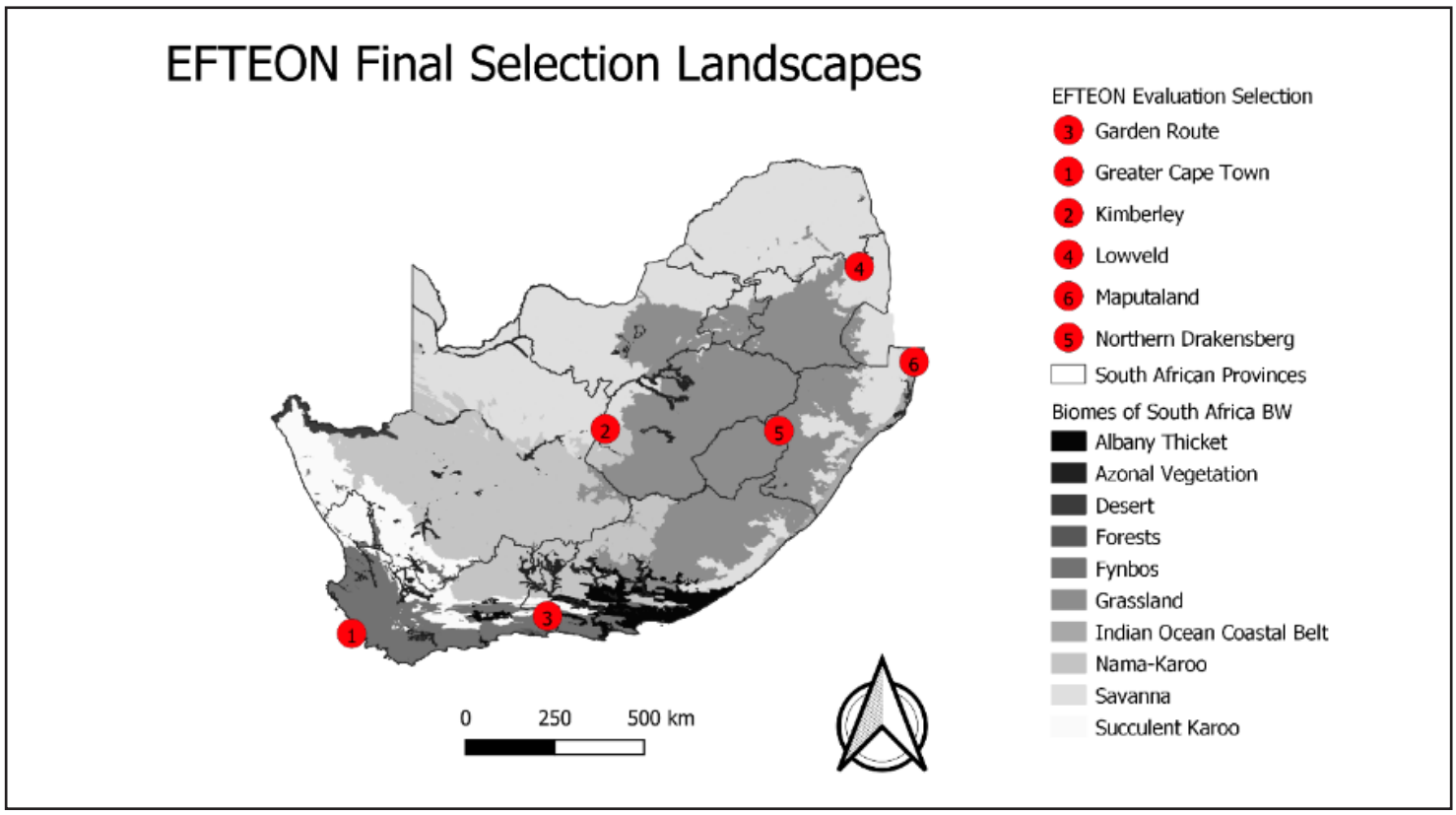

Figure 6: The National Research Foundation designates the long-term landscape-scale research sites of the Expanded Freshwater and Terrestrial Environmental Observation Network (EFTEON) Research Infrastructure.

Wetlands project at tip of Africa shows the way to ecological recovery

A wetlands project close to the southern tip of Africa is a shining example of environmental recovery that needs to be replicated the world over if we are to turn the tide on wetland loss

WWF

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The Nuwejaars Wetlands Special Management Area (NWSMA), close to Cape Agulhas, is a unique conservation venture made up of 25 landowners who have signed title deed restrictions to protect the area. With the Elim community, they are working to restore these wetlands to ecological health for the benefit of people and nature.

The work at Nuwejaars is exactly what is being advocated for this year's World Wetlands Day (2 February) with its focus on the restoration of wetlands and their importance as a source of fresh

Figure 1: Two centuries ago, hippos became locally extinct in the southern Cape, but they have now been returned to the Nuwejaars wetlands near Cape Agulhas.

water. Through the restoration work taking place at Nuwejaars, including invasive alien clearing and rehabilitation along a 5 km stretch of the river, a team of six now also enjoys secure, full-time employment.

These wetlands play a key role in securing regional groundwater flow for downstream communities and towns. They are also internationally important from a conservation perspective, feeding the Heuningnes Estuary at the CapeNature De Mond Reserve, a Ramsar site (one of South Africa's 26 wetlands of international importance) and an Important Bird and Biodiversity Area, and with examples of critically endangered fynbos types.

A vital part of the work at Nuwejaars is the restoration of palmiet, a unique indigenous plant that helps to purify water and sequester carbon.

Thousands of years ago, dense stands of palmiet dominated these wetlands and over the centuries, they likely formed the basis of the peat-like soils found here. Peat wetlands are vital in the fight against climate change, storing carbon for as long as it remains waterlogged, while helping to reduce the impact of floods.

By the late 1990s, many of these special wetlands faced increasing threats. In many places, they were overrun by invasive alien plants, which reduced water flows by up to 10%, and they became increasingly degraded.

This was one of the reasons a group of founding landowners decided in the early 2000s to create this conservation venture. WWF South Africa has been supporting the work since 2018.

Dirk Human, the chair of the NWSMA and owner of Black Oystercatcher Wines, comments, "WWF South Africa recognises the ecological importance of this area and the role our wetlands can play well beyond our borders. We're extremely grateful for their direct support over the past three years, and their belief in our work long before that, and we look forward to working with them for a long time to come."

