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**SA's endangered wetlands
need protecting**

**Getting African
grasslands right**

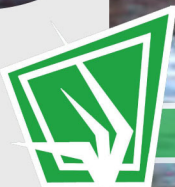
**Uncovering how grasslands
changed our climate**

NEW: Karoo plant of the month

Advancing Rangeland Ecology and Pasture Management in Southern Africa

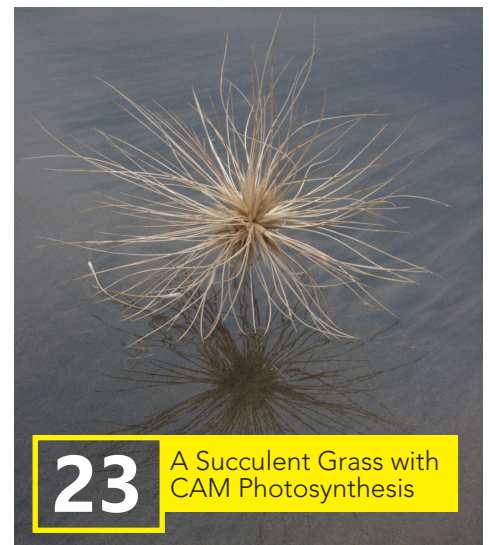
Newsletter of the Grassland Society of Southern Africa

Grassroots



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From our editor

Dear reader,

Welcome to the first Issue of Grassroots for 2022.

The Grassroots team wishes all our readers a prosperous 2022. May we all stay healthy, be thankful for the little things and live our lives to the fullest.

Highlights of this issue

We kick-off this issue with a brand-new series, "Karoo plant of the month" by Rudi Swart from the Worcester Veld Reserve, where he tells us more about *Bietou* (*Osteospermum sinuatum*).

In our feature article, Sue Milton and Ken Coetzee made sure of an interesting read about the restoration processes of bare patches in the Karoo during the drought. Another interesting read is the story about a farmer who reintroduced hippos into the Karoo which not only led to an increase in biodiversity, but also increased tourist traffic to the area.

In an interview with

Susanne Vetter, a plant ecologist at Rhodes University, we learn more about the common misconceptions of African grasslands and the pastoralist communities that depend on them.

A new study shows that the use of smaller drones is less disruptive to wildlife during surveying. Learn how to grow your own grassland garden on page 47 (and send us a photo if you do!). Go check out the newly launched open index of scholarly papers, OpenAlex.

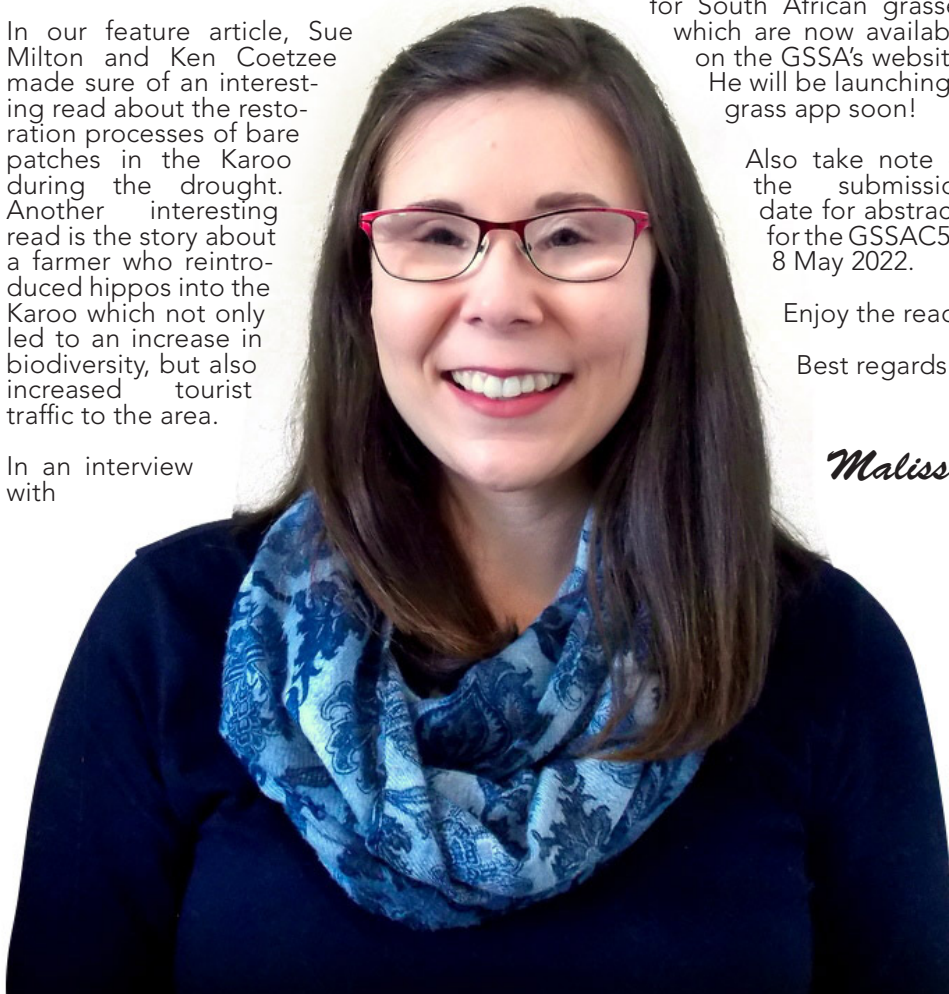
Frits van Oudtshoorn compiled a list of common names for South African grasses which are now available on the GSSA's website. He will be launching a grass app soon!

Also take note of the submission date for abstracts for the GSSAC57, 8 May 2022.

Enjoy the read!

Best regards

Malissa



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Despite the care and attention that we devote to the structure of this newsletter and the information it contains, the Grassroots Editorial Team cannot guarantee the completeness and accuracy of the data. The opinion expressed in each article is the opinion of its author and does not necessarily reflect the opinion of the editorial team.

TREE OF THE MONTH

Peltophorum africanum

Weeping Wattle / Huilboom

RSA Tree No. 328

Author: Marnus Smit | zmsmit.denc@gmail.com

Northern Cape Department of Agriculture, Environmental Affairs, Land Reform and Rural Development



Figure 1. Weeping Wattle in flower.
Image: www.discoverafrica.com/blog/the-secrets-of-the-weeping-wattle-tree/

The Weeping Wattle is a medium-sized semi-deciduous tree with a spreading, untidy canopy. In RSA the species occurs in KZN, Gauteng, Mpumalanga, Limpopo and North-west and further north into East Africa. It typically can be found in grassy savannas, woodlands, rocky outcrops and on river banks.

The Weeping Wattle is South Africa's tree of appreciation for 2022. This is the only species of the genus *Peltophorum* found in South Africa.

Diagnostic features

- The silver-grey leaves are bipinnate and look similar to the leaves of "Acacia" thorn trees.
- The flowers are bright yellow and carried in racemes. The flowers are bisexual and usually present from September to February.
- The fruit (pods) are oval-shaped and turn from greenish-yellow to brownish-red as it matures.
- The trunk is often multi-stemmed with branches occurring near the ground.

Ecological value and uses:

The leaves, when young, as well as the pods, are browsed by game and livestock. The bark of the tree is stripped and consumed by black rhino. The extremely nectar-rich flowers are preferred by bees and other insects.

The timber can be used for furniture and wood carvings. The wide canopy makes the weeping wattle a good shade tree for both livestock and humans. The tree has numerous medicinal uses. The roots can be used to heal wounds and to soothe toothaches while the leaves and bark can be ingested to relieve stomach problems.



Figure 2. The leaves look similar to those of "Acacia" species.



Figure 3. The distinct yellow flowers.



Figure 4. Example of mature pods.

Images: www.plantbook.co.za/peltophorum-africanum/
www.treesa.org/peltophorum-africanum/

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GRASS

OF THE MONTH

Cymbopogon caesius (*C. excavatus*) Common Turpentine Grass

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

Cymbopogon caesius is an erect and densely tufted grass that has a distinctly aromatic turpentine smell and taste to its leaves and inflorescence. It is a fairly common grass that grows in the open grassland and bushveld areas of South Africa. It is a Category Ia grass species – meaning that it is an unpalatable climax species that is abundant in veld which is underutilised.

The meaning behind the name

The genus name *Cymbopogon* is derived from the Greek word for “a boat” - *kymbe*. The *pogon* part of the name means “a beard”. This describes the “hairy spikelets which project from boat shaped spathes”. *Caesius* is the Latin name for blue-grey, describing the distinctly blue-grey colour of the plant.

Figure 1. *C. caesius* in its natural habitat.
Photo: P Holmes, www.inaturalist.org/observations/69315585

Distinguishing features

- Approximately 1.5m tall.
- Long pointy leaf blade that is rounded at the base.
- Membranous ligule (1-5mm in length).
- Flowers between November and May with an inflorescence described as a false panicle.
- Leaves have a turpentine smell when crushed.



Figure 2. False panicle inflorescence of *C. caesioides*.
Photo: A Deacon, www.inaturalist.org/observations/105106114

Distribution

C. caesioides is a grass that grows in a variety of soil types throughout South Africa (except in the Western Cape). It grows in areas of summer rainfall and is found throughout Africa (as far north as Sudan and Yemen).

Similar species

The leaves of this plant can easily be confused with *Diheteropogon amplexans*, which also has a rounded leaf base. The turpentine smell of the *Cymbopogon* is the distinguishing feature.

C. plurinodis also has a similar growth form and smells of turpentine, the leaves here are much narrower and do not end in a rounded base.



Figure 4. *C. caesioides* has a long membranous ligule. Photo: R Taylor, www.inaturalist.org/observations/46696163

Figure 3. The base of the leaf is much thicker than its culm. Photo: Shobie www.inaturalist.org/observations/73469591

Uses

- Thatching
- As this plant smells and tastes like turpentine, it is highly unpalatable and scores a palatability score of 1.
- In Lesotho, this grass is used to keep rodents away from the harvested grain.
- Contains an essential oil.
- In South Africa, it has been known to be used as a mosquito repellent.
- A pretty garden plant that attracts birds and is low maintenance.

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KAROO PLANT OF THE MONTH

Figure 1. Bietou shrub.

Osteospermum sinuatum

Bietou

Author: Rudi Swart | rudis@elsenburg.com

Western Cape Department of Agriculture, Worcester Veld Reserve

Bietou is a small shrub growing up to 0,5 m tall and 1 m in diameter. This widespread species occurs from Southern Namibia throughout the greater Karoo and the Klein Karoo. It is found in a variety of soils but is common on rocky clays, where it often forms large colonies. Bietou is drought-deciduous and can survive extended periods without water.

Diagnostic features

- Opposite leaves with small irregular teeth along the margins. Leaves 17-22 x 5-7 mm.
- Leaves are soft and slightly succulent, with no noticeable odour when crushed.
- The bark of older stems is pale grey, with newer stems brown with a slight purple tinge.
- Flowers are bright yellow, in typical daisy flower heads at the end of branches 25-30 mm
- Seeds are buff to brown with 3 transparent wings, 9-11 mm.
- Drought-stressed plants will drop all leaves and flowers, leaving only pale grey stems.

Ecological value

Bietou is highly palatable to both game and livestock. These long-lived shrubs are resistant to browsing and recover quickly after rain. Bietou growing in the winter-rainfall region flower from August to early October, while those in summer-rainfall regions will flower opportunistically after rain. The flowers are pollinated by a variety of insects, including beetles, flies, honeybees and bee-flies. The relatively large, winged seeds are dispersed by wind and are often consumed by rodents. The seeds have very low dormancy, high viability and are easily harvested. This makes this species ideal for re-seeding degraded, overgrazed rangelands in the Karoo.



Figure 2. Bietou leaves.



Figure 3. Bietou seeds, with rodent damage evident on the four seeds on the right side.



Figure 4. Bietou flowers with honeybee.

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- Vlok, J. & Schutte-Vlok, A. 2010. Plants of the Klein Karoo. Umdaus Press, Hatfield.

Pasture varieties and their potential in SA

Summer-planted pastures can boost a farmer's profits by keeping animal production high. Renowned grazing specialist Prof Chris Dannhauser says there is a variety of these crops to choose from and, as Susan Marais found out, many can also be used in winter in the form of hay, foggage and silage.

Susan Marais

Current Address: Farmer's Weekly
Reprinted from: <https://bit.ly/3Kyxosc>

Veld remains the cheapest source of grazing roughage, but to get the most out of it, you need to do your homework. Put simply, you can lower productivity and rangeland area if you don't pick the right type of pasture.

Veld and grazing consultant Prof Chris Dannhauser says that many improvements to popular cultivars can help farmers produce higher yields with improved quality.

Smuts finger and weeping lovegrass

"Smut's finger grass [*Digitaria eriantha*] is very popular in medium- to high-rainfall areas and is adapted to a wide range of soil types," says Dannhauser.

"It grows in most parts of North West, the Free State, Gauteng, Mpumalanga, KwaZulu-Natal [KZN] and Limpopo, in areas with more than 500 mm rain per year.

"It can be planted from October to December or in February and can be used for green grazing, hay and foggage [also called standing hay] production. Foggage is [also the practice of] grazing a summer-growing crop in winter, in the dry stage."

The potential hay production of Smut's finger grass is 3 t/ha to 12 t/ha, with a carrying capacity of 0,5 to 2 LSU/ha.

Newer Smut's finger cultivars include Irene and Tip Top. According to Dannhauser, these have a seeding rate of 6 kg/ha in low-rainfall areas and 8 kg/ha in high-rainfall areas, and farmers following these guidelines can expect hay production of between 6 t/ha and 12 t/ha, and a carrying capacity of 0,5 to 2 LSU/ha.

Agpal and PUK 436 are two newer va-

rieties of weeping lovegrass (*Eragrostis curvula*), which is especially popular on the Highveld of Gauteng, Mpumalanga, the Free State and KZN, says Dannhauser. These areas have an average annual rainfall of around 600 mm.

"[Weeping lovegrass] establishes itself relatively easily when planted from October to December or in February, and can also be used for green grazing and hay production. It needs a medium to high [level of] fertilisation, and becomes less palatable if not fertilised correctly."

A seeding rate of 3 kg/ha to 4 kg/ha should be maintained when planting in rows.

"When broadcasting, farmers should maintain a seeding rate of 6 kg/ha to 8 kg/ha. For quick establishment, farmers can seed [a mixture of] weeping lovegrass at 3 kg/ha and teff at 5 kg/ha."

The hay production potential of weeping lovegrass is 6 t/ha to 13 t/ha, with a carrying capacity of between 1 and 2,5 LSU/ha.

Buffalo and Rhodes grass

White buffalo grass (*Panicum maximum*) is best in medium- to high-rainfall areas (over 500 mm per annum), especially when planted in fertile soil. It is sensitive to severe frost but can survive light frost.

This grass can be used as green grazing, hay and foggage, but needs a medium to high level of fertilisation. It should also be planted from October to December or in February.

New types of white buffalo grass include Gatton and Petri. The seeding rate is 3 kg/ha to 5 kg/ha when planting in dryland rows. When broadcast-

ing, farmers should seed at a rate of 6 kg/ha in low-rainfall areas and 8 kg/ha in high-rainfall areas. This grass has a hay production potential of 6 t/ha to 12 t/ha and a carrying capacity of 1 to 2,5 LSU/ha.

Blue buffalo grass (*Cenchrus ciliaris*) is well adapted to conditions in Limpopo and the warmer parts of North West and Mpumalanga. It is a good grazing crop in its young stage and a good source of hay.

Popular blue buffalo grass cultivars include Molopo and Gayndah. This grass has a seeding rate of 2 kg/ha to 4 kg/ha in dry areas and 4 kg/ha to 8 kg/ha in medium- to high-rainfall regions. Hay production is 4 t/ha to 6 t/ha, while carrying capacity is 0,5 to 3 LSU/ha.

"It's important to note that while Molopo can be grazed at a young stage, it's a better hay crop. As a short grower, Gayndah makes for an excellent grazing crop, but not a hay crop."

Small buffalo grass (kleinbuffelgras; *P. coloratum*) and bushveld signal grass (bosveld beesgras; *Urochloa mosambicensis*) are both indigenous to South Africa, but were never used as planted pastures. It was only in 2015 that they became available as such, following their development for use in Australia by scientists from that country.

"Small buffalo grass is a good producer in late spring, summer and autumn as a grazing crop," explains Dannhauser.

"It can survive rainfall levels as low as 450 mm, and grows in the same areas as white buffalo grass, but not under trees. It's drought-tolerant and also grows on saline, less fertile soils and in cool areas, but not where there's severe frost. It's a good grazing, hay and foggage crop,

with a seeding rate of 4 kg/ha in low-rainfall areas, 5 kg/ha in medium- to high-rainfall areas, and 7 kg/ha under irrigation."

He adds that Rhodes grass (*Chloris gayana*) is also popular in western South Africa, especially in high-rainfall areas. It can adapt to saline conditions and various soil types. It is also easy to establish, forms above-ground runners, and is consequently good for erosion control.

October to December or February is ideal for planting Rhodes grass. "Its lifespan is shortened when overgrazed. However, it can be used for green grazing, hay and foggage production, and requires medium fertilisation."

Rhodes will produce 4 t/ha to 12 t/ha hay, and its carrying capacity is 0,5 to 2,5 LSU/ha. Its seeding rate is 4 kg/ha to 6 kg/ha in rows in areas with low rainfall, while 6 kg/ha to 8 kg/ha is needed when broadcasting in high-rainfall areas.

Katambora is a Rhodes grass cultivar used worldwide. It has a hay production potential of 4 t/ha to 12 t/ha, a carrying capacity of 0,5 to 2 LSU/ha, and a seeding rate of between 5 kg/ha and 7 kg/ha.

The Finecut and Reclaimer varieties were developed in Australia and have been available in South Africa since 2015/16.

"Research in KZN and North West on Katambora, Finecut and Reclaimer showed successful establishment," says Dannhauser. "Hay of the three cultivars was fed to cattle to test their preference, and over 14 days the selection and intake were as follows:

Finecut 41%, Reclaimed 32% and Katambora 27%."

Fodder sorghum

According to Dannhauser, fodder sorghum (*Sorghum bicolor*) is adapted to most soils and grows well in areas with rainfall of over 500 mm. It can be used as green grazing, green chop, hay, foggage and silage, and needs a medium to high level of fertilisation.

Fodder sorghum should be established in October in warm areas and November or December in cooler areas. Three to four cuttings or grazing cycles are possible.

Dannhauser advises farmers to start grazing cattle when the grass is 70 cm to 100 cm tall, while sheep can be grazed from when the crop is 50 cm tall.

"There are four more recent [fodder sor-

ghum] cultivar hybrids [see Table 1] that farmers should consider when deciding which will be best for their livestock enterprises," he says.

Sorghum x Sudan grass hybrids include most of the older cultivars, such as Trudan, Hidan and Kow Kandy. Some of the newer cultivars are higher producers and more suited to grazing, hay and silage. The sweet sorghum x sweet sorghum hybrids include cultivars that mature late in the growing season and produce high yields of high-energy crops because of the higher sugar content. They are usually used for silage production or standing hay, which can be grazed in winter and early spring.

According to Dannhauser, brown mid-rib (BMR) sorghum x sweet sorghum hybrids are lower in fibre in their leaves and stems, making them more palatable and digestible.

Lastly, there are the BMR sorghum x Sudan grass hybrids.

"These cultivars are related to the sorghum x Sudan grass hybrids, but have a lower fibre [content] and better digestibility. They can also produce good hay and silage."

Fodder sorghum has a seeding rate of 20 kg/ha to 25 kg/ha under irrigation or in areas that get more than 700 mm of rain per year. In medium-rainfall areas (450 mm to 600 mm) the seeding rate is about 12,5 kg/ha, and in dry areas (less than 450 mm) it is 8 kg/ha.