Jan Coetzee, Land Programme Manager with WWF South Africa, says, "We are very happy to be working with the NWSMA team whose commitment to the cause is clearly evident through the variety of interventions they have been willing to take – from alien clearance to controlled burns and replanting of indigenous species. They have shown how, by working together, we can restore wetlands to ecological health for the benefit of the natural world and current and future generations."

During the next phase of the WWF South Africa project, the team will open up the area to interpretive walking tours, leading people to a bird hide overlooking a secret waterbird spot.

In the meantime, visitors can experience the wetlands through two-hour guided wildlife tours. These sunrise and sunset tours take visitors to a secret lake expanse, now home to hippo and buffalo (reintroduced here two centuries after they became locally extinct). For more information on these tours, see www.nuwejaars.com.

The importance of wetlands

Wetlands are essential to human well-being, inclusive economic growth and all life on land. They provide us with water, food and medicines. They protect cities and communities from floods, droughts and coastal storms.

They directly support the livelihoods of a billion people as well as extraordinarily rich biodiversity. They store vast amounts of carbon – and are absolutely central to efforts to both mitigate and adapt to climate change.

From rivers to coral reefs, mountain streams to seagrass beds, marshes to mangroves, and lakes to lagoons, healthy wetlands are essential for people and nature – without them we cannot survive, let alone thrive.

- Directly or indirectly, they provide almost all of the world's consumption of fresh water, while wetland vegetation helps to filter pollutants.
- 1+ billion people directly depend on them for a living.
- 40% of the world's species live and breed in wetlands. Freshwater species alone account for more than 10% of all species, despite freshwater covering less than 1% of the Earth's surface.
- They are a vital source for food, raw materials, genetic resources for medicines; they mitigate floods, protect coastlines and build community resilience to disasters, and they play an important role in transport, tourism and the cultural and spiritual well-being of people.

Wetlands continue to be routinely undervalued…and to be lost at an alarming rate.

- Up to 87% of global wetlands have been lost in the past 300 years.
- Over a third of the world's wetlands have been lost since 1970 (contributing significantly to the huge loss of species populations over the same period).
- Since 2000, rates of natural wetland loss have accelerated – and we are now losing 1.6% of our remaining wetlands each year.
- Losses are due to water drainage, pollution, unsustainable use, invasive species, disrupted flows from dams and sediment dumping from deforestation and soil erosion upstream.

The world's 'wetland blindness' is inexplicable given the pivotal role of healthy wetlands in delivering global commitments on climate change, sustainable development and biodiversity.

Scientists solve a major climate mystery, confirming Earth is hotter than it's been in at least 120 centuries

Chelsea Gohd

Current Address: Space.com
Reprinted From: http://bit.ly/3rqIFSg

Scientists have resolved a controversial but key climate change mystery, bolstering climate models and confirming that Earth is hotter than it's been in at least 12,000 years, and perhaps even the last 128,000 years, according to the most recent annual global temperature data.

This mystery is known as the "Holocene temperature conundrum," and it describes a debate that has gone on over how temperatures have changed during the Holocene, an epoch that describes the last 11,700 years of our planet's history. While some previous proxy reconstructions suggest that average Holocene temperatures peaked between 6,000 and 10,000 years ago and the planet cooled after this, climate models suggest that global temperatures have actually risen over the past 12,000 years, with the help of factors like rising greenhouse gas emissions and climate change.

This "conundrum" has "cast doubts among skeptics about the efficacy of current climate models to accurately predict our future," lead author Samantha Bova, a postdoctoral researcher associate at Rutgers University, told Space.com in an email.

The new research puts this uncertainty to rest, however, demonstrating that current climate projections are right on the money.

The study "eliminates any doubts about the key role of carbon dioxide in global warming and confirms climate model simulations that show

Figure 1: Scientists have resolved a controversial but key climate change mystery, bolstering climate models and confirming that Earth is hotter than it's been in at least 12,000 years, and perhaps even the last 128,000 years, according to the most recent annual global temperature data. (Image credit: NASA)

global mean annual temperature warming, rather than cooling, across the Holocene period," Bova said.

Specifically, the team demonstrated "that late Holocene cooling as reconstructed by proxies is a seasonal signal," Bova told Space.com.

To do this, the team developed a new method that allowed them to "use seasonal temperatures to come up with annual averages. Using our new method, we demonstrate that Holocene mean annual temperatures have been steadily rising," Bova added.

The scientists analyzed previously published sea surface temperature data, which used information about the fossils of foraminifera — single-celled organisms that live on the surface of the ocean - and other biomarkers from marine algae. This allowed them to reconstruct temperatures through history.

With this data, "we show that the post-industrial increase in global temperature rose from the warmest mean annual temperature recorded over the past 12,000 years," Bova said, adding that this is contrary to recent research.

"Earth's global temperatures have therefore reached uncharted territory that has not been observed over at least the past 12,000 and perhaps the past 128,000 years."

"Given that 2020 is tied for the warmest year on record based on the new NASA/NOAA data release, our results demonstrate that average annual temperatures in 2020 were the warmest of the last 12,000 years and possibly the last 128,000 years," Bova concluded. (NOAA is the U.S. National Oceanic and Atmospheric Administration.)

By confirming temperature records throughout this time period, the team didn't just provide additional evidence for "the efficacy of current climate models in accurately simulating climate over the past 12,000 years," Bova said.

The work also "gives confidence in their ability to predict the future."

This work was published Jan. 27 in the journal Nature.

Watch the video here:

Go check out the following

Websites, Webinars & Podcasts

WEBSITES

Open Ecosystems

Grasses created the unique sunlit grasslands and savannas of the world. They are in constant battle with forests to keep the ecosystems open that support an astonishing array of life.

Therefore, William Bond has developed a website with useful grassland resources: www.openecosystems.co.za/ . It also features his newly released video "The untold story of grasses" (https://youtu.be/GAoVZoZpqro).

The indigenous gardener

The only 100% indigenous web magazine for South African gardeners. Visit: www.theindigenousgardener.co.za/

WEBINARS

Fire: A Necessary Evil

Navashni Govender, Conservation Manager at the Kruger National Park, is presenting a webinar on fire on 8 April 2021. More information is available here: http://bit.ly/3rZ71Tv

Ecology Live – British Ecological Society

An exciting new series of online talks on the latest ecological research. The free talks from 12 great speakers will be broadcasted on Zoom every Thursday from 4 March to 20 May 2021. Register at www.britishecologicalsociety.org/events/ecology-live-2021/register-now-for-ecology-live/

PODCASTS

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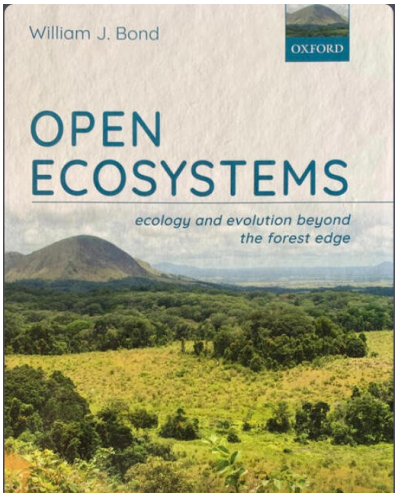

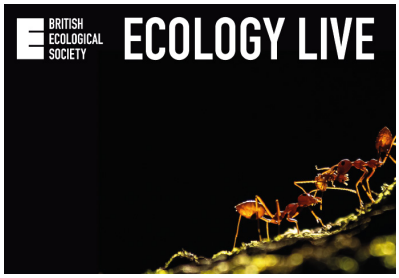

Grassland Society of Southern Africa

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Mrs Navashni Govender is a Conservation Manager focusing on using fire as a tool for ecosystem management, developing fire policies, implementation of fire plans, monitoring and decisions support systems for the Kruger National Park.

She is a co-chair of the Southern African Fire Network, serves as the Fire Protection Officer for the Greater Kruger Fire Protection Association and is a Research Associate at Nelson Mandela University.

Mrs Govender has approximately 20 years experience as a savannah fire ecologist in South Africa, mainly burning in the Kruger National Park and with Working on Fire, an Expanded Public Works Program in South Africa.

FIRE:
A NECESSARY EVIL

The importance of fire to support biodiversity, ecosystem functioning and livelihood with our grasslands, rangelands and savanna is well documented. However, current climate, land use, socio-economic and management changes have resulted in the suppression and inappropriate fire use thereby leading to more uncontrolled wildfires which are often regarded as disastrous, negative and harmful.

This presentation will highlight the collective understanding, knowledge and experiences from the Kruger National Park on how fire can be used and managed to improve our ecological, social, and economic wellbeing within our fire-dependent savanna ecosystem.

Abundant Rain Turns Namibia Green

Michael Carlowicz

Reprinted From: http://go.nasa.gov/3sTJh3d

With approximately 300 days of sunshine annually, and persistent, dry onshore winds provoked by the Benguela current, Namibia is quite dry for much of the year. The rainy season (November through April) is modest by most precipitation standards in the world. This year, it has brought an abundance.

January 2021 saw rainfall totals double to triple the norm in the northeastern, central, and southern parts of Namibia. According to a weather monitor in Windhoek, 228 millimeters (9 inches) of rain fell in January; the long-term average is 85 millimeters (3 inches).

The period of relatively abundant rains followed a December that brought about 25 percent more rain than normal. The wet season rainfall totals are the highest since 2010 and 2011. (This map shows precipitation anomalies as recorded by NOAA's Climate Prediction Center.)

The natural-colour images above show the landscape greening due to the rain. They were acquired in February 2021 and January 2020 by the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite.

The map below, also derived from Terra data, shows changes in the "greenness" of the landscape in February 2021 compared to the 20-year average for the month (Read more about the Normalized Difference Vegetation Index.)

The strong rainfall has been a boon to farmers in the region, as nearly half of Namibia's people depend on subsistence farming. The extra rain has filled many reservoirs behind the country's dams.

At the same time, the typically dry region has sporadic storm-drain systems, and some roads are poorly