Pearl Millet

Pearl millet (*Pennisetum glaucum*), also known as babala, is a drought-resistant annual fodder crop. It has been adapted to most areas in South Africa with a

rainfall of over 400 mm.

"It is widely used, even in rural areas," says Dannhauser. "It can be used as green grazing, hay and silage, and its grain can even be eaten by people."

Traditionally, only open-pollinated types were used and 'common' babala was the only cultivar available, but hybrid cultivars with a higher production volume and better characteristics entered the market recently. They include Hypearl Millet (HPM), Speedfeed, Milkstar, Nutrifeed and HPM BMR.

"Combined with annual legumes, such as cowpeas, it produces good forage. The newer hybrid cultivars also have better regrowth abilities."

The production of common babala and five newer cultivars were recently tested under two different rainfall systems (see Table 2).

"These hybrids germinate and regrow quickly and can be grazed in 40 to 50 days after planting," explains Dannhauser. "They have extended root systems, making them drought-resistant and able to supply organic material to the soil."

These millet cultivars do not produce Prussic acid and are safe to graze even at a young stage.

"HPM has a seeding rate of 3 kg/ha to 5 kg/ha in dry areas, 6 kg/ha to 10 kg/ha in higher rainfall areas, and 10 kg/ha to 15 kg/ha under irrigation." If farmers stick to these guidelines, they can expect a grazing capacity of 1 to 2,5 LSU/ha.

Phone Prof Chris Dannhauser on 082 873 4736, or email him at chriswei@vodamail.co.za.



Figure 1. Pearl millet is a drought-resistant annual fodder crop adapted to most parts of South Africa that have an annual rainfall of more than 400 mm. It can also be grown under irrigation.
Photo: Flickr

Hollows bring new life to bare patches in Karoo even in drought

Sue Milton^{1,2} and Ken Coetzee³

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Grazing, ploughing and kraaling can all reduce vegetation cover, and in arid parts of the Karoo, bare patches in the veld may stay bare and continue to erode for centuries. This is because, once the plant roots are gone, wind and water move away the loose soil permeable soil leaving a pavement of desert dust or bedrock. Hard surfaces shed water and dry out soon after rain, moreover wind- and water-dispersed seeds are quickly washed or blown off bare patches. Deflation hollows on Khoekhoen kraal abandoned 250 years ago are evidence for the slow recovery of bare patches. Much larger-scale damage to natural veld is now a daily occurrence as developments such as roads, mines and energy infrastructure sweep across the rugged koppies and vast, sparsely vegetated plains of the Karoo (Milton & Dean 2021). Ongoing repair or rehabilitation of damaged veld is essential to sustain future livelihoods in this arid region and counter the effects of climate change (Genis 2021).

With the assistance of B-tech students from Nelson Mandela University, we designed and implemented the trials described in this article.

Sites and treatments

Trials we set up in 2016 and 2017 during an unusually severe drought that lasted from 2015 until 2021 in the Central and southern Karoo and led to a loss of 25-40% of plants and vegetation cover (Milton et al. 2022; Saayman 2021). The

average monthly precipitation recorded on the Wolwekraal Nature Reserve from January 2016 until September 2021 was 10.3 mm. In 2017 and 2019 < 100 mm of rain was recorded over a period of 12 months. The soils of the two sites selected for the rehabilitation trials differed in depth and texture, but both were fairly flat.

Site 1: Eroded deep silty-sand

In August 2016 a group of 25 students

Wolwekraal Nature Reserve (-33.1902 S, 22.0292 E) to the north of Prince Albert is typical of rain-shadow succulent Karoo in that the long-term annual rainfall is 170 mm and non-seasonal. Although the property has carried no livestock for 50 years, reduced vegetation cover in comparison with neighbouring properties, a historical stone boundary wall and Khoekhoen kraals and campsites along the riverbank suggests that the land had a history of intensive grazing from which the veld has not yet recovered. It was therefore a suitable site for testing various types of restoration infrastructure described in restoration guidelines for the Karoo (Coetzee & Stroebel 2015, Milton & Dean 2021).



Figure 1. Rehabilitation structures installed at Site 1 in 2016. (A) mulched and brush-covered hollow, (B) materials used, (C) alternating brush-covered hollows and brush fences, (D) brush-packed gullies. (D)



Figure 2. Rehabilitation structures on skeletal soil when installed in 2017 and four years later in 2021.

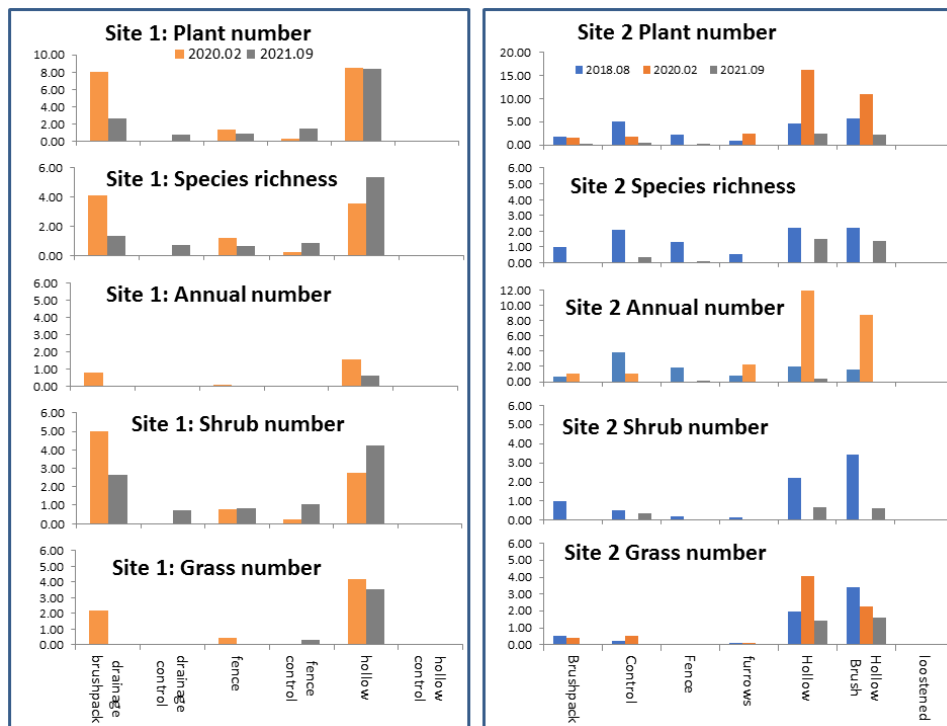


Figure 3. Plant establishment in various rehabilitation interventions at Sites 1 and 2.

spent three days installing rehabilitation infrastructure on wind-eroded and water-eroded bare patches on deep silty sand. The rehabilitation structures comprised 50 hand-dug small (0.5 m wide and 0.2 m deep), and 25 large (1.0 m wide and 0.3 m deep) mini-catchments. The excavated soil was used to form an elevated rim (150 mm high) on the down-slope side of each catchment. The catchments were partly

filled with a mulch of chipped *Vachelia karroo*. Branches were placed over the mini-catchments to attract perching birds in the hope that they would bring seeds of fleshy-fruited plant species to these microsites (Figure 1a). The micro-catchments were interspersed with the erosion control fences on the water-eroded area and small gullies were brush-packed with *V. karroo* and *Tamarix ramossissima* branches to slow down

runoff and trap seed and sediment (Figure 1b-d). Together the treatments covered an area of approximately 0.5 ha. On completion of the erosion control structures, the whole area was sown with 4 kg of locally collected seed comprising equal weights of *Osteospermum sinuatum*, *Salsola aphylla*, *Augea capensis* and *Stipagrostis ciliata*. The vegetation surrounding the eroded area was dominated by *Augea capensis*, *Pteronia palens*, *Salsola spp.* and *Stipagrostis spp.*

Site 2: Skeletal soil on mudstone

In September 2017, a group of NMMU 25 students under the supervision set out rehabilitation structures on bare ground where Ecca Mudstone bedrock was covered with 10-40 mm of skeletal silty soil. The structures included furrows, brush fencing, mulched hollows, brush-packs of reeds and *T. ramossissima* and *V. karroo* branches (Figure 2). Restoration infrastructure and controls covered approximately 0.25 ha. On completion of the rehabilitation works, the whole area was sown with 4 kg of locally-collected seed comprising a mixture of *Cenchrus ciliaris*, *Fingerhuthia africana*, *Osteospermum sinuatum*, *Stipagrostis ciliata*, *Stipagrostis obtusa* and *Augea capensis*. The vegetation surrounding the bare area was dominated by *Ruschia spinosa*, *Enneapogon scaber*, *Kleinia longiflora* and *Rhigozum obovatum*.

The sites were monitored in August 2018, February 2020 and September 2021 by counting and identifying all live plants in an 80 cm diameter hoop (0.5 sq m) placed alternatively in or adjacent to rehabilitation structures (hollows, fences, brush-packs). Average species richness and plant densities were calculated for each site and treatment and compared visually using bar graphs.

Results in 2021

Despite the extreme drought plants established on both sites. Mulched hollows, with or without brush-packing, supported more plants and greater species richness than did untreated soil surfaces (controls), loosened soil surfaces or brush-packed surfaces without hollows on both deep and shallow soils (Figure 3). Annual (or ephemeral) plants, shrubs and grasses were all more abundant in hollows than on other treatments. As the drought continued into 2021, plants on untreated and brush-packed sites tended to die and disappear, whereas many of those in hollows survived.

At Site 1, 12% of all plants and 17% of all species recorded in 2020 were species included in the seed mix. This increased to 24% of plants and 26% of

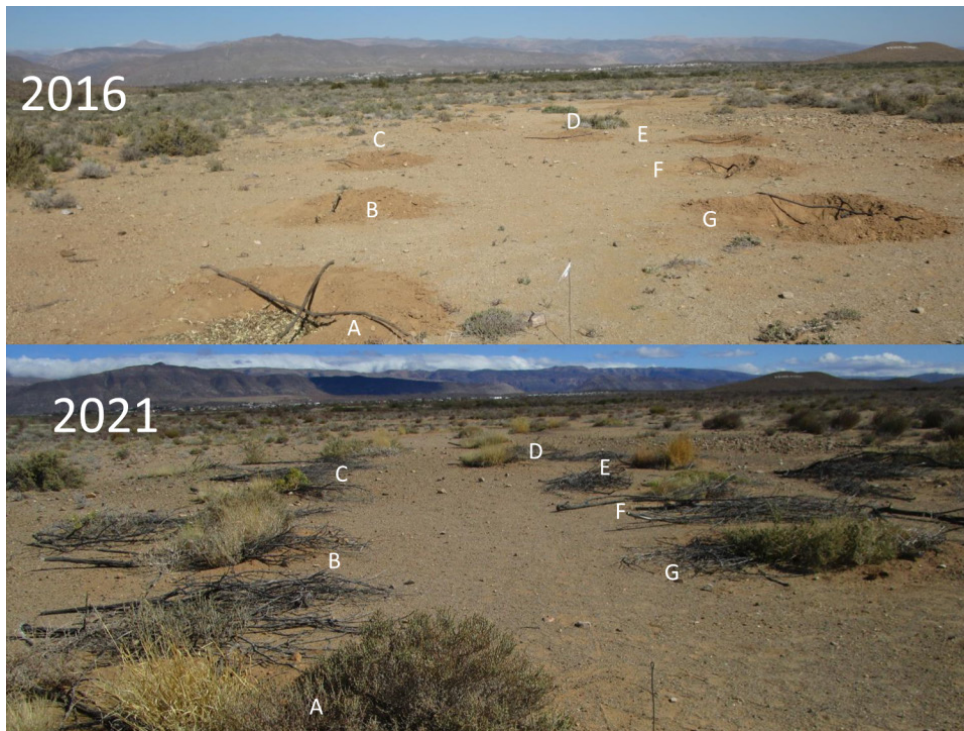


Figure 4. Development of plants in brush-packed hollows in Site 1 over five years from August 2016 until September 2021.



Figure 5. Development of plants in brush-packed hollows in Site 1 over five years from August 2016 until September 2021. (A) Two Steenbok (*Raphicerus campestris*) grazing plants in a hollow at Site 1, (B) Scrub Hare (*Lepus saxatilis*) dung in a hollow at Site 1.

species in 2021. At site 2 the patterns were similar with 18% of plants and 22% species originating from the seed mix in 2018, with the representation of seed mix species increasing to 24% of plants and 31% of species in 2021. The most abundant species on the stony ground were *Cenchrus ciliaris* and *Fingerhuthia africana* (in the mix) and *Enneapogon*

scaber (self dispersed). On deep silty soil the most abundant species were the alien invasive shrub *Atriplex lindleyi* (self-dispersed) succulents *Augea capensis* (in the mix) and *Mesembryanthemum tetragonum* (self-dispersed), and the grasses *Fingerhuthia africana* (in the mix) and *Enneapogon scaber* (self-dispersed).

Although plant and species densities were similar on the deep (Site 1) and shallow (Site 2) soil, plants appeared to perform better on deeper soils and produce more cover, biomass and seed than they did on shallow soils (compare Figures 2 and 4).

As evidenced by trap camera photographs and dung observations, plants established in hollows at both sites attracted herbivores and granivores. While brush-packing protected plants from excessive herbivory, the herbivores visitors contributed to diversity and productivity through seeds and nutrients in the dung they deposited on the rehabilitation sites (Figure 5).

Lessons learned

We have shown that in very arid areas such as Prince Albert, the concentration of the available water appears to be the most successful means of achieving plant establishment and survival on bare ground, even during drought. This can be achieved through the creation of small, shallow hollows, either by hand digging or use of a modified plough known as a “hap ploeg” (Coetzee & Stroebele 2015). The hollows are aligned to trap runoff water and should have a rim on the downslope side so as to retain some of the water they capture. The optimal depth for hollows will vary with soil texture and sandy soils drain fast and the hollows rapidly dry out, whereas on clay soils the hollows retain water long enough to drown seedlings (Milton & Dean 2021; Genis 2021). Ideally, the hollows and surrounding soil should stay moist for at least a week after rain to facilitate germination and seedling establishment (Figure 6). Mulching of hollow helps retain moisture and also prevents fine-textured soils from peeling, cracking and lifting seedlings out of the ground. Covering hollows with thorn bush protects seeds from medium to large herbivores for a few years until they are established.

Although brush-packing without hollows can stabilize soil and promote germination in some areas (Saayman & Botha 2010), this treatment was not successful on our study sites. Possible reasons for lack of success may be the failure of brush-packed areas to retain rainwater, exclusion of light in densely-packed areas, and possibly also diversion of tumble-seeds away from the brush-packed areas.

The addition of seeds appropriate for the site conditions is justified when seed availability in the surrounding landscape is limited by grazing, drought or

clearing of surrounding vegetation. Our trials indicate that about one-quarter of all plants established over the 4-5 year period originated from the seed mixture added to the site when the trials were established.

In a review of restoration projects in arid areas worldwide Shackelford et al. (2021) reported that the more species and numbers of seeds that are sown, the greater the number of plants that obtained - seed addition thus increases the probability that plants will establish.

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In addition to teaching us what rehabilitation methods work best in our area, our small-scale trials have been useful for student training, as demonstration sites for landowners.

Acknowledgements

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Monitoring of the trials in 2020 and 2021 was carried out with the help of NMMU students Callum Clark and Waldo Jordaan who were employed as interns with Wolwekraal Conservation and Research Organisation.



Figure 6. Soil in and around hollows remained moist for two weeks after rain on 2021.10.22.

Little patches of diversity: the value of small fragments of pristine grasslands

Marlize Muller

Current Address: SAEON Ndlovu Node
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Grasslands have long been neglected as an important ecosystem as it has erroneously been believed that forests represent the dominant climax state (Bond, 2019). This notion has been challenged by the fact that more than 58 percent of the planet's land area is covered by non-forested, ancient open-ecosystems (including deserts, grasslands and savannas) (Dinerstein et al., 2017).

Despite this, the threats faced by forests are well understood, documented and resourced (think Amazon rain forests), while open-ecosystems such as grasslands are poorly managed and conserved (Bond, 2019).

Grassland systems host an exceptionally high diversity of animal and plant species, habitats and communities (Carbutt et al., 2017). There are 161 orchid taxa in the Grassland Biome of South Africa, for instance, of which 67 percent are endemic (Mucina and Rutherford, 2006).

Grasslands are threatened by human activities – species richness decreases by nearly 50 percent after land transformation (Muller et al., 2021). Many grassland species are not tolerant of anthropogenic soil disturbance (Siebert, 2011) and disappear completely from the system. This is especially true for plant species with underground organs adapted to survive harsh winter conditions, drought and fire (Bond, 2016).

The loss of species when grasslands are transformed could have a significant impact on the ability of these systems to provide vital ecosystem services. Untransformed grasslands provide a variety of ecosystem services that are necessary for our survival (Figure 1), including the provisioning of food, freshwater, medicinal resources and the regulation

of systems such as erosion prevention and carbon sequestration (TEEB, 2011).

The Grassland Biome is one of the most threatened biomes in South Africa, as 40–60 percent of the biome has already been irreversibly modified, 60 percent of the remaining grassland is threatened and only about 15 percent remains natural grassland with less than

three percent of grasslands formally protected (Little et al., 2015).

Woodbush Granite Grassland

A particularly threatened grassland ecosystem is the Woodbush Granite Grassland found close to the village of Haenertsburg in Limpopo Province. Only about six percent of the grassland is still in a natural state, with the largest fragment being 192 hectares in size (Dzerefos et al., 2017).

This small fragment contains ~660 plant species, rendering the conservation value of the area especially high (Dzerefos et al., 2017; Niemandt and Greve, 2016). Most of these species are forb species; grasses represent only a sixth of the total richness. Herbaceous bulbs and forbs are the life forms that contribute to the high diversity even though they occur in low densities (Edwards et al., 2010).

Pristine patches of grasslands such as the Woodbush Granite Grassland provide a natural buffer to extreme events such as droughts. Grasslands have evolved in the presence of endogenous disturbances such as lightning-ignited fires, rainfall variability and large mammalian herbivory and are therefore tolerant, and to some extent dependent, on these natural disturbances (Buisson et al., 2019) (Figure 2).

The Forb Ecology Research Group (FERG), in close collaboration with SAEON and Potsdam University, assessed the effect of the severe drought of 2014–2016 on the floristic diversity of fragmented grasslands, with a specific focus on the Woodbush Granite Grassland. Results revealed that the floristic diversity of the Woodbush Granite Grassland remained largely intact when

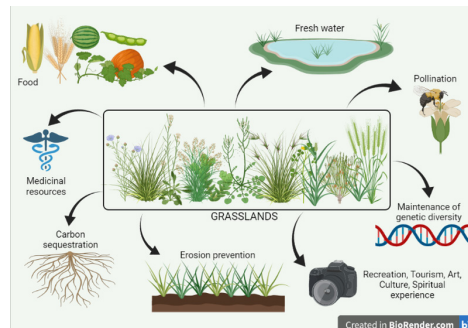


Figure 1. Some of the ecosystem services provided by grasslands. (Source: Marlize Muller)

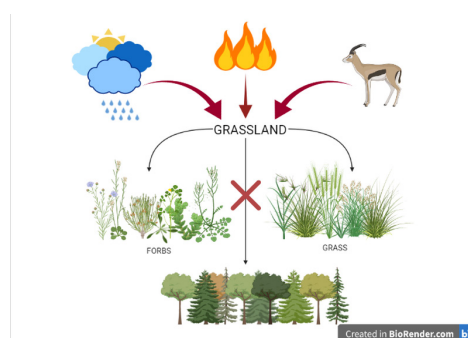


Figure 2. Grasslands consist of a high diversity of forb- and grass species that are maintained by inter-annual rainfall variability, fire and herbivory. Indigenous trees and scarce, although large areas of natural grasslands are covered by exotic timber plantations. (Source: Marlize Muller)

pre-drought, in-drought and post-drought data were compared.