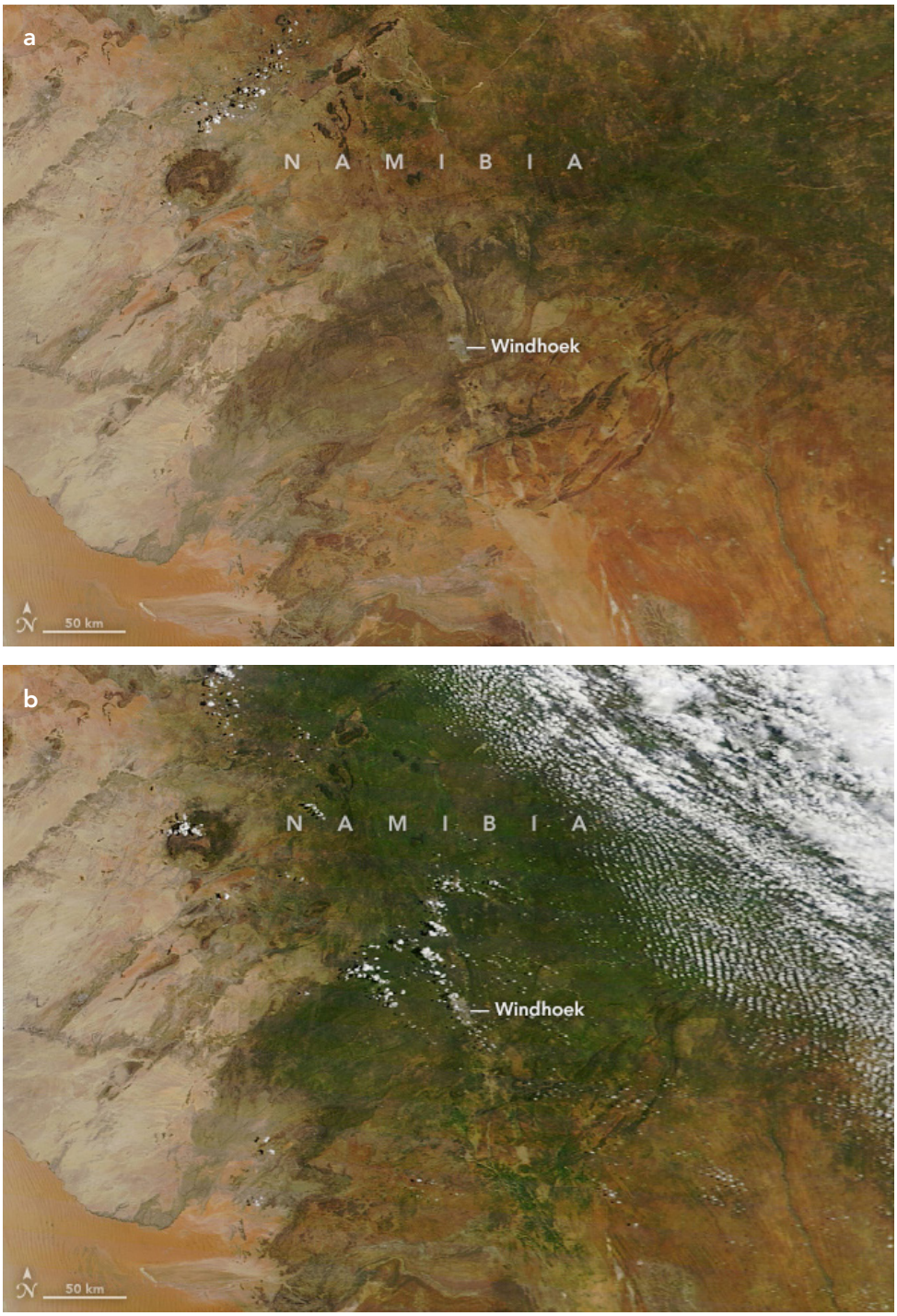

Figure 1: Satellite images of Namibia on (a) January 29, 2020, and (b) February 7, 2021.

equipped to handle heavy rain. Flash floods and overflowing ephemeral rivers posed problems for much of January.

"It has been a good year for sure, even across into Botswana and South Africa," wrote Frank Eckardt, a researcher at the University of Cape Town. "We had similar good rains in 2000 and 2011. There is a periodicity to it, which is essential for replenishing surface and groundwater storage. It will also provide much grazing for livestock and, later, biomass for burning. By April the rains will be gone."

He noted, however, that the region has been getting drier over the long term.

Footnote

NASA Earth Observatory images by Lauren Dauphin, using MODIS data from NASA EOSDIS LANCE and GIBS/Worldview.

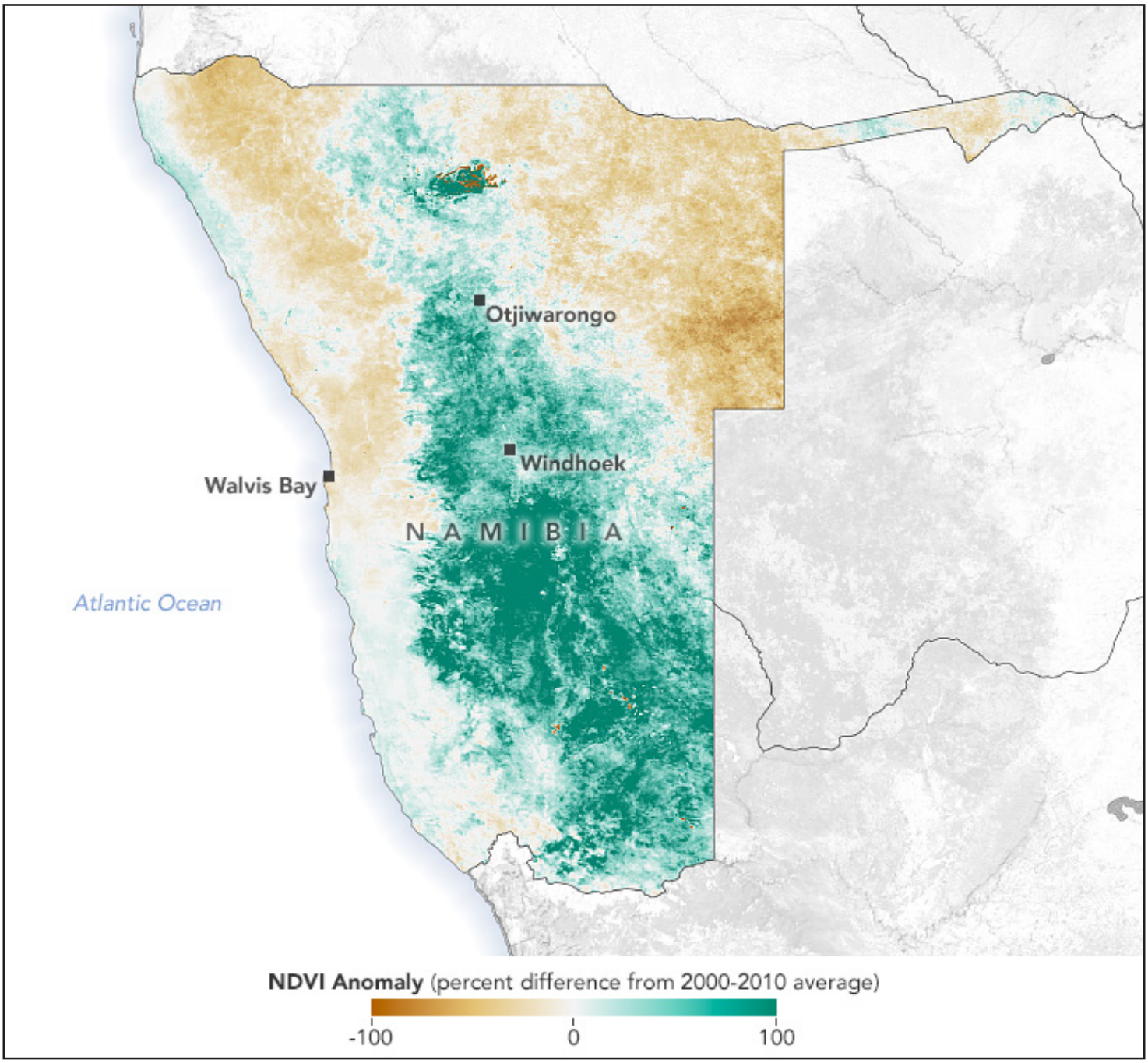

Figure 2: The map is derived from Terra data and shows changes in the "greenness" of the landscape in February 2021 compared to the 20-year average for the month.

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Clichés of scientific writing

Ken Hughes

Current Address: Brushing Up Science
Reprinted From: http://bit.ly/3qgJHyY

Novel writers use an average of 100 clichés for every 100000 words. Or about one every four pages. That's what Ben Blatt found by comparing a range of novels against a list of 4000 clichés. How does scientific writing compare?

In one sense, scientific writing avoids clichés. A scientist isn't going to write that their new results *put the nail in the coffin* of the outgoing theory, that they were careful to *dot their i's and cross their t's* so as to follow the methods of Jones et al. *by the book*, that Brown et al.'s finding is a diamond in the rough, or that two possible interpretations are *six of one and half a dozen of the other*.