Our further investigations into the functional ecology of these grassland patches are expected to improve the understanding of ecosystem resilience in grasslands and why they need to be protected, restored and managed sustainably.

This article first appeared in *ENVIRA*, the quarterly newsletter of the Unit for Environmental Sciences and Management at North-West University.



Figure 3. A bulbous geophyte (has underground storage organs), the thick-leaved gladiolus (*Gladiolus crassifolius*) is found in rocky grasslands (Photo: Marlize Muller)



Figure 4. An orchid species, *Eulophia ovalis* var. *ovalis*, occurs in open grassland.



Figure 5. The Orange River lily, *Crinum balbispermum*, grows in moist grasslands (Photo: Marlize Muller)



Figure 6. An orchid species, *Eulophia ovalis* var. *ovalis*, occurs in open grassland (Photo: Marlize Muller)



Figure 7. The author, Marlize Muller, is a PhD student at the Ndlovu Node.

Getting African grasslands right, for people and wildlife alike: Q&A with Susanne Vetter

Kang-Chun Cheng

Current Address: Mongabay
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- Africa's vast grasslands are well known for their iconic wildlife, but far less appreciated for the other ecosystem services they provide, including sequestering immense amounts of carbon and supporting millions of people practising the ancient occupation of livestock herding.
- Susanne Vetter, a plant ecologist at Rhodes University in South Africa, studies the roles not only of plants but also of people in these landscapes.
- Through her work, she has gained a rosier view of pastoralism, and its ability to coexist with wildlife, than many conservationists and policymakers hold.
- Mongabay recently interviewed Susanne Vetter via email about common misconceptions of African grasslands and the pastoralist communities who depend on them.

All across the arid and semi-arid landscapes of Africa, grasslands meet the eye. These ecosystems provide a wealth of environmental services, sequestering immense amounts of carbon (grazing lands store up to 30% of the world's soil carbon, by one estimate) and harbouring tremendous biodiversity. This includes some of the world's most iconic remaining megafauna, such as elephants, rhinos and lions, and epic annual migrations of 1.5 million thundering wildebeest.

These immense swaths of grass also sustain people practising one of the world's most ancient occupations: livestock herding. Some 268 million pastoralists live in Africa, contributing an estimated 10-44% of the GDP of African nations, according to a 2013 African Union report. Out of necessity, herders are resourceful, innovative and resilient. They require large areas of land to graze their livestock, which is why many pastoral communities across the world are nomadic or semi-nomadic. Their cows, goats, camels and sheep convert what

other people may dismiss as wasteland into milk and meat. At times, these animals are the only viable way to make a living in remote, dry landscapes.

Yet as populations of both people and their animals burgeon, as grasslands become segmented through fencing, property privatization, development projects and extractive industries, and as government policies encourage shifts away from pastoral livelihoods, both herders and the grasslands they depend on are facing new challenges.



Figure 1. Two Maasai boys were tasked with bringing the herd home in Amboseli National Park, Kenya. Image by Kang-Chun Cheng.



Figure 2. Susanne Vetter out in the field, a grassy biome in the background. Image courtesy of Susanne Vetter.



Figure 3. A cow catching up with the rest of the herd as they make their way home at the end of the day in Amboseli National Park, Kenya. Image by Kang-Chun Cheng.



Figure 4. Grevy's zebra (*Equus grevyi*) dotting the grounds of Mpala Research Centre in Laikipia County, central Kenya. Image by Kang-Chun Cheng.

At the same time, pastoralists often take much of the blame for declining grasslands. Conservationists and farmers accuse herders of having too many livestock that tramples sensitive vegetation and edges wildlife out as they overgraze the landscape.

Susanne Vetter, an associate professor



Figure 5. Maasai goats nibbling the local vegetation just outside the main gate of Amboseli National Park in southern Kenya near the Tanzanian border. Image by Kang-Chun Cheng.

of plant ecology at Rhodes University in South Africa, studies these rangeland dynamics across arid and semi-arid parts of the country. Much of her research and teaching focus on plant adaptations and vegetation dynamics.

But she says she has always been fascinated by people's deeper relationship with plants and nature, and this theme has taken root in her studies as well. Through her work, she has gained a rosier view of pastoralism than many conservationists and policymakers take.

"I believe that pastoralism and wildlife are compatible and probably the combination is the most ecologically appropriate form of land use in these parts," Vetter says. She adds that she believes traditional methods of herding are a more sustainable and ecologically appropriate way to manage drylands than the main alternatives: "fenced-in" ranching and other intensive forms of farming.

Vetter also notes that people often misunderstand the intrinsic productivity of grasslands and their utility to local communities, and that this often manifests in ecologically inappropriate development strategies that threaten both grasslands and pastoral livelihoods, such as attempts to convert grassy biomes into agricultural plots or forests.

Mongabay contributor Kang-Chun Cheng recently interviewed Susanne Vetter via email about common misconceptions of African grasslands and the pastoralist communities who depend on them. The interview was edited for length, clarity and style.

Mongabay: Could you tell me a bit about your work? What is currently the most exciting aspect of your research?

Susanne Vetter: My research is very diverse and includes the ecological dynamics of rangelands, the cultural values of biodiversity, and the functional ecology of savannas and thickets. I am interested in the drivers that have shaped vegetation in the past (climate, fire, herbivory, humans) and how they are changing the vegetation into the future. Currently what excites me most is expanding my research to other parts of Africa through field visits and collaboration with other African scholars. It is allowing me to gain a better understanding of the large-scale patterns in these dynamics across sub-Saharan Africa.

Mongabay: What is it about traditional pastoralism and the human culture behind it that helps it inherently coexist with wildlife conservation?

Susanne Vetter: Like wildlife, traditional pastoralists and their livestock had to survive and thrive in environments where productivity varies hugely in space and time, often with a severe dry season. As a result, densities of livestock and people tended to be sparse and mobile, and many areas far from water were inaccessible to humans and their livestock while providing habitat for wildlife, thus reducing conflict.

However, there are few areas today where traditional pastoralism hasn't been affected by land-use change, provision of supplementary feed and water, conflict over resources and changes to the lifestyles and aspirations of the pastoralists themselves. As a result, the compatibility with wildlife is now much more variable.

Fundamentally, however, pastoralism and wildlife are compatible at least to an extent, and the natural vegetation of savannas and grasslands is well adapted to being grazed and browsed. Compared to ploughing or other intensive

forms of land use, extensive pastoralism is the most ecologically sound land use in these vegetation types.

Mongabay: What are some foundational misconceptions in the rangeland narrative?

Susanne Vetter: When I did my PhD research on land degradation in communally managed rangelands in South Africa, I became acutely aware of the mismatch between mainstream development thinking and the realities on the ground. The knowledge and experience of local land users were neglected in the development process and implementation of rangeland policy.

As an academic in plant ecology, I have become aware of how strongly ecological thinking and training are shaped by ecological paradigms originating in the Global North. Notably, vegetation type is determined primarily by climate; fire and herbivory are rare disturbances. Large areas of the world are natural grasslands, savannas, and other open ecosystems wet enough to support forest, but maintained by fire and/or herbivory. Specialist flora and fauna have adapted to these conditions. There is still a common misconception that open ecosystems were created by humans through overgrazing and deforestation — this has led to myriad inappropriate interventions to increase tree cover.

Within agriculture, African pastoralism has long been viewed as inefficient and destructive. Narratives about the “Tragedy of the Commons” and the “cattle complex” have led to the widespread assumption that pastoralists aim to amass livestock for individual gain on a shared resource, which inevitably becomes overused. These narratives ignore the complexities of local livelihood systems, as well as the history of these systems, including their traditional management and how this has become increasingly modified and constrained.

Mongabay: Why do so many people seem to get the narrative wrong?

Susanne Vetter: A key issue is a persistent focus on increasing productivity and stability, which is at odds with the inherently unstable, unpredictable nature of drylands that form the basis of most pastoral systems. The attraction of “greening the desert” is as seductive as always, even though there are good reasons why deserts aren’t green. There is plenty of evidence that greening through tree planting and irrigation schemes is unsustainable and damaging. In Diana Davis’ book *The Arid Lands: History, Power, Knowledge*, she provides a fascinating analysis of how modern development thinking has

remarkable continuities with colonial forestry and colonial resource management. Such entrenched paradigms are hard to change.

At the same time, it is overly simplistic to see “development” as a monolithic, homogeneous endeavour. Many organizations have long been embracing and promoting more land user-centric and locally appropriate approaches. But scale has become a recurring problem. Locally appropriate and sustainable approaches often take time, but don’t result in striking increases in outputs and are hard to scale up. Yet many funders want to see a big impact in a short time and over large areas.

There is an obvious gap when one goes to any conference on ecology, conservation, or rangelands, even when the focus is the tropics: the limited number of African ecologists generating and contributing original knowledge to these global debates. Despite Africa being home to a large part of the world’s savannas and most of the world’s extant megafauna, the number of senior, research-active African savanna ecologists is vanishingly small in comparison to the size of the international ecological community. Many African academics with their students studied abroad themselves, on a diet of ecology curricula that fail to represent African open ecosystems and their dynamics. This perpetuates the situation where inappropriate ecological models and worldviews inform development.

Mongabay: Could you speak a bit about the capacity of grasslands to sink carbon in the context of afforestation — growing trees where they didn’t historically exist — or reforestation — growing trees where forests did historically exist?

Susanne Vetter: The contribution of grasslands to carbon storage has indeed been widely overlooked. Much of the focus when it comes to deforestation and tree planting is on the carbon stored above ground, in the wood of trees. Grasslands don’t have high aboveground biomass but store large amounts of carbon in their extensive root systems and the soil. When grasslands burn, the carbon released during the fire is quickly recovered in the next season’s growth. At the same time, when roots die back after fire, the carbon released from the breakdown of the dead root material is incorporated into the soil. Carbon storage in the soils of grasslands is resilient to fire and grazing, while extreme hot and dry weather events and wildfires make forests increasingly vulnerable to losing their stored carbon.

However, grassland soils quickly lose their carbon when they are ploughed or otherwise disturbed (e.g. afforestation). It is thus important to recognize the role grasslands play in capturing carbon and to protect remaining natural grasslands from soil disturbance. Low-intensity grazing by wildlife and/or livestock is the most naturally compatible way to protect the carbon storage function of grasslands.

Mongabay: What are some successful models of forest landscape restoration in the African context? What sets them apart from others that may be well-intentioned but miss the mark?

Susanne Vetter: There is no doubt that many areas have experienced negative land use and can benefit from restoration. The key is involving local land users and land managers from inception — their knowledge and needs must inform intervention type, location, and timeline. Understanding the local and larger-scale ecological, social and political dynamics will help to ensure that strategies are based on correct assumptions and models. All this takes time and requires more than a technical “fix.”

The Shinyanga region in Tanzania is a good example. Since 1986, over 300,000 hectares [741,000 acres] of transformed acacia and miombo woodlands have been restored in over 800 villages, at scales ranging from individual household plots to village forests. A conducive policy environment, the inclusion of local knowledge, and recognizing the livelihood benefits of the restoration initiative all contributed to this initiative’s success.

In other cases, trees may not be the answer — sometimes, they may even be the problem. South Africa is a water-scarce country with vast areas of fire-driven grasslands, savannas, and shrublands. Invasive exotic trees have a massive impact on streamflow and therefore water security; this has led to a massive public works program called “Working for Water.” Every year, large areas are cleared of water-thirsty exotic vegetation while creating employment for thousands of workers. The positive effect on water yields makes the project cost-effective and sustainable.

Mongabay: What are viable strategies to support traditional pastoral land use while optimizing the process with new findings?

Susanne Vetter: While recognizing the merits of traditional mobile pastoralist systems, it is important to acknowledge that societies and their cultures are not static. The challenge is to foster aspects of traditional pastoralism that

are ecologically sound and viable while remaining open-minded and innovative to counter new challenges. The mobility [that is] key to resilience has greatly reduced through increasing populations, competing for land use, shrinking pastures, and/or pastoralists' desire to remain closer to schools and other services.

Mobility allows vegetation to recover between periods of grazing, ensuring the survival of herds in rangelands where forage production varies throughout space and time. Safeguarding pastoralist access to seasonal resources is crucial. Supplementary food during the dry season also plays an important role. The caveat is the risk of excessive grazing impact during the wet season. Livelihood diversification is vital to buffering the uncertainty of a fluctuating and shrinking resource base, as is access to markets for livestock, livestock products, and information (e.g. market prices and seasonal forecasts that help with planning).

Mongabay: I would love to hear a bit more about your experience in South Africa; how does pastoralism play out there?

Susanne Vetter: South Africa has incredible ecological and cultural diversity. The vegetation ranges from arid shrublands and heathlands to grasslands and savannas to forests. In the succulent winter rainfall shrublands of

Namaqualand, the descendants of Khoi Khoi pastoralists still practice a form of semi-nomadic pastoralism with sheep and goats. Traditional African agropastoralism that was widely practised in the grasslands and savannas has been heavily modified by decades of colonial and apartheid rule, which confined people of African descent to a small fraction of the country's land. High population densities and widespread migrant labour to support rural households have led to greatly reduced herds and a dwindling contribution of livestock to livelihoods.

The challenges are significant: increasing rates of unemployment, high population densities, increasingly frequent droughts and widespread bush encroachment where trees proliferate because there is less fire, more grazing and elevated atmospheric CO₂. The material and cultural role of livestock remain strong, however, and the challenge is now to find innovative and locally appropriate ways to support livestock farming as part of diverse livelihood strategies in this changing world.

In contrast, large areas of South Africa are sparsely populated with extensive areas of land owned by (still mostly white) commercial livestock farmers and conservation areas. One noticeable shift has been a widespread shift from livestock farming to keeping wildlife for ecotourism or hunting.

Mongabay: Could you please describe a recent interesting research project or experiment?

Susanne Vetter: Through a long-standing collaboration with Michelle Cocks, an anthropologist who also works at Rhodes University, we have been delving deep into the relationship rural and urban Xhosa-speaking people in South Africa have with nature. The findings have blown us away — despite lifestyles that are a far cry from traditional agropastoralism, the connection to nature is still deep, and inextricably linked to cultural practices such as resource use and rituals. Apart from providing natural resources, nature also offers a place of reflection, healing and identity. Research and interventions aimed at developing and conserving African ecosystems would benefit from engaging more with people's worldviews, practices and experiences that shape their relationship with the land they live in.

Kang-Chun Cheng is an environmental photojournalist based in Nairobi, Kenya, with an interest in community-based natural resource management and traditional ecological knowledge.

Citation

Schuman, G., Janzen, H., & Herrick, J. (2002). Soil carbon dynamics and potential carbon sequestration by rangelands. *Environmental Pollution*, 116(3), 391-396. doi:10.1016/s0269-7491(01)00215-9



Figure 6. Maasai market day near Kimana Sanctuary in southern Kenya. Cattle are prized possessions amongst the Maasai and a sign of both wealth and power. Image by Kang-Chun Cheng.

Uncovering how grasslands changed our climate

Grasslands are managed worldwide to support livestock production, while remaining natural or semi-natural ones provide critical services that contribute to the wellbeing of both people and the planet. Human activities are however causing grasslands to become a source of greenhouse gas emissions rather than a carbon sink. A new study uncovered how grasslands used by humans have changed our climate over the last centuries.

IIASA – International Institute for Applied Systems Analysis

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Grasslands are the most extensive terrestrial biome on Earth and are critically important for animal forage, biodiversity, and ecosystem services. They absorb and release carbon dioxide (CO₂), and emit methane (CH₄) from grazing livestock and nitrous oxide (N₂O) from soils, especially when manure or mineral fertilizers are introduced. Little is known, however, about how the fluxes of these three greenhouse gases from managed and natural grasslands worldwide have contributed to climate change in the past, and about the role of managed pastures versus natural or very sparsely grazed grasslands.

To address this knowledge gap, an international research team quantified the changes in carbon storage and greenhouse gas fluxes in natural and managed grasslands between 1750 and 2012 in their study published in *Nature Communications*.

The study's comprehensive estimates of global grasslands' contribution to past climate change illustrate the important climate cooling service provided by sparsely grazed areas, and the growing contribution to warming from quickly increasing livestock numbers and more intensive management - which are in turn associated with more CH₄ and N₂O emissions - in determining the contemporary net climate effect of the grassland biome.

"We built and applied a new spatially explicit global grassland model that includes mechanisms of soil organic matter and plant productivity changes driven by historical shifts in livestock and the reduction of wild grazers in each region.

This model is one of the first to simulate the regional details of land-use change and degradation from livestock overload," explains Jinfeng Chang who led this study at IIASA and is now based at Zhejiang University in China. "We also looked at the effect of fires, and soil carbon losses by water erosion; CH₄ emissions from animals; N₂O emissions from animal excrement, manure, and mineral fertilizer applications; and atmospheric nitrogen deposition."



Photo: © Narong Khueankaew | Dreamstime

The study shows that emissions of CH₄ and N₂O from grasslands increased by a factor of 2.5 since 1750 due to increased emissions from livestock that have more than compensated for reduced emissions from the shrinking number of wild grazers. The net carbon sink effect of grasslands worldwide – in other words, the ability of grasslands to absorb more carbon and pack it in the soil – was es-

timated to have intensified over the last century, but mainly over sparsely grazed and natural grasslands. Conversely, over the last decade, grasslands intensively managed by humans have become a net source of greenhouse gas emissions – in fact, it has greenhouse gas emission levels similar to those of global croplands, which represent a large source of greenhouse gases.

"Our results show that the different human activities that have affected grasslands have shifted the balance of greenhouse gas removals and emissions more towards warming in intensively exploited pastures, and more towards cooling in natural and semi-natural systems. Coincidentally, until recently the two types of grasslands have almost been cancelling each other out," notes coauthor Thomas Gasser from IIASA.

"However, the recent trends we see towards the expansion of pasture land and higher livestock numbers lead us to expect that global grasslands will accelerate climate warming if better policies are not put in place to favour soil carbon increases, stop deforestation for ranching, and develop climate-smart livestock production systems."

According to the authors, the cooling services provided by sparsely grazed or wild grasslands makes it clear that countries should assess not only the greenhouse gas budgets of their managed pastures (such as specified in the current national greenhouse gas reporting rules of the UN's Framework Convention on Climate Change), but also the sinks and sources of sparsely grazed rangelands, steppes, tundra, and wild grasslands.

Full greenhouse gas reporting for each country could facilitate the assessment of progress towards the goals of the Paris Agreement and better link national greenhouse gas budgets to the observed growth rates of emissions in the atmosphere.

“In the context of low-warming climate targets, the mitigating or amplifying role of grasslands will depend on a

number of aspects. This includes future changes in grass-fed livestock numbers; the stability of accumulated soil carbon in grasslands; and whether carbon storage can be further increased over time or if it will saturate, as observed in long-term experiments,” concludes Philippe Ciais, a study co-author from the Laboratory for Sciences of Climate and Environment (LSCE).

Reference

Chang J, Ciais P, Gasser T, Smith P, Herrero M, Havlik P, Obersteiner M, Guenet B, et al. (2021). Climate warming from managed grasslands cancels the cooling effect of carbon sinks in sparsely grazed and natural grasslands. *Nature Communications* DOI: [10.1038/s41467-020-20406-7](https://doi.org/10.1038/s41467-020-20406-7)

African Journal of Range & Forage Science

SPECIAL ISSUE ALERT

Friend or Foe?