In another sense, scientific writing is full of clichés. Our writing often feels like a fill in the blanks: *the results of this study show X, these findings are in good agreement with Y, or Z is poorly understood and needs further study*. Need more examples?

Check out the Manchester Academic Phrasebank, a collection of phrases from the academic literature that are "content neutral and generic in nature."

Perhaps I'm being too harsh. Maybe scientific writing isn't full of dull, procedural, and formulaic expressions. Maybe it's confirmation bias in that I've read hundreds of scientific papers, so it's easy to recall at least a few such expressions.

This calls for some data. Specifically, an inspection of the text of 360 papers that I've collected over the years in my field of physical oceanography (published since 2000). I've used this set of papers before in a similar post.

Combining an automated search with some manual intervention, I checked the 360 papers for a range of clichés: third-person constructs, hedging terms, overzealous assertions, and directives for future work.

The author dislikes third-person statements

It's a myth that scientific writing should demonstrate dispassionate observation. But let's say you do buy into the myth and want to pretend you're somehow impartial and uninvolved in the experiments that you're reporting. When it comes time to recognise your own role, you'll be forced to describe yourself and co-authors in the third person as "the authors".

As in, for example, "the categories were selected by the authors". This awkward phrasing appears in 6% of the papers (a small number, fortunately). And not only is it awkward, it can be ambiguous. Another 6% of papers use "the authors" to refer to other writers, not themselves.

The most common scenario for third-person references is phrases along the lines of "as far as the authors' are aware, no studies have considered process X". The second-most common usage of "the authors" is in abstracts, as if for some reason they need to be even more dispassionate? Though maybe a desire to remain neutral is not actually relevant here.

Case in point: Acknowledgements, the one section of a scientific paper where personality is always allowed. Yet, if I include that section in my count, the 6% ramps up to over 30%. "The authors thank …", "The authors wish to thank …", "The authors acknowledge …", etc. Why gratitude is often expressed in this odd manner beats me.

There's no good reason to use "the authors" when "we" is simpler, shorter, and better. That's why 96% of the papers use "we" at least once. (Six of the 14 that don't use "we" are single-author papers, but none of these uses "I" instead.) On average, the pronoun comes up 22 times per paper. One paper features 247 uses. Ironically, that paper has a single author (though it's mathematical convention to use "we" regardless).

Hedging our bets

"Extraordinary claims require extraordinary evidence". A flip side of this oft-repeated aphorism is that if you have only ordinary evidence, you can make only ordinary claims. What's a sure-fire way to ensure your claim is ordinary? Hedge.

Take the word "suggest". There's at least one use of suggest (or suggests, suggested, suggesting, suggestion) in 87% of the papers. On average the word shows up five times per paper, or about once for every three pages. When you get to using "suggest" more than once per page (as 10% of papers do), that's a sign of overuse.

Close cousins of suggest are "consistent with" and "likely". Both occur, on average, three times per paper. As it happens, both terms showed up at least once in 256 of the 360 papers. The stronger phrase "agrees with" (or agree without the s) is 10 times less common.

A different type of hedge is "believe". This is used in 1/4 of papers, implying that at least 3/4 of us agree that science isn't about "belief". It's about facts, evidence, theories, experiments. (Obviously, using the word "believe" doesn't imply a scientist disagrees with the statement. And seldom is the word used more than once in a paper.)

This is important. That's important. Everything is important.

We all strive to do important science. But in some sense, importance is a zero-sum game. If everything is important, then nothing is. But that doesn't stop us from claiming importance, however tenuous it is.

"Important" or "importance" shows up in 96% of papers. That's as often as "we"! (Though "we" is used three times more often when tallying up all uses.)

Importance is referenced, on average, seven times per paper. But don't use that number as a guideline for your own writing since it is skewed by a few large values.

Instead aim for something closer to the mode of the distribution: three times per paper. Better yet, aim for a single thing being important.

Like "important", but more assertive, is "crucial". This is used far less often: it shows up in only 20% of papers. And only 20% of that 20% uses it more than once. You might say that the comparatively limited usage of "crucial" is consistent with our propensity to hedge.

Leaving it for later

The cliché that something *creates more questions than it answers* often applies to science. Suggestions for future research are an acceptable approach to flesh out a discussion (though you shouldn't end with them). Yet I was surprised at how few papers explicitly identify such suggestions.

"Future study/studies/work/research/experiment" showed up in 18% of papers. "Beyond the scope" showed up in 9%. "Cannot explain", "do not explain" or "does not explain" showed up in 4%.

Here's where I might acknowledge the shortcoming of my methods and note that in future work I'd check whether there are phrases equivalent to those above that I forgot and thereby excluded from my counts. But this is a blog post, not a scientific paper, so ...

What isn't cliché in scientific writing?

Among the 360 papers, there's a single use of "gigantic". I also recently came across the hedge "hopingly," which is sufficiently rare that WordPress is underlining it as a spelling mistake as I type. But, of course, single words don't really count. Real answers to the question of what isn't cliché might be humour, contractions, or one-word sentences and single-sentence paragraphs. I look forward to the days when these become common.

Endnotes

Asides inspired by the main text, but that didn't quite fit.

1. Regular clichés, like those in the second paragraph, seldom occur within the body text of scientific papers. Yet they are common fodder for titles, as shown by Google Scholar searches for *All in a day's work*, *Back to square one*, or *Don't judge a book by its cover*.
2. For a particularly notable academic cliché combination, consider one of the topic sentences in a well-known psychology paper: "To clarify the distinctive nature of our proposal it is useful to briefly consider prior research on overconfidence". The first 17 of the 18 words are a generic framing of the only meaningful word in the sentence. (Do check out the paper though. Its topic, the illusion of explanatory depth, is fascinating and relevant to the practice of science in general.)
3. The Academic Phrasebank notes on its homepage that it was designed for non-native speakers of English, but it is the native speakers that have ended up as the majority of its users.
4. I acknowledge that the fill-in-the-blanks approach is a good way to get started writing, but some push-back against this approach is warranted.
5. Like "we" and "important/importance", another common word is "data", which shows up, on average, 22 times per paper ("dataset" is included in this count). 2% of papers had triple-digit usage. Conversely, 22 of the 360 papers did not use the word. Of those 22 papers, 20 were focused on either theory or simulations.
6. Awkward second-person references are worse than third-person. 10% of papers mentioned "the reader", whereas <1% of papers mentioned "you" in any second-person sense. (That 10% excludes the boilerplate phrase used in 10 papers that "the reader is referred to the web version of this article" [for colour figures].)
7. In a similar vein to "the author" and "the reader", there's the phrase "this paper". This phrase is used in 60% of papers. On average, it was used 1.4 times per paper, which is reasonable. Four of the 360 papers, however, had double-digit uses of the phrase.
8. I wanted to include stats for "possible/possibly" in the hedging section. But these words are can be used in many ways other than hedging, so I left them out. Similarly, I excluded "critical" in the importance section as that has specific meanings in my field.
9. The heading *This is important. That's important. Everything is important* should be read in Oprah's voice.
10. Rather than proclaiming importance where it's not due, this paper is more honest: "From a practical perspective, that result, of course, is only moderately interesting."