Lessons from a century of
evidence-based fire management
in grassy ecosystems

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First Report of a Succulent Grass with CAM Photosynthesis

Sejarah Poaceae

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The Poaceae as a whole are about equally divided between those that use C3 photosynthesis, and those that have the C4 version of photosynthesis, which is more energetically costly, but which allows the plants to be more productive in hot and arid environments.

In C3 plants, which are the vast majority of plants in the world, CO₂ is directly fixed into a 3-Carbon compound by the enzyme RuBisCo in the Calvin-Benson cycle. Unfortunately, RuBisCo can use both O₂ and CO₂, and when a C3 plant closes its stomata in order to conserve water in hot dry environments, more O₂ is used, which leads to a net loss of carbon in the plant. In fact, some calculations show that C3 plants could end up wasting up to 40% of absorbed energy due to photorespiration!

C4 plants solve this problem through a carbon-concentrating mechanism. They have modified leaf anatomy wherein CO₂ is first fixed onto a 4-carbon compound in outer mesophyll cells by an enzyme not affected by O₂, before being shunted to inner bundle sheath cells, where it is converted back to CO₂ for use by RuBisCo in those cells.

CAM plants are also adapted to hot and dry environments, and they also initially fix CO₂ into a 4-carbon compound. In their case, they keep their stomata close during the heat of the day, then open them at night. The CO₂ that comes in when the stomata are open is fixed into a 4-carbon compound by the same enzyme used by C4 plants, then shunted into a nearby vacuole, where they remain until needed to complete carbon fixation during the daytime. So in the case of CAM plants, they concentrate carbon by separating the process temporally, instead of spatially like C4 plants do.

The Poaceae recently became one of only 8 families of plants that have members using all 3 different photosynthetic methods, with the single grass species

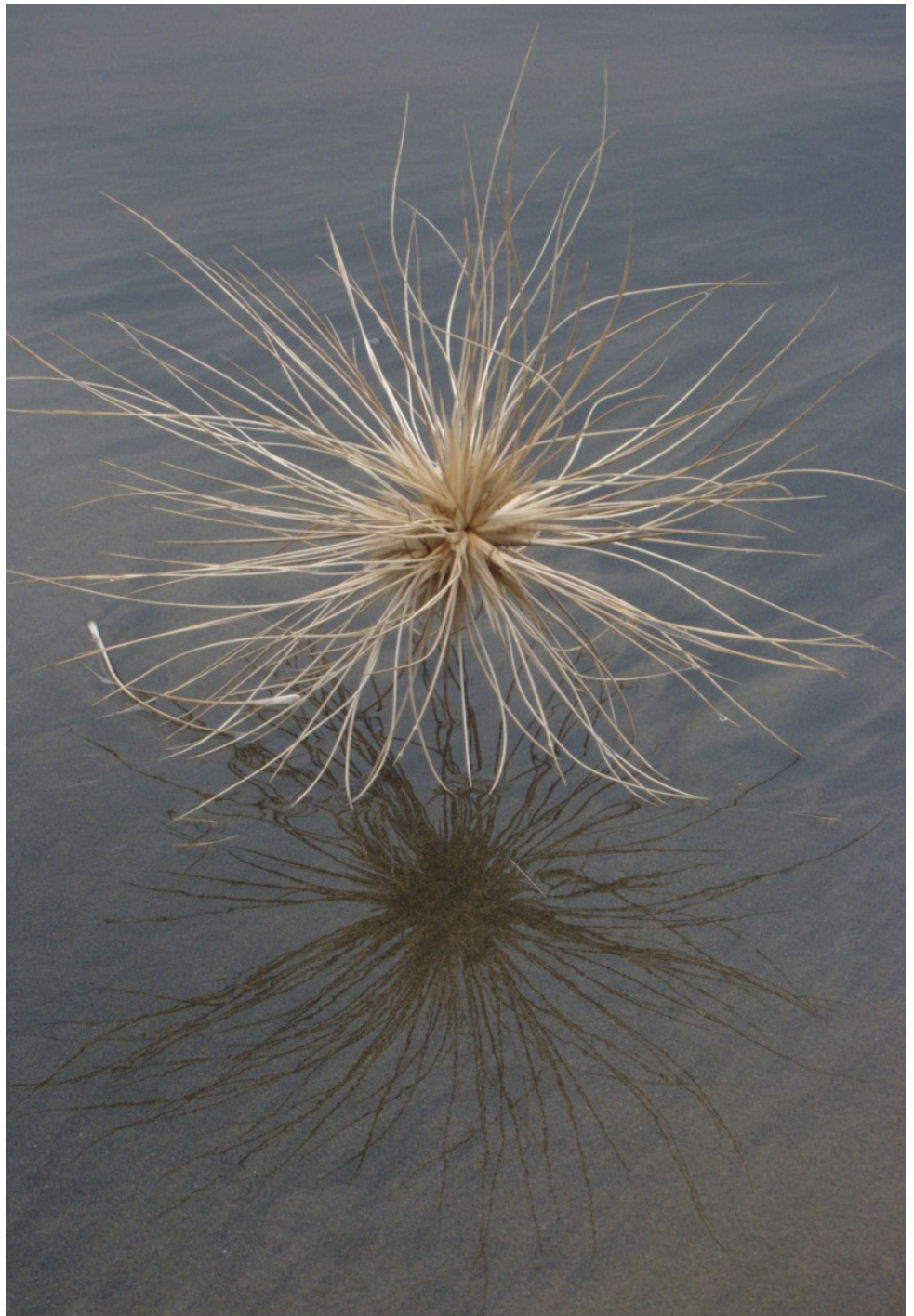


Figure 1. Seed of *Spinifex* sp. by Avenue - Own work, CC BY-SA 3.0

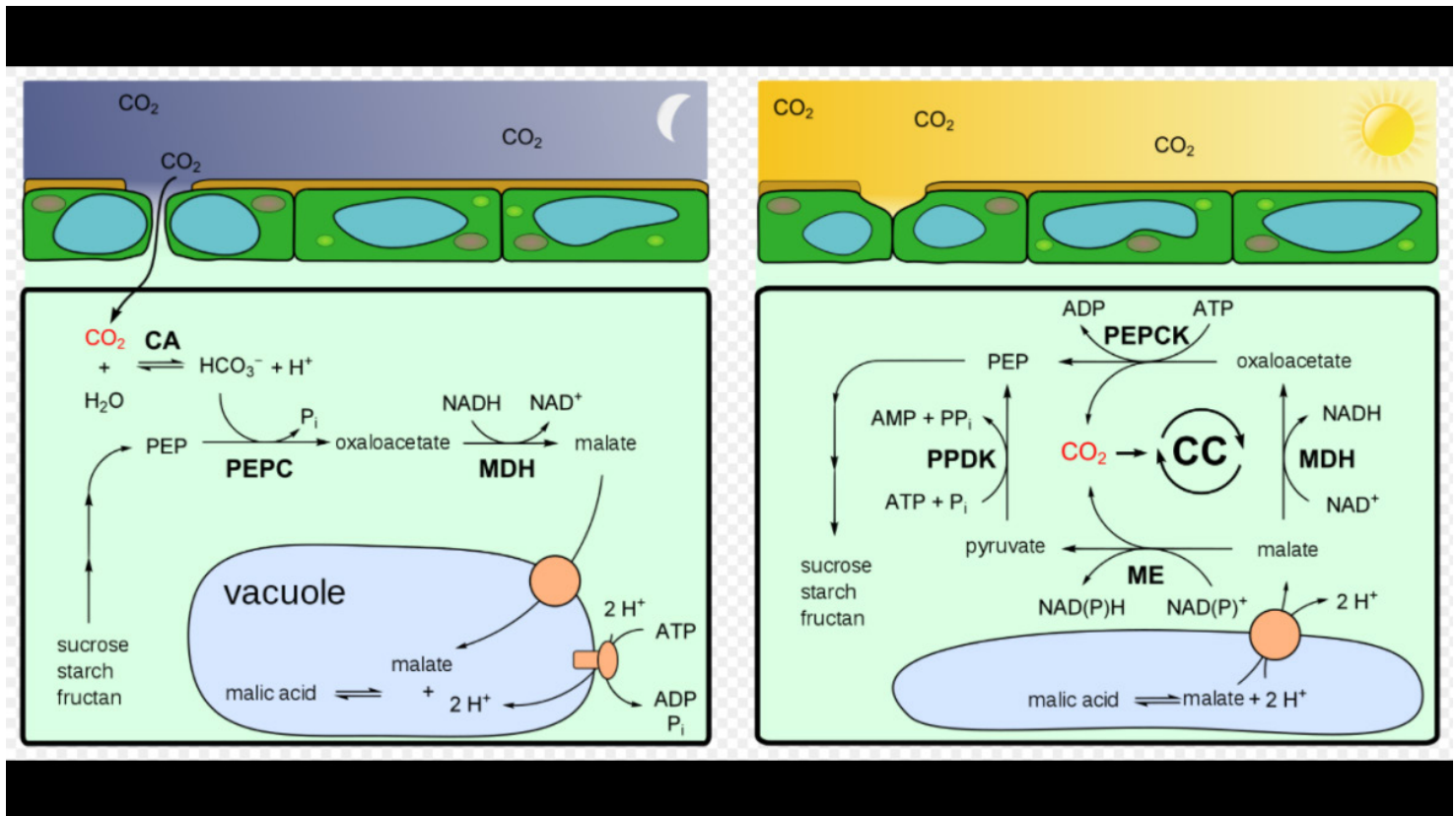


Figure 2. CAM process by [YikrazuulDerivative: Ed \(Edgar181\)](#)

that exhibits CAM metabolism able to use both C4 and CAM.

Spinifex littoreus is a halophyte with thick, stiff leaves that is found on coastal sand dunes in East Asia. It has been reported as a C4 plant, with all the concomitant structural modifications for this pathway, but a relatively new study showed evidence that it may also be undergoing CAM metabolism.

Measurements confirmed that the leaves of this species are succulent, which is usually correlated with CAM plants. In addition, the researchers found diel fluctuations in leaf acidity, with acidity rising during night, another clue that it is using CAM photosynthesis.

If true, *S. littoreus* is the first grass ever exhibiting CAM, and it will be joining members of the non-grass genus *Portulaca* as the only plants that can do C4/CAM cycling.

Reference

Che-Ling Ho, Jyh-Min Chiang, Teng-Chiu Lin, Craig E. Martin (2019). First report of C4/CAM-cycling photosynthetic pathway in a succulent grass, *Spinifex littoreus* (Brum. f.) Merr., in coastal regions of Taiwan, *Flora*, Volume 254, Pages 194-202, ISSN 0367-2530, <https://doi.org/10.1016/j.flora.2018.08.005>.



Figure 3. From [Flowers of India](#) by Prashant Awale

South Africa's 'common vision' to survive in a hotter world

Ethan van Diemen

Current Address: Daily Maverick
Reprinted from: <https://bit.ly/3w9OwR4>

Climate change mitigation is defined as “a human intervention to reduce the sources or enhance the sinks of greenhouse gases”.

While much of the world understandably devotes considerable attention to mitigation efforts and strategies, even in the most optimistic scenarios and projections the planet is hurtling toward and beyond the thresholds that define “dangerous climate change”.

What then is to be done when the global average temperature is increasingly likely to eclipse the 1.5°C of global warming that scientists have concluded will set off various irreversible climatic phenomena that will affect the next generations?

How does South Africa prepare for a future where surface water resources are ever more scarce, with increasingly frequent multiyear droughts, extended heatwaves and unpredictable rainfall patterns? How do coastal regions prepare for the increased coastal storms and inevitable sea-level rise that threaten coastal and low-lying communities? How does South Africa prepare for a future where staple crops and the livestock industry are threatened by soaring temperatures, opening the door to starvation and civil unrest?

In a word: adaptation.

Professor Coleen Vogel, a climatologist and adaptation and sustainability specialist at the Global Change Institute at the University of the Witwatersrand, told *Daily Maverick* that adaptation is “what people are trying to do to enable society and the environment to better respond when a major climate risk occurs”.

South Africa's most recent draft Climate Change Bill defines adaptive capacity as the “ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage

of opportunities, or to respond to consequences”.

Vogel explained that the essence of an adaptation strategy is to increase this adaptive capacity. “We've got to try to build that capacity as soon as possible.”

We have to understand that South Africa's adaptation plans operate on a number of different scales, from the international and institutional to the local and individual. “Adaptation is very context-relevant,” she said. For example, tsunamis and other ocean-borne threats are not expected in Johannesburg.

“So each plan is adapted to its people and to its environment. The thing that we can say about South Africa is that we need to really be clipping our development strategy much, much more closely to our adaptation strategy.”

Vogel explained: “If we're building new houses we should be building with an eye to the future in terms of climate change. If we are designing new settlements, we should be designing those with an eye to climate change, not develop them in riverbank areas or in wetland areas.”

“So I think we've done quite well as a South African community. In fact, internationally our adaptation work is exemplary... we have some of the best adaptation planning, and I emphasise the word ‘planning’. So we've got a lot of ideas, but putting them into practice is another story.”

South Africa's National Climate Change Adaptation Strategy (NCCAS) is one such plan. It is an attempt to provide a “common vision” for climate change adaptation and climate resilience and outlines priority areas for achieving this. It is intended to be the “cornerstone” of climate change adaptation in the country, reflecting a “unified, coherent, cross-sectoral, economy-wide approach to climate change adaptation”.

It defines adaptation as “the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.” It is important to note that, because the NCCAS is a national strategy it does not prescribe in detail how adaptation will or should take place in the many sectors affected by climate change.

While the country's National Climate Change Response Policy (NCCRP) lists water, agriculture, health, human settlements (rural, urban, coastal), biodiversity and ecosystems and disaster risk reduction as priority adaptation-related sectors, the NCCAS goes even further and adds transportation and infrastructure, energy, mining, oceans and coast.

The NCCAS has four strategic objectives:

1. Build climate resilience and adaptive capacity to respond to climate change risk and vulnerability;
2. Promote integration of the climate change adaptation response with development objectives, policy, planning and implementation;
3. Improve understanding of climate change impacts and the capacity to respond to them; and
4. Ensure resources and systems are in place to enable implementation of climate change responses.

It also has nine strategic interventions:

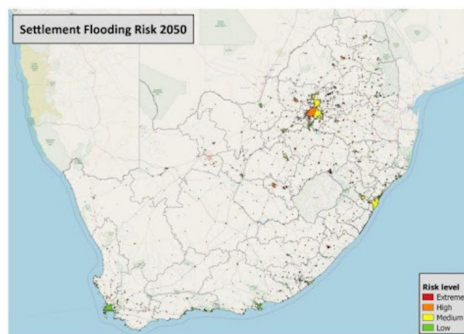
1. Reduce human, economic, environmental, physical and ecological infrastructure vulnerability and build adaptive capacity;
2. Develop a coordinated Climate Services system that provides climate products and services for key climate-vulnerable sectors and geographic areas;
3. Develop a vulnerability and resil-

ience methodology framework that integrates biophysical and socioeconomic aspects of vulnerability and resilience;

4. Facilitate mainstreaming of adaptation responses into sectoral planning and implementation;
5. Promote research application, technology development, transfer and adoption to support planning and implementation;
6. Build the necessary capacity and awareness for climate change responses;
7. Establish effective governance and legislative processes to integrate climate change with development planning;
8. Enable substantial flows of climate change adaptation finance from various sources; and
9. Develop and implement a monitoring and evaluation system that tracks the implementation of adaptation actions and their effectiveness.

Minister of Environment, Forestry and Fisheries Barbara Creecy explained in 2020 that “this strategy defines the country’s vulnerabilities, plans to reduce those vulnerabilities and leverage opportunities, outlines the required resources for such action, while demonstrating progress on climate change adaptation”.

“Adaptation to climate change presents South Africa with an opportunity



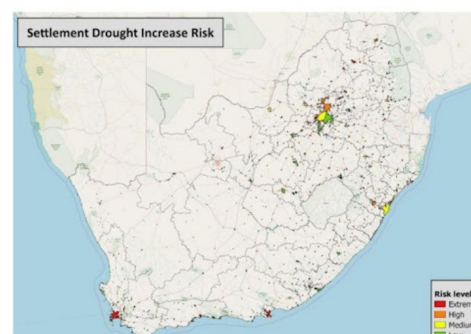
The settlements at risk of projected increases in floods using a risk matrix (low, medium, high or extreme) that considered a calculated flood hazard index and the projected change in extreme rainfall days for 2050 (Maitre, Kotzee, Le Roux and Ludick, 2019 in CSIR, 2019).

Figure 1. Screenshot from the National Climate Change Adaptation Strategy

to transform the health of the economy and build resilience, thus strengthening the social and spatial fabric, and enables the country to remain globally competitive.”

A report by the World Bank on *Africa's Pulse: Climate Change Adaptation in Sub-Saharan Africa Can Improve Resilience and Deliver Jobs* states that “urban policies that are climate-sensitive can help local governments leverage their limited public finance with private sector investment while addressing problems such as pollution, floods, extreme heat and energy access”.

“For instance, energy-efficient retrofits of buildings, low-carbon municipal waste and water, and green urban trans-



The settlements at risk of projected drought tendencies using a risk matrix (low, medium, high or extreme) that considered the different values within a drought index and whether they indicate an increase or decrease in drought tendencies (Beraki, Le Roux and Ludick, 2019 in CSIR, 2019).

Figure 2. Screenshot from the National Climate Change Adaptation Strategy

port can deliver benefits to cities in the short and medium term.”

The report notes that “South Africa will need \$215-billion in investment in its cities which would “deliver benefits” in South Africa of \$700-billion, or just more than R10-trillion, and result in an average of 120,000 net new jobs in the country by 2050.

“Africa has been hit hard by climate change and there is a need for massive investment in adaptation – for instance, decarbonisation of the grid with renewable energy, nature-based urban infrastructure, scale-up of climate-smart agriculture and modernisation of food systems, among others.”



A newly proclaimed private nature reserve in Zululand has secured the potential to restore an ancient wildlife corridor, while also protecting critical habitats and building resilience to climate change

Wildlife corridor South Africa - Press release

There is no shortage of privately owned game reserves in South Africa but what makes the Greater Ukuwela Nature Reserve different from most, is that its main purpose is not tourism, but to save habitat for wildlife conservation. The Reserve is the outcome of an agreement between Wild Tomorrow Fund, an NPO that owns 85% of the reserve, and several private landowners to work together to protect the region's exceptional biodiversity. Spanning 1283.1 ha, the reserve directly borders iSimangaliso Wetland Park World Heritage Site to the east. Its northern neighbour, the Mun-ya-wana Conservancy, in which & Beyond's Phinda Private Game Reserve is located, lies across the Msineni River that edges sections of Ukuwela and flows into the False Bay section of iSimangaliso. Being thus positioned, Ukuwela, which in isiZulu means 'to cross over', is well placed to substantially reduce habitat fragmentation through linking existing wildernesses and restoring a wildlife corridor, which could contribute significantly to securing the survival of endangered species.

The ecological value of the new reserve is enhanced by its location within the Maputaland Centre of Endemism, which is part of the Maputaland-Pondoland-Albany Biodiversity Hotspot, one of 36 hotspots covering just 2.4% of the earth's land surface - arguably the most important 2.4% of places on Earth to protect. According to Conservation

International, to qualify as a biodiversity hotspot, a region must have a high percentage of plant life found nowhere else on the planet and, at the same time, its continuing existence must be threatened. The Maputaland-Pondoland-Albany Hotspot, which is the second richest floristic region in southern Africa with an estimated 8,100 species, at least 23% of which are endemic, is the most densely populated region in SA, characterised by high levels of poverty, severe land degradation and transformation, and uncontrolled development. Yet it retains corridors of pristine habitat that must be protected at all costs if rare and endemic species are to survive.

Given its full protected status, Ukuwela Nature Reserve is set to play a pivotal role in guarding pristine habitats as well as rehabilitating degraded areas. Containing three habitats – Dry Sand Forest (endangered), Subtropical Freshwater Wetland (vulnerable), and Western Maputaland Clay Bushveld (also vulnerable) the reserve supports over 1000 species, nearly 50 of which are threatened with extinction. These include African Wild Dog, Leopard, Suni, the critically endangered White-backed Vulture, Southern Banded Snake Eagle – also critically endangered, and the vulnerable Eastern Hinged-back tortoise. The 235 tree species identified to date include the threatened, near-endemic *Carissa tetramera* (Sand forest Num-num), and the magnificent giant of the Sand Forest, *Newtonia hildebrandtii* commonly

known as the Lebombo Wattle, a protected species that's in decline. More than 160 wild flower species have been identified, among them the critically rare *Sansevieria metallica* and the endemic, near threatened *Crinum acaule*.

Ukuwela's ecological importance is further amplified when considered in the context of the global figures for the International Union for the Conservation of Nature's (IUCN) 2121-22 Red List of Threatened Species, that was presented at the Union's World Conservation Congress in Marseille in September 2021. Of the 138,374 species assessed 38,543 (or about 29%) are threatened.

These figures are only for species that have been assessed for the IUCN Red List to date, which means that not all species on Earth have been evaluated. Nevertheless, the list provides useful and sobering insight into what is happening and highlights the urgent need for rigorous action to conserve biodiversity.

Such action is what defines Wild Tomorrow Fund. Founded in 2015, the NPO is registered as a charity both in the United States, where the major donor base is established, and South Africa, where a dedicated team is responsible for the day-to-day rewilding and ecological management of the reserve. The organisation's initial goal was to support under-resourced reserves in northern KwaZulu-Natal, supplying park manag-

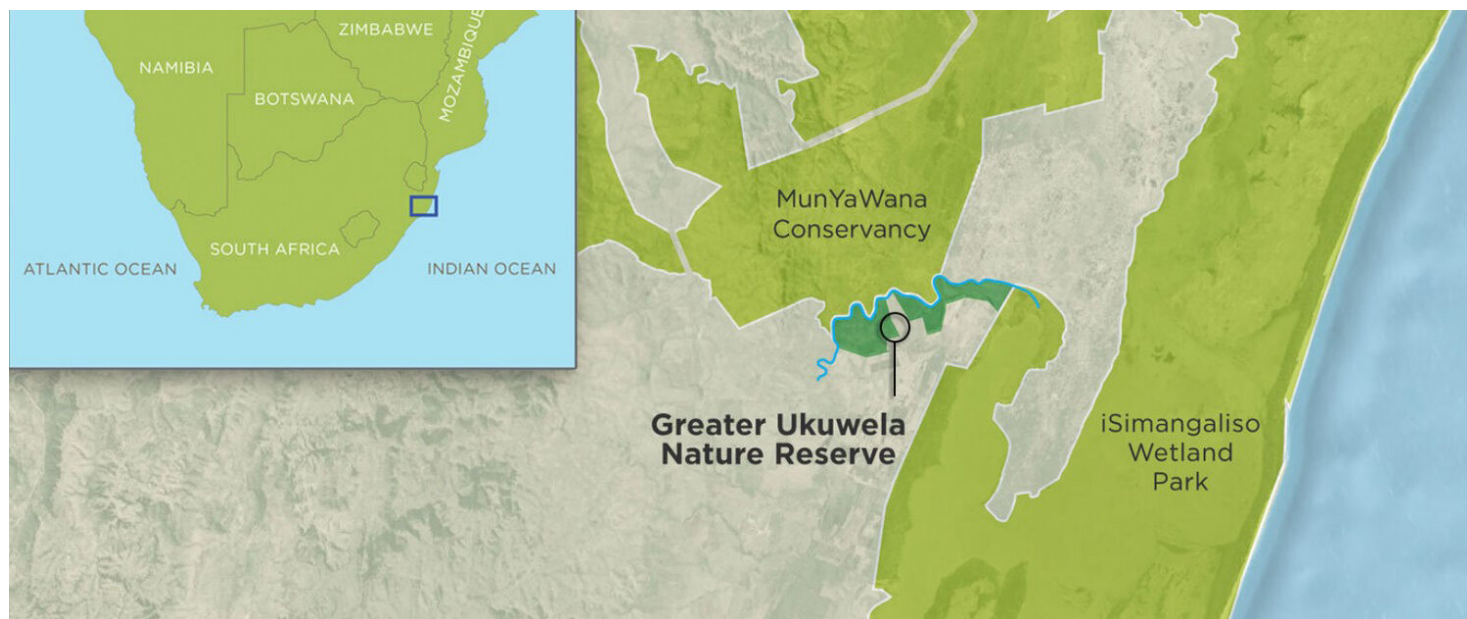


Figure 1. Situated within the Maputaland Centre of Endemism, the Greater Ukuwela Nature Reserve is strategically positioned between two major protected areas thus creating a unique opportunity to expand wilderness, protect ecological integrity, support surrounding communities, and play a meaningful role in ensuring the survival of endangered species in southern Africa.

ers and staff with essential equipment needed to keep wildlife safe. Subsequently, when the charity acquired two ecologically sensitive properties, parts of which were at risk of agricultural encroachment, the vision broadened to include habitat protection. Says Wild Tomorrow Fund co-founder and Executive Director, John Steward, who is based in New York, "We believe that the solution to the wildlife extinction crisis lies in protecting wild spaces in areas rich with biodiversity. According to eminent biologist EO Wilson, who started the half Earth project and from whom we take great inspiration, saving 80% of species on Earth requires us to protect half of the Earth's land and sea to ensure species have the space they need to thrive. Since 2017, Wild Tomorrow Fund has acted on this urgent call in KwaZulu-Natal South Africa".

Recognising too that local communities must have a stake in protected areas, Wild Tomorrow Fund works hand-in-hand with its neighbours through, for example, upskilling and employing residents, supporting schools, empowering women (14 so far) through a mutually beneficial livelihoods training project called the Green Mambas and, during Covid lockdowns, providing emergency food parcels. In their dual commitment to their neighbours and to conserving habitats, the organisation's work is consistent with one of the major goals of COP26: Adapt to protect communities and natural habitats from the impacts of climate change.

"Climate change is deeply inequitable," says Wild Tomorrow Fund's co-founder and COO Wendy Hapgood. "It

impacts the most vulnerable people on our planet who contributed least to historical emissions, particularly the most innocent of victims: children. Globally, approximately 1 billion children – nearly half of the world's children – live in places at extremely high risk from the impacts of climate change. By saving and restoring ecosystems, our habitat protection program is a nature-based solution that mitigates the impacts of climate change while helping women, children and wildlife adapt to escalating environmental hazards."

While tourism sustains most private wildlife reserves, the Greater Ukuwela Reserve offers only minimal tourism opportunities and is dependent instead on the generosity of donors, many of whom may never set foot on the far-flung reserve they support.

But these are people who are concerned with the greater good and who understand that environmental degradation in one part of the world – for example, rampant clearing of the Amazon rainforest – affects us all. Accord-

ing to the South African National Biodiversity Institute (SANBI), South Africa is ranked the third most biologically diverse country on Earth and is one of 17 megadiverse countries which collectively contain the majority of the world's biodiversity. Much is at stake globally if we don't protect that exceptional biodiversity.

As Wendy Hapgood says, "We believe it's the international community's responsibility to help protect African wildlife. Most of us grew up reading stories about elephants and lions, rhinos and hyenas, and watching the Lion King. A future when these animals no longer exist in the wild is unthinkable. We have a moral calling to help save our planet's threatened wildlife and wild places."

More Information

Available at www.wildtomorrowfund.org

Video

"How we save wildlife"
www.youtube.com/watch?v=jOLPQnJ2d7A



Mozambique's ISIS insurgency threatens to destroy conservation progress and fragile environmental protections in Niassa Special Reserve

Angus Begg

Current Address: Daily Maverick
Reprinted from: <https://bit.ly/3I1W4aV>

The Islamic State (IS) insurgency in northern Mozambique has taken a new, sinister turn, moving inland and westward into the Niassa Special Reserve, since the first attack on November 25 destroying four towns and displacing over 2,000 people en route, according to the UN-aligned International Office for Migration (IOM). This figure, from Tuesday 14 December, focused on just one of four affected districts, doubled from the day before.

In this wilderness space of 42,000 square

kilometres, larger than all of South Africa's protected areas combined, and co-managed by Mozambique's National Administration for Conservation Areas (Anac) and the Wildlife Conservation Society (WCS), another humanitarian crisis beckons, with a potential environmental catastrophe lurking around the corner.

The conflict is linked to the insurgency in neighbouring Cabo Delgado, which, although it began in 2017, exploded when the once sleepy fishing village

of Palma was attacked by Islamic fundamentalists, primarily because French company Total was developing a \$20 bn (£14.6 bn) gas liquefaction plant for the second largest gas reserve in Africa just off Palma, and there was wealth to be had.

Palma had become a thriving hub for Mozambique's burgeoning gas industry, attracting a building boom of hotels, banks and construction yards. There was significant foreign investment in town and more than 1,000 foreign



Figure 1. Typical Niassa special Reserve landscape around the Lugenda river. (Photo: Colleen Begg)



Figure 2. The Niassa Carnivore Project (NCP), anti-poaching patrols and rangers in the 98 people they employ. Colleen Begg says the ramifications of the insurgency are huge, for both the civilian population and wildlife. (Photo: Colleen Begg)



Figure 3. Tourist establishments, like this lodge on the Lugenda River, have closed up shop, meaning a loss of kitchen, housekeeping, maintenance and guiding jobs – and no protection for the wildlife. (Photo: Angus Begg)

workers linked to the gas industry.

The eyes of all concerned by the mere mention of ISIS were drawn to northern Mozambique, and almost half a year after the Palma attack and public beheadings SADC and Rwandan troops were sent to help the Mozambican military. It is thought that this combined pressure has forced the insurgents to move east into Niassa.

Experienced southern African commentators will remember the tragic tale of Gorongosa National Park's demise, be-

fore its current revival. Once frequented by Western film legend John Wayne and his Hollywood acting set, the Park, its people and wildlife soon fell victim to over two decades of civil war, a period in which the Park became a central Mozambique butchery.

The co-director of the Niassa Carnivore Project, Colleen Begg (no relation to the writer), who, with her husband Keith has spent 19 years in Niassa, working in partnership with government and communities "to secure the safety of large carnivores", says the same fate

threatens the reserve.

The Project occupies a significant, established position in the NSR's conservation and community space. The Project's 2020 Annual Report reveals that it employs 101 staff (98 are Mozambican), 44 community guardians and 160 seasonal staff, some of whom are engaged in distance education in finance and environmental management.

According to German news service *Deutsche Welle*, via a Mozambican news portal, Mozambican police chief Bernardino Rafael claimed on 14 December that a 'terrorist' leader — "a Muslim from Mecula" — was recently killed by members of the country's Defence and Security Forces (FDS).

Worst case scenario

Local Niassa residents will fear the consequences of the insurgents being allowed to penetrate deep into Niassa's thick bush just before the region's big rains. Between late December and April, it will be impossible for any conventional government forces to follow them. The fear of anyone concerned about Mozambique's people and wildlife is that the terrorists will dig in, raid, poach, attack and burn.

The Carnivore Project co-director says the incentives for conservation will be gone.

"People will look to the bush for meat as they always have, and it will provide, but the conservation losses will then mirror the devastation of the communities, and will create a cycle that will be difficult to recover from." Gorongosa's recent history, far to the south, is living testament to exactly that experience.

Niassa offers a landscape in many ways as unique and compelling as Namibia, yet it has only recently shown signs of recovering from intense poaching. Colleen, speaking from visiting family in South Africa while Keith works with ANAC and WCS in assisting with humanitarian efforts, says Niassa was just getting over the worst of the challenges.

The implications of the Niassa insurgency

She speaks of what she calls the "hidden costs" to the developing insurgency inside Niassa Special Reserve.

"We nearly lost the elephants", says the former Johannesburg schoolgirl, referring to 18,000 lost to poaching before stability was reached, "how much more is at stake?"

"85% of our team are from the Mecula



Figure 4. The NCP has helped develop alternative income streams for villagers in the Niassa Special Reserve, bee-keeping and the production of honey among them. (Photo: Colleen Begg)



Figure 5. Villagers leaving Erevuka, the first village attacked, carrying what they can. Image taken and sent by an NCP Community Wildlife Guardian. Four of their 47 community wildlife guardians have lost their homes in this latest fighting. (Photo: Colleen Begg)

District. They have nowhere else to go, This is their home, their livelihood and their future."

After the first attack of this Niassa insurgency, Colleen says she was warned by an elder, born in Niassa Reserve and a survivor of the two previous (liberation

and civil) wars, Mzee Mustafa, to take the insurgency "very seriously...this is not a game, and we need to be very vigilant and work together to protect our families otherwise we will lose everything".

In this compelling rural area of in-

selbergs, iconic miombo woodland in Niassa province — with all the wildlife within — and occasional meandering rivers, Mozambicans have lost everything before, and work is scarce. What jobs there are, are found in tourism and conservation, with at least 500 permanent staff employed through various conservation organisations, and hundreds of seasonal staff.

When this writer visited Niassa over ten years ago, tourism was a tree-trunk largely occupied by sport hunting, with ecotourism an emerging branch overhanging the reserve's winding and iconic Lugenda river. The hunted wildlife was skittish.

With increasing ecotourism operations taking root in Niassa over the past decade, however, game-viewing became easier and more rewarding, more visitors arrived, and more people had work.

Like a relentless attack by an elephant, that tree has suffered relentless annual body-blows in the past two years, with Covid resulting in almost no visitors in 2020 according to Colleen, and only 40-60% recovery in 2021.

"Tourism will not recover easily as memories are long and.....we all know that insecurity and conservation are not comfortable bedfellows."

Banks, evacuations and gunfire

Banks are also averse to insecurity. While they put up with the relative threat to security posed by Eskom's load shedding in South Africa, they will draw the lines at gunfire and killings as witnessed in Cabo Delgado in the past week.

Colleen says one bank in the district capital, Mecula, has closed, leaving them unable to pay their salaries.

"No one has access to their money and salaries. The next nearest bank is 140 km away. Cash is risky now." So, apparently is getting sick. Or shot.

"50% of health technicians have left (the Mecula area). Several clinics have been left without a medic. The ambulance can't help, and little other transport is available for emergencies. Medicines can't come in, and people can't get out to hospital."

Most of the people in Niassa are fishermen or subsistence farmers. This is the season for preparing fields and planting crops ahead of the rains, crops which provide the food needed to get through the long dry season.

"If this is not resolved soon there will be food shortages and hunger".



Figure 6. Niassa is a 'special' reserve in that villages live within the park. The Niassa Carnivore Project (NCP) has been operating the park for 19 years, together with ANAC making inroads in carnivore conservation through environmental education, job creation and tertiary education opportunities. Colleen and Keith Begg are concerned about what happens to the people that have become their family, and the wildlife they are trying to protect. (Photo: Colleen Begg)

Government and international response

The IOM has been releasing clear and detailed information daily on the numbers of people fleeing villages, including the genders and ages of those fleeing which village and the provisions needed to assist in their relocation.

President Felipe Nyusi in a speech at a military graduation ceremony in Nam-pula on Monday said "the enemy is scattering, they're running away..." because the Mozambique military and their allies from Rwanda and SADC had "imposed heavy losses on the terrorists in Cabo Delgado."

Some tourism and conservation opera-



Figure 7. The Niassa Carnivore Project (NCP) runs an annual education camp at Mariri Environmental Centre in the reserve, where 100 children and teachers spend four nights "learning, playing, climbing" says Colleen Begg. (Photo: Colleen Begg)

tors who have left the area say they have no confidence in the military's ability to act. Colleen says she is waiting for an official government response.

Hope for conservation

Beyond the humanitarian crisis playing out now, uppermost in the minds of those focused on Mozambique's rare biodiversity status will be another kind of hope. Hope that the country's recent environmental focus — including President Nyusi attending the collaring of a Niassa elephant named 'Mr President', after him, as part of an elephant monitoring operation near a village in the reserve — will act as some sort of stimulus for the country to act quickly.

Beyond the conservation kudos that 'Mr President' attaches to Felipe Nyusi, ANAC has been busy, in partnership with both African Parks and the South Africa-based Peace Parks Foundation, consolidating environmental gains in many of the country's parks. In the past three months alone ANAC and its partners were involved in relocating elephants to parks in Zambezia province and reintroducing cheetah to the Maputo Special Reserve in southern Mozambique, where they haven't been seen since the 1960s.

So conservation and tourism, albeit Mozambique-slowly and in between cyclones, are both in a rebuilding phase.

The Niassa Carnivore Project's 2020 An-

nual Report revealed 27 lion, seven hyena, seven leopard and five wild dogs poached in Niassa Special Reserve. On the same page, it revealed a commitment to "hiring and training Niassa residents for our staff, providing advanced schooling through scholarships, and mentoring young Mozambican conservationists".

It's a well-worn and proven path, working with communities to ensure sustainable conservation of species.

Colleen says 100 children and their teachers from schools across the Reserve come each year to visit the Mariri Environmental and Skills Training Centre, which the Project opened in 2015.

"They play conservation games, climb mountains, go on game drives, debate conservation issues, clean up fishing camps and learn about alternative livelihoods like gardening, livestock breeding and beekeeping. They laugh, learn, see and experience the best of Niassa."

A happy, idyllic vision shrouded in the dark cloud of Islamic State (IS) insurgents.

"We need to put a face and details to this", says the former Parktown Girls High pupil. "Remember our humanity, over and above the fear and the horrific loss of a life, there are many daily struggles as the fragile social and economic infrastructure collapses."

Range of variation in wetland vegetation on a subcontinental scale in Southern Africa

Erwin Sieben

Current Address: University of KwaZulu-Natal, Vegsciblog.org
Reprinted from: <https://bit.ly/3CGeNlk>

During the 2000s, it was clear that the South African Government started to place more value on aquatic ecosystems as they understood that South Africa is a water-scarce country. Various decision-making tools were developed to evaluate wetland ecosystems and the services they deliver. These were 'quick' assessments based on a single field visit that helped managers to make decisions about wetland restoration measures, prioritization of how important a wetland was within the wider catchment and what the causes of degradation in a wetland were. Most of these types of decision-making tools were designed to use very little data as there was very little information on biodiversity in wetlands on a national level. As a group of wetland scientists, we started worrying that for many politicians and decision-makers, these tools would be the final story. We thought that while these decision-making tools were being used to protect and restore wetlands, at the same time, we should also develop a database that would go into greater detail to provide actual data on wetlands and wetland vegetation so that better decisions for reference conditions and environmental monitoring could be developed in the future. It all started at a workshop organized in August 2009. Here we looked at what vegetation data already existed across the country and how we should bring it all together, based on what was considered the minimum data requirements.

Two exemplary studies that were carried out at that time were Fynn Corry's work on the use of vascular plants as bio-indicators on the Cape coastal forelands and Nacelle Collins' work on the wetlands of the Free State Province, where he also sampled soils in great detail. Both studies involved the sampling of soils in the same place where vegetation samples were collected from, and

they collected soils for every single plot (in the case of the Free State plots, even for every diagnostic horizon within the soil profile).