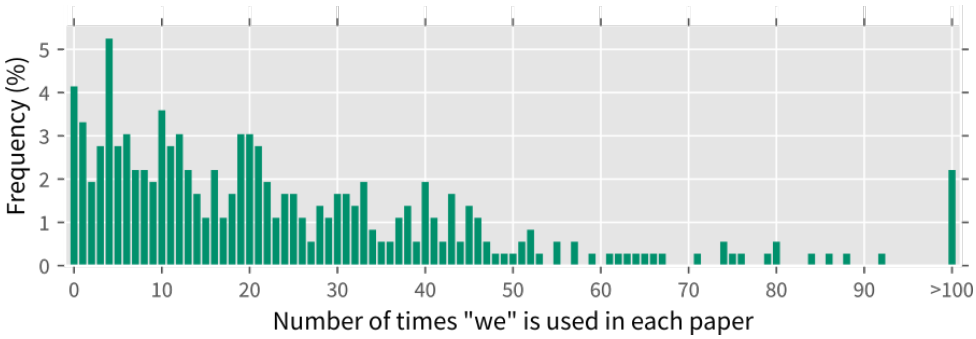

Figure 1: How frequently "we" is used in each paper.

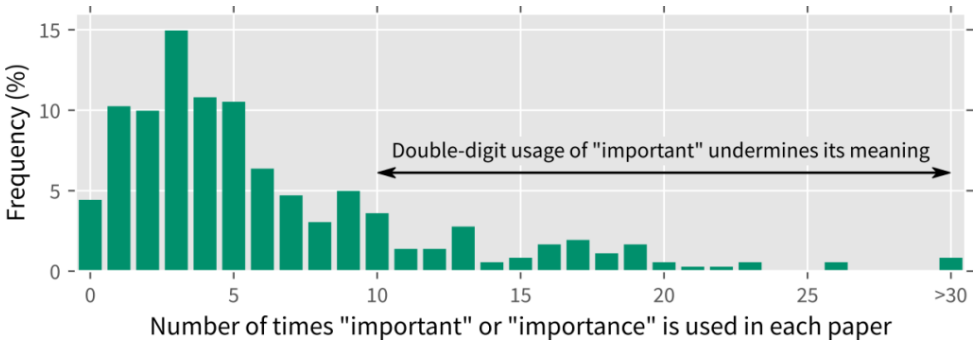

Figure 2: How frequently ''important" or "importance" is used in each paper.

Civilising Grass: Jonathan Cane's study is thought-provoking, entertaining, interesting and provocative

Kathy Munro

Current Address: The Heritage Portal
Reprinted From: http://bit.ly/3cm2aW7

The title, *Civilising Grass - The Art of the Lawn on the South African Highveld*, intrigued and immediately raised questions. What is the difference between grass, veld and lawn? Why is there an art in its cultivation? What does a lawn mean? Why do some people spend precious leisure time mowing a lawn? Why do lawns matter and what do they represent? If you read this book you will find some of the answers. This is certainly a book to set you thinking. We all benefit from the author's scholarship (the bibliography is vast). His interest lies particularly in the art and literature of the lawn. He is strong on contemporary political ideology and the makeup of the urban landscape and what part a lawn may have played in taming Africa.

The lawn in the view of the author, Jonathan Cane, was and still is a colonial idea and imported from somewhere else. It is an essentially English idea that has no place in Africa. The lawn is something difficult to maintain, it is hard work to mow a lawn, the lawn is a family thing and a feature of the heterosexual world view but ultimately the lawn fails. Now I know - we are cultivating the wrong vegetation in the wrong spot. Johannesburg and the Highveld are ecologically not right for lawns. The central thesis is that suburbs have lawns but townships do not. Why and how did this come about? Colonial conquest of the ridges of the Witwatersrand holds the clue but it is more complex.

f you are someone who lives in a suburban Johannesburg house and are privileged enough to possess a private garden you are likely to have a lawn. You will be interested in the title. I bought this book at the time of publication because it looked like a promising addition to my collection of Johannesburg books and perhaps it had a lesson or two about the art of the lawn. The coloured photographs alone are worthy of close study – there are 26 plates.

Figure 1: Suburbs and townships from above – sourced by Kathy Munro

Owning a house with a lawn in Johannesburg induces a love-hate relationship. The first lesson from this book is that a lawn is a luxury and the epicenter of a garden – a soft green visually appealing surface into which you sink your bare toes. You possess an exquisite green velvet carpet for play, picnics, the sundowner on the lawn alongside the turquoise pool. But cultivating a lawn requires effort, energy, and time. To grow a lawn requires planting grass seed, watering the seed or buying squares of kikuyu sods when out doing drive-by shopping. This lawn may well not be a privilege but may be a duty and a responsibility. Beyond the ultimate status symbol of the suburbs of Johannesburg, there is a burden of responsibility.

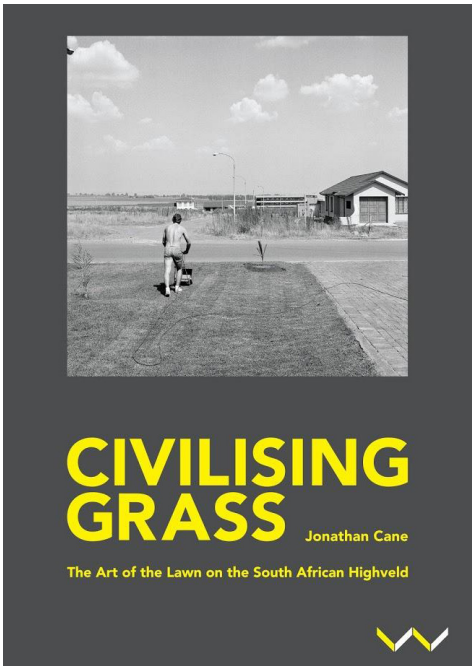

Figure 2: Civilising Grass – Book Cover

Figure 3: Villa Arcadia from the lawns (Heritage Portal – 2014).