We settled on a set of minimum data requirements and started to get to work on compiling a database on South African wetland vegetation, based on historical studies. Wetland plots had been sampled in the past, but in South Africa, the focus had always been on terrestrial vegetation with a few wetland plots in each study included as 'azonal vegetation'. Only a few areas where wetlands were very abundant or where there were very large wetlands of special significance, had studies that focused in their entirety on wetland vegetation, such as on the coastal flats of Northern KwaZulu-Natal, near Lake St. Lucia. In those studies, special focus was directed to-

wards the measurements of soil factors that were important to understand the context and the ecology of the wetland in itself. Most importantly, the hydrop-eriod, which is the time period that an area is saturated with water, could be assessed by looking at soil hydromorphic features (which worked in most cases but proved tricky in some situations, for example, on coastal sands). For this reason, a soil auger was used to dig a hole up to 1 m deep in most wetlands. It became clear that the studies done by Fynn Corry and Nacelle Collins, who extended these methods over much larger regions, were really the first of their kind, but we wanted to do this type of work to cover the entire country, so a proposal was submitted to the Water Research Commission for funding to do that work.



Figure 1. Sampling a wetland near Port St. Johns along the Eastern Cape coastline, South Africa (Photo credit: Erwin Sieben)



Figure 2. Sampling a wetland near Chrissiesmeer on the Mpumalanga Highveld, South Africa (Photo credit: Erwin Sieben)

When the funding became available, it led to a few of the busiest field seasons that we have experienced during our careers, and every free week that we could find was spent on touring the country, visiting wetlands, and taking vegetation samples. In the summer of 2010/2011, Erwin Sieben left the Free State, where he was working at the time, to travel the Western Cape before the December holidays, meeting with several fellow wetland ecologists, travelled up the coast towards the East, took a short holiday somewhere along the coast for the Christmas holidays, and then went on to Durban in early January to pick up a student with whom he would then sample the wetlands of the Wild Coast, just south of Durban. These and many other memorable field trips led to a large number of plant collections that required identification and soil samples that needed to be dried and sent out for analysis in the laboratory of the Agricultural Research Council in Pretoria. By now, we sampled only a single soil plot per wetland, unlike previous studies where soil samples were taken in every vegetation plot of the wetland.

The previously mentioned Wild Coast area in the Eastern Cape formed one of the most interesting and most inac-

cessible areas to visit, and there were certainly some botanical treasures to be found there. Generally, the wetlands that were found in nutrient-poor substrates such as those on quartzites or in peat on coastal sands proved to be the richest in species and among the most interesting wetlands in terms of species composition. Another area that was very rich in species was the Maloti-Drakensberg area, but this had already been extensively visited during the surveys that were done for the Maloti-Drakensberg Transfrontier Park in 2006, and the standard sampling protocol developed in 2009 was not yet applied there.

For this reason, the study that is now published in the *Journal of Vegetation Science* would not have been possible without the contribution of vegetation plots in Lesotho, which represents the upper reaches of the biggest rivers in South Africa, but is politically an independent nation. So when Peter Chantanga eventually joined Erwin's research team in 2017 to survey wetlands in Lesotho, we could finally sample vegetation plots in the mountainous regions with the standard sampling protocol and including soil samples. The plots in Lesotho made the environmental gradient from low to high altitude wetlands

complete, and therefore the inclusion of plots from this country made for a narrative that makes ecological sense. Ecologically speaking, South Africa, Lesotho, and Eswatini (formerly Swaziland) should be regarded as one region, as they share river catchments, geological units, and climatic zones, and it is clear that political borders are quite arbitrary when it comes to understanding the large-scale ecology of a region. Eswatini has not been included in this study, but that is not a serious problem as similar altitudes and climatic zones have been sampled extensively in neighbouring South Africa, whereas Lesotho represents a unique climatic zone.

This **Behind the paper post** refers to the article *Components of plant species diversity along environmental gradients at various spatial scales in wetland environments of southern Africa* by Erwin Sieben et al. (2021), published in the *Journal of Vegetation Science* (<https://doi.org/10.1111/jvs.13097>).

South Africa's endangered wetlands need protecting

Onke Ngcuka

Current Address: Daily Maverick
Reprinted from: <https://bit.ly/37s8E6T>

Existing wetlands make up about 2.4% of South Africa's surface area, but only 11% of them are protected. In a water-scarce country, protecting wetlands is key to ensuring better water quality.

Despite the small area covered by wetlands, they contribute R4.2-billion per year to South Africa's economy. They are key points for development, tourism, recreation, supporting biodiversity, livelihoods and marine fisheries.

The Berg Estuary, which was declared a Ramsar site on World Wetlands Day, contributes about 60% of the estuary habitat on the West Coast and plays a

pivotal role in biodiversity and cultural and economic activities. It is the second wetland in South Africa to be declared a site of national importance in two years; the Ingula Nature Reserve in the northern Drakensberg was the last declared Ramsar site in 2021.

"The declaration of South Africa's 28th Ramsar site is an indication of the importance of conserving and protecting these unique environments that are considered super ecosystems because of their contribution to the provision of water and because they provide habitats to a large variety of migratory birds, especially water birds," said Minister of Environment,

Forestry and Fisheries Barbara Creecy.

The 2019 National Biodiversity Assessment concluded that wetlands have the highest proportion of threatened ecosystem types as well as the least-protected ecosystems. Wetlands play an important role in water conservation since the poor flow of water through the ecological systems makes expensive water treatment necessary.

According to the Department of Environment, Forestry and Fisheries, wetlands play a role in supplying water that sustains 60% of the country's population, more than 90% of urban water users, 67% of national economic activity



Figure 1. Pelicans take off at dawn from the Rietvlei Wetland Reserve in Cape Town on 5 January 2007. (Photo: EPA/Nic Bothma)

and 70% of irrigated agriculture.

Known for being marsh pits of still water – between aquatic and terrestrial systems supporting vegetation adapted for saturated soils – wetlands function as water-purifying bodies. They play a role in slowing down floodwaters, are natural filters and provide food and shelter for nearby animals.

Wetland ecosystems are threatened mainly by invasive alien species, erosion, developments in and around them, pollution and excessive nutrients, slash-and-burn agriculture and mining.

Conserving them is of great importance as the world is losing them three times faster than forests, with nearly 90% of them having degraded since the 1700s, according to Ramsar.

South Africa's wetlands include the Blesbokspruit wetlands, with some in the Ntsikeni Nature Reserve, Natal Drakensberg Park, Prince Edward Islands, St Lucia, Bot-Kleinmond Estuarine and Verlorenvlei.

Verlorenvlei is among the most important wetlands and the largest on the West Coast, at 13.5 km long and 1.4 km wide. The system has been reported to be drying up, with the surface water in the vlei being saline and unusable. The vlei houses more than 4,000 birds and is

a space of significance for conservation of the birds and other biodiversity.

Last year, in an effort to improve Cape Town's water bodies, the City of Cape Town restored an old wetland, the Zandvlei estuary. The improvement of the Muizenberg vlei aimed to revive the wetland habitat, though residents had concerns about the vlei being polluted, as another in the area had been.

One of the country's biggest wetlands, iSimangaliso Wetland Park, which was listed as South Africa's first World Heritage Site in 1999, will be on the receiving end of space-based sensors for wetland monitoring.

The three-year project, funded by the Water Research Commission and led by the Council for Scientific and Industrial Research, will focus on the Maputaland Coastal Plain. Wetlands make up a quarter of the coastal plain, an area rich in wetland biodiversity, swamp forests, mangroves and floodplain forests, grass and sedge wetlands.

The plain is in northern KwaZulu-Natal, running along 8,000km² of the eastern coastline. The focus will be on monitoring changes in wetlands that are often hidden beneath forest canopies and other vegetation, or exist as temporary pans following rains.

The Water Research Commission's research manager overseeing the project, Bonani Madikizela, said: "Many of the wetlands of the Maputaland Coastal Plain are under severe stress, yet they are so important to the marginalised sectors of our communities that rely on them for food and other ecosystem services."

Dr Heide van Deventer, who is leading the project, said remote sensing could be valuable for monitoring the coastal plain's wetlands as these can be difficult to access due to muddy conditions and potential encounters with hippos, crocodiles, buffaloes and elephants.

"Areas in need of rehabilitation could be more easily identified and prioritised [through the programme]. If successful, the intention is to incorporate this capability into the National Wetland Monitoring Programme."

Despite wetlands taking up less than 3% of South Africa's land, the benefits they provide are proportionately high as they provide water purification, nutrient cycling, carbon storage, storm protection, recreation and harvesting of food directly from nature. Protecting them could be of utmost importance for not only biodiversity, but also for the country's water quality and resources, and society at large.



Figure 2. General view during the World Wetlands Day at Bayhead Natural Heritage Site on February 2, 2020, in Durban, South Africa. (Photo by Gallo Images/Darren Stewart)

Wildest dreams: Meet the Karoo farmer who's bringing back the wilderness and resurrecting 'dead' towns

Angus Begg

Current Address: Daily Maverick
Reprinted from: <https://bit.ly/3MLVvKH>

Early records show that, at one stage, colonial hunters shot 25 hippos a day along this Seekoei River. They even used them as bait to catch the San bushmen," says PC Ferreira as he leans against the rail of a small jetty jutting out over the river, on his farm between the Karoo settlements of Richmond and Hanover.

The river runs through his farm, part of its 300 km journey between its source

in the Compassberg outside Nieu-Bethesda in the Eastern Cape, and the Vanderkloof Dam, a Northern Cape Department of Environment and Nature Conservation property.

This Karoo born and bred farmer says the last hippopotamus in the area was shot 230 years ago. But, today, we are looking for one, which speaks to a re-introduction programme, the journey Ferreira has been on to get them back,

and the creation of a vast private nature reserve in the central Karoo.

Gazing out at the reeds, Ferreira says he had five hippos in the 300 km river until not too long ago, but natural causes and fighting among them left only one bull, with no family or potential mate. The jetty is where he says the bull is usually found at this time of day.

The rains have been good and the river

Figure 1. The Seekoei River's only hippo in a characteristic warning display – showing how big his teeth are. PC Ferreira says he is involved in finding and translocating suitable companions. (Photo: Supplied)





Figure 2. Farmer Piet Cronje 'PC' Ferreira, the driver of the Karoo Seekoei River Nature Reserve initiative in the central Karoo, tends to a beehive on his property. He hopes to use hives as a common thread in linking the 13 towns around the proposed reserve. (Photo: Angus Begg)

looks healthy, with white-fronted swallows and darting swifts feasting on invisible insects in flight.

"When he sees me, he is curious and usually comes over."

The tell-tale collection of bubbles next to the reeds on the opposite bank of the river signals the presence of the sole Seekoei River hippo moving quickly beneath the surface, causing me to think of the almost comical television documentary footage of hippos "swim-running" underwater. He pops up about 40 m away.

This hippo, alone in the Great Karoo, has nowhere to run to, nothing to run

for. Hopefully not for much longer, says Ferreira, who is waiting for news from SANParks about a hippo cow that will be relocated from the Kruger Park to this part of the Seekoei River.

He is also waiting for four white rhinos to be delivered, which is in addition to the small herd of buffalo already on his farm.

South Africa's largest private nature reserve?

It is this narrative, of large mammals' prior existence and relative extinction in the Karoo, that is behind Ferreira's proposal for the declaration of a 450,000 ha Karoo Seekoei River Nature Reserve (KSRNR).

In preparing to restore the river's hippo population, he had the family's farm declared as the Karoo Gariep Nature Reserve 21 years ago. This entailed applying for "hippo permits, obtaining [government] fencing directives and developing a section of the Seekoei River into an approved environment for hippo".

The first hippos were released in December 2006, with "babies sighted" in January 2008, 2013 and 2014.

For his efforts in getting hippos back to the Seekoei River, Ferreira was recognised by former SANParks CEO Dr David Mabunda in 2008 with a Kudu Award in the Community Contribu-

tion to Conservation category.

The award recognised his efforts in increasing "biodiversity in the region, but also increased tourist traffic to the area, which is benefiting the whole community".

It's a point echoed by Johan Jonk, the stewardship biodiversity officer of the Northern Cape Department of Agriculture, Land Reform and Rural Development, who has worked with Ferreira.

"If the initiative were to become a reality, it potentially could contribute in two ways – safeguard biodiversity (an entire river from source to mouth) and further develop the economy in a sustainable way," Jonk says.

In a landscape where faith is often relied on to bring rain, the two men seem to be singing from the same hymn sheet.

Wildlife and livestock

"I believe that the Seekoei River Initiative is important and that every effort [should] be made to make it a reality," says Jonk.

In keeping with his portfolio, he also adopts an economic view, emphasising that the farms that would be involved in the KSRNR are mostly stock farms that cannot be developed any further as stock farms, because grazing capacity has already been reached.



Figure 3. The central Karoo landscape tells a story of beauty and economic hard times. (Photo: Supplied)



Figure 4. The Seekoei river, in the Northern Cape Karoo. The sole surviving hippo. Image supplied



Figure 5. The Seekoei River, in the Northern Cape Karoo, where, historical records show, hippos were abundant in the late 1800s. The sole surviving hippo can be seen just behind the reeds in the middle of the picture. (Photo: Supplied)

“However, Ferreira’s vision would be to add another component, tourism, which is still underdeveloped, further grow[ing] the economy of the area, which has some of the poorest communities in the country.”

Ferreira’s proposal has been finding fa-

vour with not only rural development players, but also with municipalities, academics and conservationists.

His conservation dream has run with the relative speed of a wildfire around his Karoo-Gariep Nature Reserve: buffalo, red hartebeest and eland were donat-



Figure 6. Karoo farmer PC Ferreira on his farm-cum-nature reserve, with the Seekoei River in the background. (Photo: Supplied)



Figure 7. Richmond farmer PC Ferreira hopes to give Karoo residents like farmworker Steyn Bosman an insight into their deep San heritage through the establishment of a heritage centre in one of the 13 towns in the region. (Photo: Supplied)

ed by Northern Cape provincial parks; the 450,000 ha of the KSRNR – still a proposal – was included in the Northern Cape government’s protected area expansion programme; and a research station hosting 12 students was built on his farm in partnership with the Biodiversity and Development Institute (BDI) in 2019.

That same year, the first BDI citizen science seminar was hosted on Ferreira’s farm.

Les Underhill, BDI head and retired University of Cape Town statistics professor, says Ferreira “is amazing”, and that the institute has chosen to partner with him because he has an important vision: “He wants his farm to produce food and he wants to protect its biodiversity at the same time.”

On the ground, roan and sable antelope have been introduced to the reserve, with Ferreira having the Hanover Aardvark Nature Reserve, a second nature reserve, proclaimed on his parents’ nearby farm.



Figure 8. PC Ferreira says his farm is now ‘fully transformed’, home to livestock and wildlife. While tourism has been added as an income stream, he is protecting and restoring the region’s fragile biodiversity. (Photo: Supplied)



Figure 9. A steenbok on Karoo farmer PC Ferreira’s Karoo Gariep Nature Reserve, just off the N1, outside Richmond. (Photo: Supplied)

Big skies, big picture, big plans

Today, Ferreira shares some of that biodiversity by taking guests on “shy five” night drives once his day of farming sheep and cattle is done, revealing porcupine, aardvark, aardwolf, bat-eared fox and black-footed cat. He says it’s a strong tourism product in an area that remains dominated by livestock farming. There is a large flock of blue cranes that roost at his dam every winter and he has been acknowledged by the Endangered Wildlife Trust Crane Conservation Group as a crane custodian for his conservation efforts.

But he says it’s the “big picture”, the potential inherent in such a large nature reserve, that drives him.

Breaking down the numbers over a map

of central South Africa, the proposed KSRNR lies between the Eastern Cape towns of Nieu-Bethesda and Petrusville, following the flow of the Seekoei River to just east of Hanover and west of Colesberg in the Northern Cape.

It is a large tract of natural veld that would stretch about 250 km from south to north and about 100 km from west to east at the widest point, comprising 57 properties.

Ferreira says that among those already signed up to the project are “a core group of conservation-minded landowners” who “came together because they would like to see the area transformed into the once-pristine wilderness area Colonel Robert J Gordon witnessed in his well-documented travels of the late 1700s”.

Gordon was “a botanist, zoologist, ethnographer, linguist, geologist, cartographer and draughtsman”. In his 20 years at the Cape, he recorded “an enormous quantity of material, both visual and verbal, concerning the topography, fauna, flora, meteorology, geology and inhabitants of South Africa”.

It’s all about the numbers

Regardless of the Karoo’s harsh beauty and its contribution to the country’s biodiversity, it’s a hard place to farm, and Ferreira knows farmers won’t buy into his project unless it makes financial sense.

Ellané van Wyk of Wilderness Foundation Africa, says farmers in the area have been struggling for the past few years because of the severe drought.

At the same time – as the foundation’s environmental tax services and training, innovative finance lead – she says she feels that although it is ambitious, this project “can be done”.

Van Wyk says that combining farming with protected area status “has been done in other places in South Africa where rotational grazing and reduced stocking rates are applied in line with protected area management plans”.

Jonk says there are examples in South Africa where landowners have joined in declaring large areas as protected areas. He gives the examples of the Dinokeng Game Reserve outside Pretoria and the Mountain Zebra-Camdeboo Protected Environment in the Eastern Cape Karoo.

Working with Jonk on the foundation’s Northern Cape Land Project, and to help landowners access tax benefits aimed at stimulating the tourism and conservation economies, Van Wyk says she “did the numbers” of the proposed KSRNR reserve.

The 57 landowners who are connected to it by virtue of their location may also qualify for tax deduction – if they choose to participate, she says.

“Tax efficiency is regarded as one of the most important aspects of financial sustainability. Reducing tax payable by these landowners may enable them to spend more resources on conservation, employment and in improving the lives of communities within and around the proposed protected area.”

This must sound like rain in the desert to Ferreira. The Karoo farmer is all for the improvement of the whole region, saying it could help prevent the death of various Karoo towns.

A drive through a decaying Noupoot, as just one example, provides proof of the need for his vision.

Community and tourism

Ferreira says that, after 28 years, his own transformation from farming only to a sustainable farming, conservation and tourism enterprise is complete, citing the December visitor statistics for their 86-bed establishment: 1,650 people were accommodated from 10 December to 15 January, with most going on a night drive.

“They are attracted by nature. We [his family] cannot leave as we carry a vision and people come for that vision.” As an avid birder, he says he has counted 225 species on his farm-cum-nature reserve.

Ferreira is well aware, however, of the importance of community buy-in to such a project – beyond nature and wildlife – from local (often troubled) municipalities to farmworkers.

To this end, he has engaged with mu-

nicipalities and registered non-profit organisations (NPOs) to support his vision.

Through the Karoo Oasis Route, he says he can incorporate – in partnership with the Northern Cape Tourism Agency – what he refers to as “13 small, dead and bad towns around Hanover” into a tourism route.

Through the Khoisan Karoo Nature and Community NPO, he wishes to start “a central house of safety, a skills-training facility and a heritage hub for the lost San people of the Karoo”.

He says he has had a meeting with social workers in the relevant areas “to identify the cases to bring into the house of safety”.

Being the owner of a successful tourism destination, Ferreira says he is now pursuing an integrated development plan to address what he calls “the tourism killers”, citing plastic-bag litter, street kids begging, no water and electricity as chief culprits.

“To bring tourism in, we need to lift the whole town,” he says.

It’s ambitious stuff

“I’m just a cog in a big wheel,” says the busy Ferreira, mentioning the rhinos he expects to be offloaded at his reserve in the next couple of weeks.

“I will dedicate the next 10 years of my life to these three NPOs. They can change the 13 towns in my area.”

In an agricultural landscape dominated by news of farm attacks, and a national news environment dominated by an imploding and underperforming government, these developments in the large and quiet Karoo make for a happy project.

This story first appeared in our weekly Daily Maverick 168 newspaper which is available for R25 at Pick n Pay, Exclusive Books and airport bookstores. For your nearest stockist, please click [here](#).



Figure 10. The Seekoei River runs through PC Ferreira’s Karoo Gariep Nature Reserve. (Photo: Supplied)

This map may make you feel better about the state of the planet

Here's where nature is, in fact, healing.

Benji Jones

Current Address: Vox
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About 100 miles west of Chicago, Illinois, a tallgrass prairie teems with life. Here in this 3,800-acre piece of land, you can walk among brightly coloured fields of wildflowers, hear the song of cerulean warblers and the hoot of short-eared owls, and, if you're lucky, glimpse rare box turtles.

It wasn't always this way. Over the past two centuries, the Prairie State lost all but about 0.01 percent of its original prairie. This particular region, now known as the Nachusa Grasslands, was covered in part by neat rows of corn and soy, and that left little habitat for monarch butterflies, bison, or any of the thousands of plants and animals that depend on prairie ecosystems.

That started to change in the 1980s, when a crew of volunteers and scientists began reviving the land — planting seeds, carrying out controlled burns, and reintroducing native species. The ecosystem bounced back, and today, the Nachusa Grasslands are home to 180 species of native birds, more than 700 species of plants, and a small herd of bison.

In an age of extinction and climate change, you don't often hear this kind of success story. Yet the Nachusa Grasslands of the world can help people find hope that the Earth isn't doomed.

Last summer, Thomas Crowther, an ecologist at ETH Zurich, launched Restor, a

mapping tool that shows where in the world people are doing this sort of restoring or conserving of ecosystems. Think of it as the "nature is healing" meme from the early pandemic, but serious.

We should be angry about climate change and the destruction of ecosystems, Crowther told Vox. "But without optimism, that outrage goes nowhere," he said. Examples of people restoring land give us all something to root for, and now there's a spot to find a whole bunch of them — tens of thousands, actually.

Restor joins a trove of new environmental initiatives that focus on ecological "wins." Last summer, for example, the International Union for Conservation of Nature (IUCN) — which oversees the official "red list" of threatened species — came up with a new set of standards to measure the recovery of species, like the California condor. Perhaps it's a sign that people want to look beyond what we have to lose, especially when there's so much to gain.

Where nature is really healing

There are more than 76,000 examples of restoration on Restor. In a former cattle ranch in Brazil's Atlantic Forest, for example, a nonprofit planted trees to revive an ecosystem that's now home to more than 170 species of birds. In the Tanzanian savanna, members of local villages have helped restore acacia woodlands, which provide fuelwood and timber, as well as habitat for hyenas, jackals, and other animals. (You can find several other inspiring examples [here](#).) Restor is an open platform, so anyone can upload their own project if it involves conserving land, Crowther said.



Figure 1. The Nachusa Grasslands in northwestern Illinois, about 100 miles west of Chicago. Courtesy of Charles Larry/The Nature Conservancy.



Figure 2. The Nachusa Grasslands boast more than 730 native plant species. Courtesy of Charles Larry/The Nature Conservancy.

“We’ve never known where all the conservation and restoration is happening on our planet,” Crowther said. “It’s the first time we can begin to visualize a global restoration movement.”

Restor aims to map restoration sites worldwide is “excellent,” but it comes with some limitations, said Karen Holl, a restoration expert at the University of California Santa Cruz who sits on Restor’s science advisory council. For one, a lot of information that feeds into the platform comes from global computer models that aren’t always accurate at a local level.

Plus, there’s no verification process to make sure the projects that people enter accurately reflect what’s happening on the ground. “The ambitions are right,” Holl said. “I am concerned about it being misused.”

How to use the map



Figure 3. A satellite view of the Nachusa Grasslands in Illinois. (Photo: Restor)

Crowther built the website largely for organizations and people who are themselves conserving land. But if you just want to poke around to find neat projects, or see what kind of ecosystems are in your backyard, it’s pretty easy to use. It’s also home to an impressive collection of data sets that you can explore (though, once again, keep in mind that they’re not always accurate at a local level). Here’s how:

1. Go to restor.eco/map.
2. Click the pins on the map to learn about different landscapes that people are restoring.
3. Pull up a project and you’ll see all kinds of information, like who’s running it and what’s being done with the land.
4. Under the “global predictions” tab, you’ll see estimates for the amount of tree cover, diversity of wildlife, and carbon stored in the soil of any given area, based on global

computer models. You can also view how the area has changed over time by pulling up super-high-resolution satellite imagery.

5. You can also draw your own area on the map to estimate, say, how many species of animals live in the forest behind your house, or how much carbon is in the soil. If you’ve got an ecosystem that you’re conserving, you can share it publicly.

There’s a more in-depth guide [here](#) if you want to learn more.

Over the next decade, Crowther says Restor will focus on adding more projects to the platform and making it useful to companies that want to give customers a look into their supply chains. He imagines a future in which a customer buying a T-shirt, for example, might be able to pinpoint on Restor’s map where the cotton came from.

The value of measuring what nature has regained

One problem with the onslaught of negative environmental news — extinctions, oil spills, and so on — is that people become numb to it, as Barney Long, senior director of conservation strategies at the nonprofit Re:wild, told Vox last fall.

“I’m a strong believer in flipping this on its head and really starting to talk about the positive stories,” said Long, who’s involved in IUCN’s new tools to measure recovery (but not the Restor map). We want to avoid extinction, he said, “but what do we want to achieve?”

Efforts to restore ecosystems don’t always work, of course, and it’s important to highlight failures and course corrections, Crowther said. His previous research into forest restoration helped inspire enormous tree-planting campaigns, for example, but these efforts often fail to restore forests and can even destroy native ecosystems. Restoration is also not going to stop climate change on its own, experts say.

Scientists have learned a lot from those failures about how to help a landscape heal; it’s important to consider the underlying conditions that fuel destruction in the first place, for example. Restor creates an opportunity to learn from the successes, too.

A renewed focus on achievements could have a big upside beyond just feeling better about the state of the planet. It could help us imagine the world we want to build. “If we start looking up the hill toward recovery,” Long said, “our ambition can almost be endless.”

Large drones make a big splash: Using smaller drones to conduct less disruptive wildlife surveys

Chloe V. Robinson
(Post provided by Kayla Kuhlmann)

Current Address: Methods Blog
Reprinted from: <https://bit.ly/3tUvNqc>

Ecologists have started looking into drones as new tools for wildlife surveys, but how can drone disturbance be minimized in order to produce accurate wildlife counts? In this post, Kayla Kuhlmann describes a drone practice to reduce disruption during acoustic bat surveys as featured in the paper "[Miniaturization eliminates detectable impacts of drones on bat activity](#)", recently published in *Methods in Ecology and Evolution*.

Drones offer an appealing tool for wildlife surveys

Several countries have lifted legal restrictions on drone flight, and now researchers can consider how drones offer advantages over current methods in wildlife surveying. For instance, drones can navigate over inaccessible landscapes quickly and safely compared to surveyors on foot. In some cases, drones could offer a safer, cheaper, and quieter method to collect aerial data that traditionally require manned aircraft, such as helicopters. Also, drones come in many forms (from [rotary quadcopters](#), to [fixed wing "planes"](#), and [boat drones](#)) and can carry a variety of payloads (including cameras, acoustic recorders, GPS devices, and frequency receivers) which make them versatile for wildlife surveys.

Despite the enthusiasm to conduct wildlife counts with drones, some surveyors still hesitate because of the conflicting reactions by wildlife. Although studies focused on monitoring rhinos, bats & birds, and wildlife in general observed little to no obvious behavioral response to UAV flight, others have documented strong behavioral responses (e.g. seabird species, particularly sub-Antarctic seabirds) and physiological stress responses (e.g. bears). Researchers do



Figure 1. Hoary bat (*Lasiurus cinereus*). Credit: Veronica Zamora-Gutierrez.

not want to disturb the wildlife they are studying, especially since doing so can cause animals to abandon the site and change the results of the surveys.

The several types of drones and the differences in their characteristics inspired us to examine how variation in drone size, noise, and frequencies would affect wildlife activity. The goal was to dis-

cover whether different drone models had varying effects on wildlife and to determine which drone characteristics make them most disturbing to our study species.

Detecting bats acoustically with drones

Bats are typically surveyed with special-



Figure 2. A wide variety of commercial drones are available. Three rotary quadcopters were used in this study, two of which are featured here. On the left, the DJI Phantom 4 was the largest and loudest drone used for this study. On the right, the DJI Mavic Mini was the smallest and quietest drone used for this study. Photo credit: Kayla Kuhlmann.

ized acoustic recorders that pick-up ultrasound frequencies. Traditionally, bat biologists detect bats on foot and carry the acoustic recorder by hand. Even though acoustic recorders make bat detection significantly easier, bats are still difficult to survey accurately since they occupy aerial habitats. Essentially, bat species that forage at certain heights above the forest canopy or occupy certain frequencies with their echolocation calls are underrepresented in survey counts because of the limited detection range of acoustic recorders. Since many bat species lack reliable popula-

tion counts, the conservation status of several species is unknown.

Drones would be useful tools to help survey bats, since elevating the acoustic recorder would bring it into the range of detection for bats that are frequently missed. Additionally, some acoustic recorders are small enough to be added as a payload to many drones. Researchers would be more optimistic about conducting bat surveys with drones if not for the large disruption drones may cause bats. Since bats are nocturnal and tend to avoid noisy environments,

they are at risk of being significantly disturbed by drone flight.

Using bats as our study subject, we flew three different drones in bat habitats. We conducted acoustic detection before, during, and after drone flights to measure how bat activity differed between periods of drone disturbance compared to periods of no drone disturbance. Acoustic profiles were conducted on the three drones to define their characteristics. The significant characteristics compared in this study were the drones' dimensions, weight, noise intensity and frequency range. Based on how bat activity responded to flight with each drone, we can see which drone characteristics are most disruptive.

Fewer bat passes are detected during flights with larger drones

Our acoustic profiles demonstrated that drone size and noise intensity are correlated, indicating that the largest drone (in size and dimension) was the loudest and the smallest drone was the quietest. However, when it comes to frequency range, there is no correlation between drone size and frequencies emitted. These profiles were key to deciphering which drone characteristics disturbed bats the most.

The least bat passes were detected when the loudest and largest drone flew, and bat activity was unaffected by the quietest and smallest drone. Indeed, bat activity was directly correlated with the size and noise intensity of the drones. The differing frequencies emitted by the drones did not have any detectable impact on bat activity, as the



Figure 3. The properties of each of the drones used for this study. The largest and loudest drone is on the left, and the smallest and quietest on the right. Noise correlated with drone size, but frequency range did not. Drone images sourced from dji.com, infographic produced by Kayla Kuhlmann.

smallest drone occupied some of the highest frequencies and the medium-sized drone had the lowest frequency range. It was interesting that most of the bats returned after the drone finished flight and powered off, and that different bat species had varying levels of sensitivity to drone flight.

Summary

Some drones have characteristics that are less disturbing to wildlife and are

better suited for wildlife surveys compared to others. For bats, and likely many other animals, smaller and quieter drones minimize the impact of drones on wildlife surveys. Despite this finding, wildlife surveys often require sensors that may be too heavy for miniature drones. With this in mind, we encourage drone users to use the smallest and quietest drone possible within the constraints of their study and make modifications to ensure their drones produce less noise and disturbance to wildlife.

This case study demonstrates that drone miniaturization eliminates any measurable impact of drones on wildlife and therefore produces more accurate and less invasive drone-based acoustic wildlife surveys.

To read the full *Methods in Ecology and Evolution* article, click on the following link: [Miniaturization eliminates detectable impacts of drones on bat activity.](#)

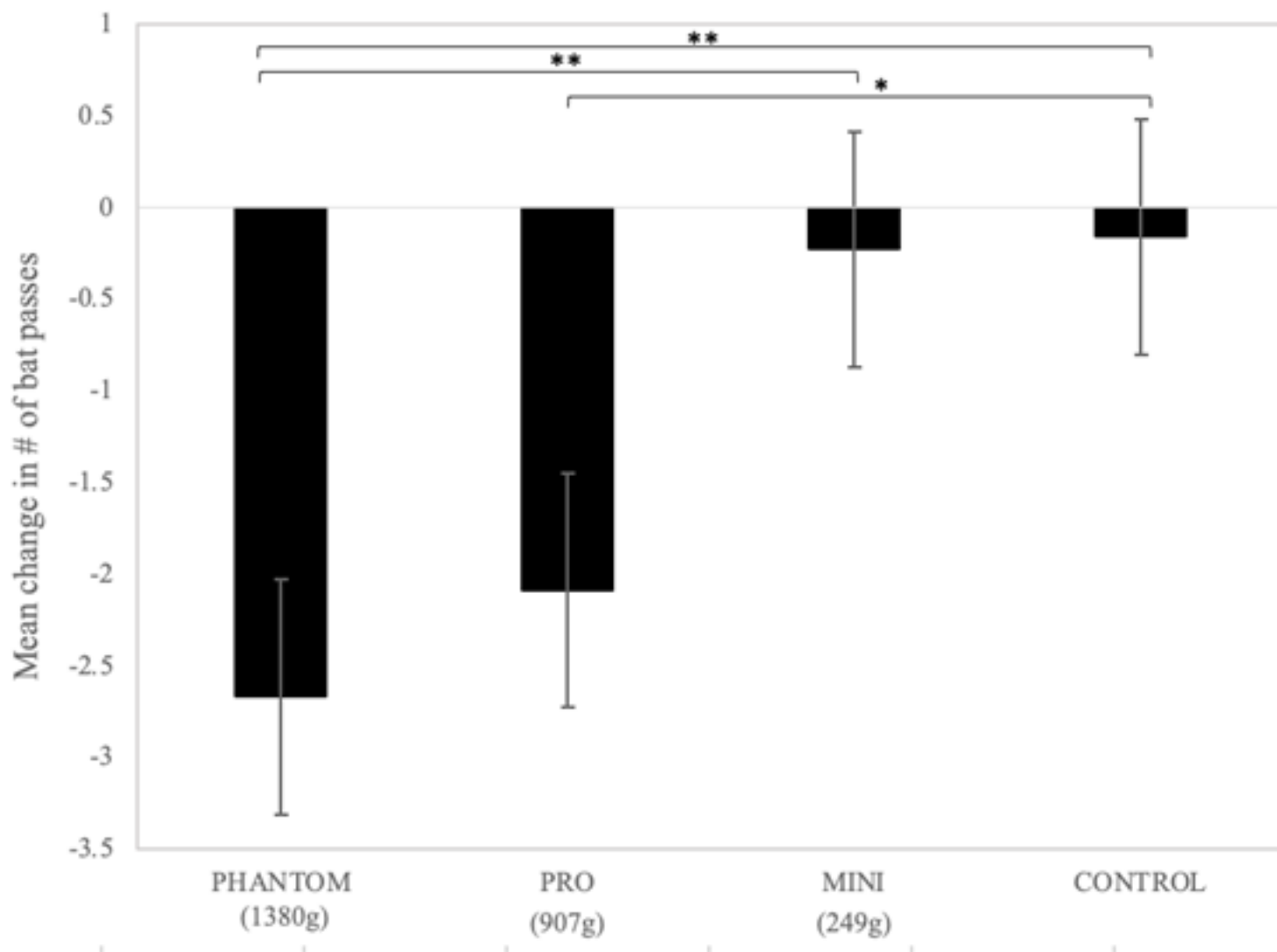


Figure 4. Larger drone models correlate with a larger decrease in bat activity. The two largest drones (Phantom and Pro) caused the largest negative change in bat activity compared to the smallest drone (Mini), which produced an equal response in bat activity to the control. Credit: Kayla Kuhlmann.

How to grow a grassland garden in South Africa

Zoë Chapman Poulsen

Current Address: Botanical Society of South Africa Blog
Reprinted from: <https://bit.ly/3i23P66>

One of South Africa's most biodiverse biomes, South Africa's grasslands are found on the central inland plateau of the country, encompassing the inland and coastal areas of the Eastern Cape, KwaZulu-Natal, Gauteng, Northwest Province, Mpumalanga and Limpopo.

Our grasslands are biodiverse, yet highly threatened

The grassland biome is the second largest in the country, covering around one third of South Africa's land surface. Grasslands are known for their extraordinary biodiversity. Far from only being home to grasses, South Africa's grassland ecosystems are home to a plethora of plant species, many of which are threatened or endemic to specific grassland vegetation types.

However, South Africa's grassland biome is highly threatened, with extensive habitat loss due to the growth of urban development, ploughing of grassland for agriculture for crops including sugar cane, and the expansion of forestry plantations. Degradation by overgrazing, inappropriate fire management and alien invasive vegetation is a further cause of concern.

Grassland gardens in the spotlight

In recent years, growing grassland gardens has increased in popularity in South Africa, particularly on larger housing estates in KwaZulu-Natal, because of their combination of beautiful blooms at different times of the year, as well as how easy they are to maintain and waterwise they are.

It is important not to confuse grassland gardens with grass gardens. Grass gardens only comprise grasses of various shapes, colours and sizes, whereas grassland gardens also include a range of other plants alongside grasses, including bulbs, succulents and many other indigenous plants.



Figure 1. *Erythrina zeyheri* in bloom during summer the grassland garden at the University of KwaZulu-Natal (UKZN) Botanical Gardens. Photo: Alison Young.



Figure 2. Aloes add architectural structure to grassland gardens, with their bright candles of flowers adding light to the winter garden among the dry grasses. Photo: Alison Young



Figure 3. Cat's Whiskers (*Ocimum obovatum*) after rain. Photo: Alison Young



Figure 4. Bronze mannikens enjoy visiting grassland gardens to feed on the grass seedheads. Photo: Alison Young



Figure 5. The day after an ecological burn in the grassland garden on 2 July at the UKZN Botanical Gardens. Photo: Alison Young

Grassland gardens can make fantastic habitats for wildlife, with the blooms of flowers attracting pollinators into the garden. As the grasses in a grassland garden grow, flower, mature and set seed, they are often visited by birds to feed on the grass seeds.

Grassland Garden Inspiration

One of the best places to visit to be inspired to grow your own grassland garden at home, is the grassland bed at the [KwaZulu-Natal National Botanical Garden](#) in Pietermaritzburg.

This garden was designed to educate people about South Africa's grasslands and is affectionately known as the 'people's garden', given its celebration of the relationship between grassland plants and people.

In the grassland bed during the winter months, the bright and architectural blooms of Aloes and Red Hot Pokers stand bold against the dry grasses. During summer, there are spectacular displays from many bulbs, as well as *Senecio* and *Helichrysum*. The grassland bed is also home to numerous medicinal plants.

Starting your own grassland garden

So how can you start growing your own grassland garden? To begin, you'll need to choose the right site. Pick an area that is away from deep shade of trees and receives around 6-8 hours of sunlight per day.

Before you start planting your grassland garden, clear the area of any weeds and alien vegetation. The next step is to add your compost. This only needs to be done once when you are creating your garden.

You can either use homemade compost if you have a compost heap, or apply a compost mix that comprises decomposed leaves, bark and well-rotted manure. A carbon rich organic fertiliser can be added during the initial soil preparation.

During the initial soil preparation, you can sculpt the surface of the soil to create a more natural appearance, as well as adding in rocks and logs to create spaces for wildlife to shelter underneath.

Choosing plants for your grassland garden

Once the ground has been thoroughly prepared, you are now ready to begin planting up your grassland garden. The next step is to choose the plants you are going to use. Some of the most popular grasses for use in grassland gardens are the Ngongoni grass (*Aristida junceiformis*) and the KwaZulu-Natal Red Top (*Melinis repens*). Both of these grasses are highly ornamental and easy to grow.

Beautiful pineapple lilies (*Eucomis*) make a fantastic addition to grassland gardens, with their architectural foliage and flowers. Several members of the genus have sweetly scented blooms. Cape Scabious (*Scabiosa africana*) and Wild Scabious (*Scabiosa columbaria*) produce gorgeous purple or white flowers that attract bees and butterflies into the garden.