Figure 4: Riverclub Golf Course (Heritage Portal – 2018).

This book appealed because it spoke to the personal experience of living on the Highveld from childhood to adulthood. I know exactly what is involved in the art of the lawn; it is another suburban accoutrement to worry about. In winter the lawn on our Witwatersrand ridge needs water to stop that fade from verdant green to dying toughened ragged brown and reverting back to veld. In summer the lawn sprouts aggressively, weeds and grass grow in fierce competition, encouraged by the summer rains. The Lawn needs trimming, mowing and edges neatened. You need the tools to do the job and not only is a lawnmower required but an edge trimmer and someone to assist with what is fast becoming hard work. Someone has to be a willing husband (boyfriends will never mow a lawn) or you employ a gardener and in no time you are on the slippery slopes of master-servant relationships amidst the greenery of Africa.

I must share a secret. I am a failed gardener and lawn keeper. A few years ago I tried to spread grass seed on a rocky stretch of open land that pretends to belong to my garden and the resultant grass only looks good at a distance. Close examination still shows up insistent weeds and those hard little 'klippies". Sometimes bigger rocks creep to the surface - these items of geology that must have been there when Bezuidenhout was the farm owner and there was no suburb. Now I know precisely why I have failed and why I can blame the whole lawn enterprise on my ancestors and on history. Having read this book I can give up lawn cultivation, I can carry on reading soothed by this book, feet up and a relaxing tipple at hand in a deck chair on what was the lawn but now happily reverts back to veld and bush. All guilt about a failed lawn disappears.

Nonetheless, we find lawns all over the world. My most interesting encounters with a lawn in other cultures came with visits to Moscow, Germany and England. In Moscow I encountered a city beauty spot - with a park where people spread themselves in summer, grass grew soft wild and tall but there was no lawn. I asked the innocent question... why do you not mow the grass and make a lawn and back came a rhetorical question – "why?" I could only share a laugh; it solved my Russian linguistic inadequacies. In Manheim, German policeman far more aggressive than the Russian park keepers chased us off the lawn in front of their very modern art gallery – their lawn was no place for a civic picnic. When playing the part of the tourist in England, I was conscious that one did not tread on the grass of Noel Coward's stately homes. There was a sacred quality to the lawns of the Oxford Colleges or Hampton Court. The National Trust is the custodian of the lawn and now I can leave them to it. When there are cultivated lawns at hand the shortest distance between two points is never a straight line across the diagonal of the lawn. Quite the opposite, its two sides of a rectangular.

Let's delve into lawns and this book. This is a clever book - the author is smart and has a critical mind. He does not think the lawn is a civilising device at all. He ranges widely over the subject, a familiarity with all of the socio-cultural theories is evident and competently handled. The strengths lie in the literary and artistic analysis of what the lawn represents, where it came from and why it is here.

He uses the metaphor of the lawn to tell the story of the taming of the landscape, and the conquest of the country by colonists who wished to transform red earth into controlled and managed spaces of green on bowling greens, golf courses and private gardens. Gardens, lawns and suburban houses were combined in a neat geographical layout of the city according to the prevailing economic and political markers of who could live where in Johannesburg. If the lawn civilized, it was with effort and to maintain a lawn in a garden in the suburbs required the employment of a servant class which takes me back to my point about a quality to judge a prospective husband is how good a lawn aficionado he is. Or we have the problem of a servant class when you engage a gardener.

The lawn is about the making of place and the sense of individual home ownership in the garden city suburbs. Lawns are personal parks in enclosed gardens. The politics of apartheid and segregation comes into the story because new townships did not worry much about lawns. Lawns are manmade but with

specific intent - the cultivation of the lawn is a political statement. Oddly though the author does not go into the details of the making of public parks with vast expanses of lawn (Zoo Lake or Joubert Park for example) or the bowling greens of the city (bowls, the sport of an older generation and now on the decline) or what about the more than 20 golf courses of the city. All of these are the ultimate expression of the green lawn writ large.

At the end of the book I could not decide whether it sets out to kill the concept of the lawn or divide the literature writers, garden advisors, scholars into two categories - those to be severely criticized as having ideas beyond the pale and those to be cheered and lauded. Cane is keenly interested in how lawn cultivation and its importance has been written about and nurtured by gardening experts such as Sima Eliovson, Marion Cran and Joane Pim (a trio of old fashioned ladies). The book explores how the art of the lawn has been portrayed in the work of photographers and artists such as David Goldblatt, Terry Kurgan, Brett Murray and even Moses Tladi. How did the town planners and architects view the possibilities of using pocket-sized garden square where the new township house was placed in the middle of the stage and what this meant for social arrangements? We meet the pioneering academic students of township layout such as DM Calderwood. We learn very little about Roelof Uytenbogaardt's NG Kerk at Welkom and its architecture but the author argues that this modernist church and modernist masterpiece was a monolith planted in the veld and it really should not be there at all.

It is excellent when a keen university student steps forward to write a provocative thesis and the final product is a book to enlighten and change minds. Suburban house owners who have tried so hard and failed with a lawn, and I am among that number, will read this book and join a cheering chorus because the analysis is spot on. The Highveld is not for taming, why bother with a lawn and cultivated grass.

There is a slight nod to botany but the far bigger and more serious untold story about grass on the Highveld is the excellent work done by the botanists at universities in laboratories and the vegetation department of the Chamber of Mines to research and grow different kinds of grass seeds (with a multiple of wonderful exotic names such as Rescue Grass, Star Grass, Cows Foot, Weeping Love Grass, Yorkshire Fog, Kentucky Blue, Creeping Salt Bush, Sour Fig and many more) which were researched and cultivated. The objective was to find and grow grass that could be planted on the mine dumps or mine tailings of the man-made Johannesburg landscape. The memory of dust storms from the mine dumps is no longer in living recall but we can read about it and there are even photographs of billowing blinding dust storms down Eloff Street. The mine dust was hazardous. The excavated mined soil came from the bowels of the earth, impregnated with poisonous chemicals making breathing dangerous. My own memory goes back to the sixties at Wits. I recall the beds of experimental grass down the edge of Yale Road which were cultivated to find and develop the best grass to cover the industrial mountains around us. It was all before the dumps were re-mined for uranium and those final traces of gold dust. The mine dumps were used as foundation ballast for the motor ring roads of the sixties and slowly they disappear.

But let's not forget the work of the Wits botanists and their search for grass and lawns of a different type to improve health and cover the mine dumps. Prof Edward Roux was an impressive botanist and an activist political figure who was cruelly treated by the apartheid state. I remember attending a lecture he gave on the Wits campus shortly before his death. The botanical work of those hardworking scientists is also part of the story. Without gold right here in the earth, there would have been no reason for a gold rush, the growth of a mining camp and the peculiar geography and intertwining of mining activities, mine dumps, grand motorways, segregated housing and those northern suburbs with their disappointing or brilliant lawns.

Jonathan Cane's study is thought-provoking, entertaining, interesting and provocative. Most important of all, he presents his sense of the multiple places and landscapes of a wonderful tortuous, fractured city.

ABOUT THE REVIEWER: Kathy Munro is an Honorary Associate Professor in the School of Architecture and Planning at the University of the Witwatersrand. She enjoyed a long career as an academic and in management at Wits University. She trained as an economic historian. She is an enthusiastic book person and has built her own somewhat eclectic book collection over 40 years. Her interests cover Africana, Johannesburg history, history, art history, travel, business and banking histories. She researches and writes on historical architecture and heritage matters. She is a member of the Board of the Johannesburg Heritage Foundation and is a docent at the Wits Arts Museum. She is currently working on a couple of projects on Johannesburg architects and is researching South African architects, war cemeteries and memorials. Kathy is a member of the online book community the Library thing and recommends this cataloging website and worldwide network as a book lover's haven.

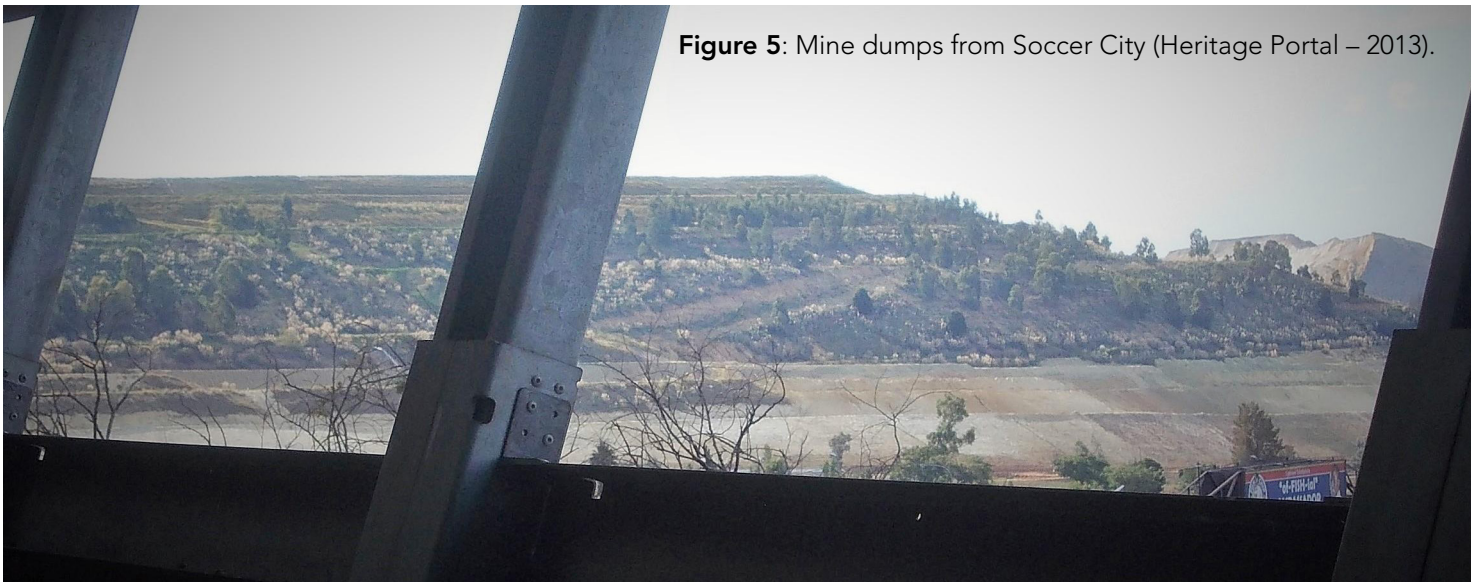

Figure 5: Mine dumps from Soccer City (Heritage Portal – 2013).

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

10 - 12 May 2021

11th Oppenheimer Research Conference
The Oppenheimer Research Conference brings together select individuals and organisations operating and/or interested in the fields of natural and environmental science. It will be held at the Randjesfontein Cricket Pavilion in Midrand (South Africa). Visit http://bit.ly/30lytP6. for more information.

26 - 30 July 2021

Grassland Society of Southern Africa's 56th Congress
The GSSAC56 is to be held at the Surval Boutique Olive Estate, Oudtshoorn, Western Cape (Congress for tbc).
Visit https://2021gssa.dryfta.com/index.php for more information, or send an email to info@grassland.org.za

12 - 13th & 16 - 17th August 2021 (Virtual)

African Conference for Linear Infrastructure and Ecology (ACLIE)
The second ACLIE is co-hosted by the Endangered Wildlife Trust (EWT), Grevy's Zebra Trust (GZT) and Ewaso Lions (EL). The theme is "Connecting for Resilience". Visit http://bit.ly/3ehhtBG for more details.

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

Upcoming events

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.

21 - 30 September 2021 (Virtual)

International Conference on Ecology & Transportation
The title of the conference will be "Transforming Transportation Ecology in the Global Village", reflecting the changing landscape of science and practice in transportation ecology.
Visit https://icoet.net for more information.

23 - 29 October 2021

IGC & IRC
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

5 - 9 September 2022 (Hybrid event)

MEDECOS Conference XV
MEDECOS 2021 has been postponed until 2022. It will be held at Club Mykonos, Langebaan, Western Cape and the theme is "Partnerships for Global Change". See http://medecos2020.org/ for more details or contact Mrs Madaleen Schultheiss at Vetlink (conferences@vetlink.co.za).

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

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Grassland Society of Southern Africa

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ISSN: 10166122