The African Potato (*Hypoxis*) is a hardy bulb that is easily recognised by its attractive yellow star-shaped flowers. The flowers are pollinated by honeybees. For winter colour in your grassland garden, consider planting some Aloes, such as the Spotted Aloe (*Aloe greatheadii*).

Remember as you plant up your grassland garden not to plant your plants too close together, with no more than 8 plants per square metre. Once planting has been completed, add a layer of mulch and water thoroughly.

Maintaining your grassland garden

As your grass garden becomes established, it requires relatively little maintenance. After the initial planting, the only water your grass garden will need is the seasonal rainfall it naturally receives each year. No additional fertiliser is required.

You can also top it up with a fresh layer of mulch each year. Once a year during winter (between May and July), trim grasses back to around 5 cm in height and rake up the resulting dry grass from this process. This will encourage your other grassland plants to grow and come into bloom during spring.

We wish you happy grassland gardening!



Figure 6. Top: A winter ecological burn in July in the grassland garden at the UKZN botanical gardens. Above: The yellow fire lily (*Cyrtanthus breviflorus*) in bloom among the burnt vegetation in the grassland garden at the UKZN botanical gardens. Photo: Alison Young

Massive open index of scholarly papers launches

OpenAlex catalogues hundreds of millions of scientific documents and charts connections between them.

Dalmeet Singh Chawla

Current Address: Nature

Reprinted from: <https://go.nature.com/37lcbUp>

An ambitious free index of more than 200 million scientific documents that catalogues publication sources, author information and research topics, has been launched.

The index, called OpenAlex after the ancient Library of Alexandria in Egypt, also aims to chart connections between these data points to create a comprehensive, interlinked database of the global research system, say its founders. The database, which launched on 3 January, is a replacement for Microsoft Academic Graph (MAG), a free alternative to subscription-based platforms such as Scopus, Dimensions and Web of Science that was discontinued at the end of 2021.

"It's just pulling lots of databases together in a clever way," says Euan Adie, founder of Overton, a London-based firm that tracks the research cited in policy documents. Overton had been getting its data from various sources, including MAG, ORCID, Crossref and directly from publishers, but has now switched to using only OpenAlex, in the hope of making the process easier.

Improved coverage

Microsoft's move to close MAG, announced last May, worried some academics and others who used its data to conduct studies and build research tools.

In response to MAG's closure, non-profit scholarly services firm OurResearch in Vancouver, Canada, created OpenAlex, using part of a US\$4.5-million grant from London-based charity Arcadia Fund. The index is currently accessible through an application programming interface, or API, that can perform complex searches. A simpler search-engine interface is scheduled to launch in February.

OpenAlex draws its data from MAG's existing records and other sources including Wikidata identifiers, ORCID, Crossref and ROR, says Jason Priem, co-founder of OurResearch.

The tool is also integrated with the Unpaywall database, which contains more than 30 million open-access articles that Priem and OurResearch co-founder Heather Piwowar launched in 2017. "We now have much better coverage of open access than MAG ever did," Priem says. "Not only can we tell you where the free-to-read copies of any particular article live, but we can also tell you the licence and the version of that article."

Priem says that OpenAlex updates every fortnight by bringing in more data from its sources. The tool goes a step further towards openness than MAG did because OpenAlex's data is freely available under a CC0 copyright licence for anyone to build on, says Priem. That means that if OpenAlex were to be discontinued, any researcher can pick up where OurResearch left off instead of having to rebuild the whole database from scratch.

Easy set-up

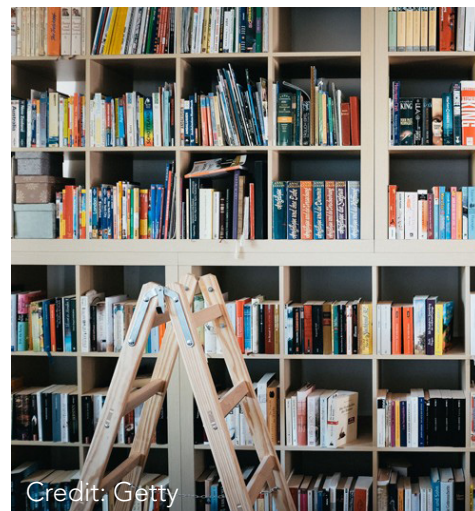
OpenAlex is also free to use, thanks to sponsorship from Amazon Web Services, and requires no registration or log-in information, making the process more user-friendly, says Priem. This differs from MAG, for which users had to log into Azure, Microsoft's cloud-hosting system, and pay a small fee to download their data set. Priem says that his firm might consider rolling out a premium, pay-to-use tier of OpenAlex for users who want super-fast access, but a free up-to-date version will always be available.

It's "written in such a way that's very easy for somebody to pick up and use",

says Adie. He adds that it took him only about 20 minutes to get started on OpenAlex, compared with three to four days with MAG. "The downside is that Microsoft had a lot of technical capability that they could apply to Microsoft Academic. So we'll have to see how OurResearch does without that," Adie says.

Roar Bakken Stovner, who studies researchers' citations patterns at Oslo Metropolitan University, says that it took him around two hours to start working with OpenAlex, compared with around a week with MAG. "For somebody who is more computer savvy, MAG might be easier," he says. "For researchers who want to try small projects on their own, OpenAlex will be way easier to start with."

Frode Opdahl, chief executive of Keenious, a start-up firm based in Tromsø, Norway, which scans millions of papers to suggest relevant references, says he's pleased with the documentation published about OpenAlex. "It makes it a lot easier to work with and implement into our product," he says.



New book examines how science and tech shaped South African history

¹William Beinart & ²Saul Dubow

Current Address: ¹University of Oxford and ²University of Cambridge
Reprinted from: <https://bit.ly/3JbNLL7>

As historians, we have both been immersed for many years in trying to understand and write about South Africa's complex, conflictual history. Conquest, colonial domination and racial division in the shape of apartheid played a central role. So too did the rise of black opposition and the transition in 1994 to an African National Congress government.

There were many strands in the weaving of this history, some neglected in the focus on race and political power. These include the profound role that science and technology played in shaping South Africa's history. In our new book, *The Scientific Imagination in South Africa, 1700 to the Present*, we offer a historical overview of scientific ideas, practices and institutions in South Africa over more than three centuries.

We refer in the title to the "scientific imagination". That's because we link science both with power and with ideas about how human society can be reshaped. We also aim to discuss science as an expression of human curiosity, ingenuity, and the ability to make unlikely connections.

This book is a history of individuals, ideas and institutions that were at the fulcrum of important scientific developments. Writing history is bounded by what has happened. Our text explores the complexity of the colonial era and its indelible legacies. We argue that science and technology both facilitated colonialism and to some degree stood outside such processes.

Racial policies and modernist approaches privileged the narratives of formal, written, largely disciplinary-based sciences. The book incorporates discussion of indigenous and local knowledge when it fed into scientific discussion,

such as in understanding the local environment in the eighteenth century. We also explore alternative approaches and conflicts over knowledge.

Innovation testing ground

South Africa has been a regional rather than a world power. In global terms, it was not a major centre for invention. Yet its geographic position at the southern foot of the African continent made it a

staging post for Portuguese, Dutch and British maritime empires. It became part of an expanded European and global imaginary. Colonisation by Britain from 1806 brought the region into tight connection with one of the most powerful – and technologically advanced – world empires.

From the late eighteenth century, the Cape became an important site for botanical and zoological exploration. The



Figure 1. In the nineteenth century, improved breeds and new agricultural technology underpinned exports of ostrich feathers from South Africa. powerofforever/iStock/Getty Images Plus

wealth of its plant species, as well as the extraordinary diversity of wildlife, attracted sustained attention. By the early twentieth century, the discovery of ancient fossils, stone implements and hominin remains suggested that the country may have constituted a “cradle” of modern human evolution.

South Africa was not a core zone of invention. But it was, at key moments, a significant incubator and testing ground of innovation. Application could be as

important as discovery. In the nineteenth century, improved breeds and new agricultural technology, including dams, wells, fodder and fencing, underpinned exports of wool and ostrich feathers. Devastating new rifles helped to change the balance of power in favour of colonial regimes.

In the twentieth century, the mineral revolution necessitated developments in applied geology and the chemistry of gold extraction. The scientific imagina-

tion was also more exploratory in curiosity-driven fields such as astronomy, palaeontology, and wildlife conservation.

Our text also builds on many individual stories. James Barry, who came to the Cape in the 1810s, was probably the first formally trained woman doctor in Britain. She made a significant contribution to modernising Cape Town’s early medical institutions. She also performed one of the first successful Caesarean operations in the British empire, for an ancestor of the man who became the first Afrikaner nationalist Prime Minister. It was in commemoration of this operation that he carried the unusual name James Barry Munnik Hertzog.

Elsewhere in South Africa, rich mineral resources gave impetus to a sequence of discoveries. Hans Merensky, son of a German missionary, was sent to train as a geologist in Prussia. Returning to South Africa, he played a major role in identifying coastal diamond deposits, as well as platinum, and phosphates. Platinum-group minerals have outstripped gold in their value. Merensky invested his wealth in a farm, Westfalia, which became an important site for scientific work in improving avocado pears.

Thinking creatively

South Africa gave birth both to Afrikaner and African nationalism, which affected the trajectory of scientific endeavour. White South Africans were also carriers of a darker tradition – the attempts to justify racial segregation in scientific terms. In the relatively brief era of African nationalist rule after 1994, the state has espoused more universalist goals and the segregationist drive to account for racial difference has yielded to an emphasis on common humankind.

We explore the circulation of ideas, recognising that many originate in the north but are not trapped in the social context of their origin. Scientific ideas are potentially universal and can be appropriated and modified everywhere.

Today, it is clear that scientific work in multiple sites with diverse backing is important for South Africa to address its socio-economic and environmental problems. There are signs that its scientists are up to the challenge: after all, it was in South Africa that the Omicron variant of COVID was first identified. Scientists were sufficiently inserted in global networks to identify this variant and sufficiently open to publicising it.

The scientific imagination needs to be nurtured in the country, along with the capacity to think creatively about history and society.

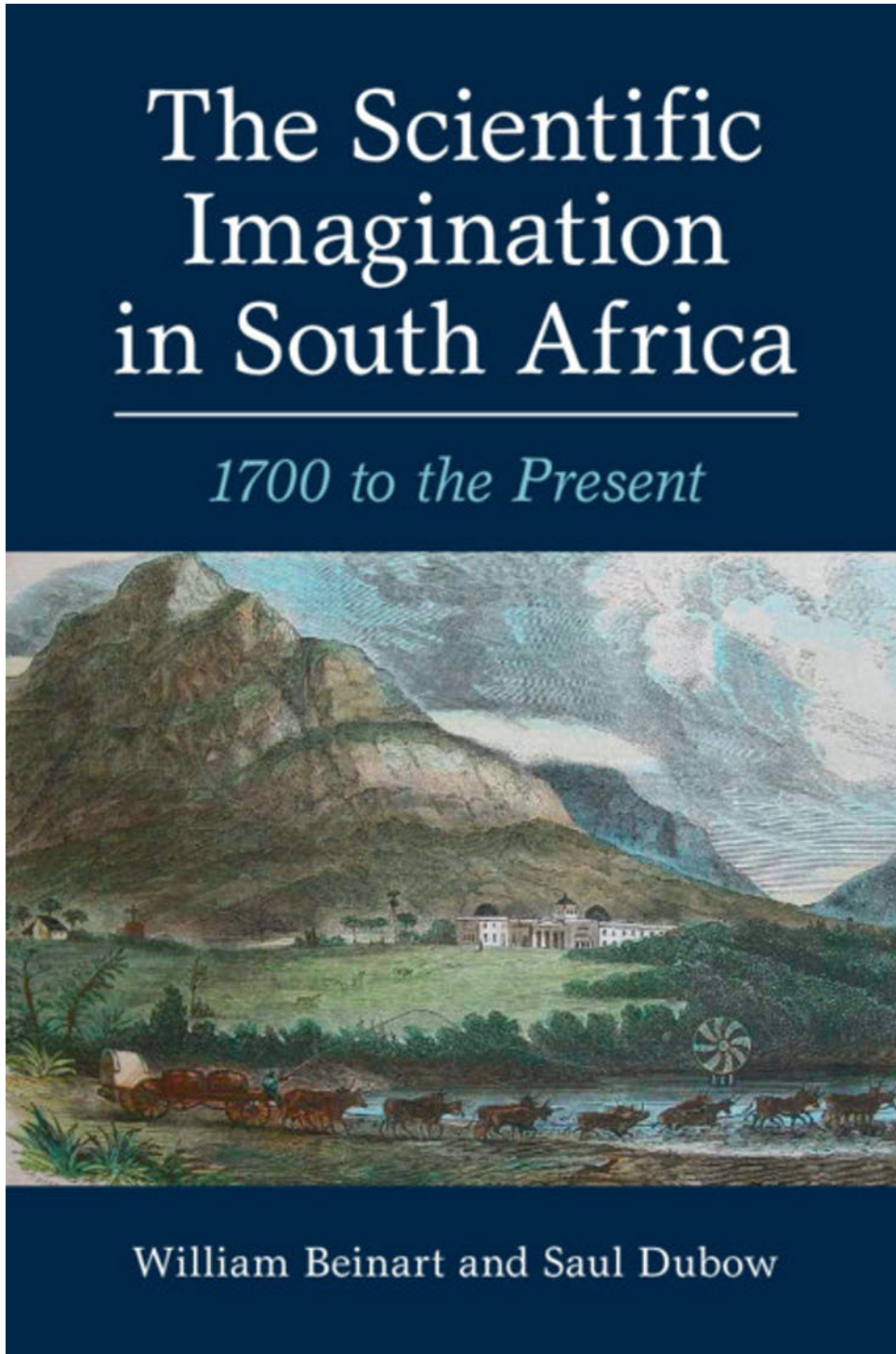


Figure 2. The Scientific Imagination in South Africa, 1700 to the Present, is published by Cambridge University Press (2021)

Upcoming events

25 - 29 July 2022

The 57th Annual Congress of the Grassland Society of Southern Africa (Hybrid Event)

The GSSA congress will be held at Aldam Resort & Conference Centre near Ventersburg in the Free State, South Africa. Abstract submissions are open and can be submitted via the event website. For more information, please visit our [website](#) or email the administrator at info@grassland.org.za.



4 - 9 September 2022

SAWMA Conference 2022 (Hybrid Event)

The conference will be streamed live from Bonamanzi Private Nature Reserve, KwaZulu Natal Province. Presenters will have the option of presenting either in person or virtually. Similarly, prospective delegates may choose to attend in person or virtually. Deadline for abstracts are 29 April 2022. For more information, please visit <https://sawma.co.za/conference-2022-2/>

30 - 31 August 2022

ICRER 2022: 16. International Conference on Rangeland Ecology and Research

Kuala Lumpur, Malaysia (Virtual)

Prospective authors are kindly encouraged to contribute to and help shape the conference through submissions of their research abstracts, papers and e-posters. Also, high quality research contributions describing original and unpublished results of conceptual, constructive, empirical, experimental, or theoretical work in all areas of Rangeland Ecology and Research are cordially invited for presentation at the conference. The conference solicits contributions of abstracts, papers and e-posters that address themes and topics of the conference, including figures, tables and references of novel research materials. Visit <https://waset.org/rangeland-ecology-and-research-conference-in-august-2022-in-kuala-lumpur> for more information.

5 - 9 September 2022

MEDECOS Conference XV (Hybrid Event)

Fynbos Forum 2022 will be accepting abstracts soon again for the postponed 15th Conference on Mediterranean-type ecosystems to be held at Club Mykonos Resort, Langebaan, Western Cape. Visit www.fynbosforum.org.za for more information.



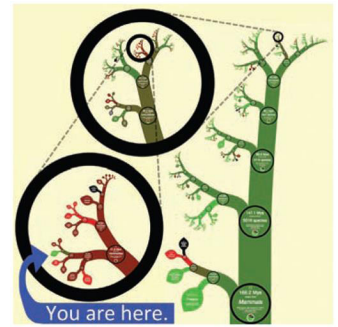
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Websites, Webinars & Podcasts

The OneZoom explorer

Maps the connections between 2.2 million living species, the closest thing yet to a single view of all species known to science. The interactive tree of life allows users to zoom in to any species and explore its relationships with others, in a seamless visualisation on a single web page. The explorer also includes images of over 85,000 species, plus, where known, their vulnerability to extinction.

It is available at onezoom.org.



Stuart on Nature

Chris and Mathilda Stuart have been involved in wildlife research and book writing for over 40 years. Their interests are wide and include photography, writing and travel; conservation and wildlife research; horses and music. They have published many scientific and popular articles. Between them they have visited, and spent time in, 50 countries, including Canada, USA, Australia and Zambia, with their time being split between their homes in South Africa and Austria.

Visit www.stuartonnature.com



Common names of South African Grasses

Frits van Oudtshoorn has compiled a list of common names of grasses of South Africa in one document.

Visit the Grassland Society of South Africa at: <https://grassland.org.za/> to view this list.

Conservation Conversations with BirdLife South Africa

These weekly webinars hosted through Zoom will hopefully bring some entertainment and education to your household as we embrace the new virtual reality that we all find ourselves in thanks to the restrictions brought on by the recent COVID-19 pandemic. Each talk will last approximately 45 minutes to an hour with a 15-30 minute Q&A session with our presenters afterwards. These sessions will give you a chance to learn about the incredible conservation work taking place across South Africa and beyond while also sharing some of the conservation success stories which BirdLife South Africa has been privileged to drive.

Visit: <https://www.birdlife.org.za/blsa-conversations/?fbclid=IwAR00phkAK1Omx5vxSu2omJfBI1fHIAaZoEnBwAF7d9PMoEWF3bJZ61pOusc#1622816346779-1e6331a3-6b23>



The Art of Range

The Art of Range is a podcast about rangelands for people who manage rangelands. The goal is education and conservation through conversation.

Find us online at www.artofrange.com



Go check out the following

Websites, Webinars & Podcasts

What you need to know about carbon removal - Gabrielle Walker

What do woolly pigs have to do with climate change? They're part of a vital, ingenious and evolving strategy to take carbon out of the sky and store it safely -- in trees, soils, the ocean, buildings, rocks and deep underground. Every carbon removal approach takes some combination of natural resources, human ingenuity and technology, says climate thinker Gabrielle Walker. If we get the mix right, we can clean up the environmental mess we've made, reverse the processes behind climate change and give nature a chance to heal. "What goes up must now come down," she says.

Watch it at: www.ted.com/talks/gabrielle_walker_what_you_need_to_know_about_carbon_removal



FruitLook Team

This channel features video outings referring to the FruitLook platform in the Western Cape of South Africa. FruitLook is funded by the Western Cape Department of Agriculture and made available by eLEAF (www.eleaf.com) together with South African partner Blue North. Via FruitLook all Western Cape farmers have access to state-of-the-art satellite information to improve farming efficiency. A better informed farmer makes better decisions. FruitLook allows them to do so.

Visit: www.youtube.com/channel/UCzC_yc9WcTLG9k26Sj8PFmQ/featured



Grassroots

Quarterly digital newsletter of the
Grassland Society of Southern Africa

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Grassland Society of Southern Africa

WEBINAR SERIES



DROUGHT, CLIMATE CHANGE AND THE AGRICULTURE / WILDLIFE SECTOR IN THE KAROO, SOUTH AFRICA: WHAT CAN WE LEARN FROM THE 2015 - 2020 MULTI-YEAR DROUGHT?



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Emma Archer is a Professor in Geography and Environmental Studies at the University of Pretoria. Her research focus is largely on drylands.

Her two main study sites are the southern Waterberg, Limpopo Province, and the eastern Karoo, in South Africa, close to the Marakele and Camdeboo National Parks, respectively.

She is active in international assessments, including work on certain of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) assessments, on GEO-6, on the IUFRO Forests and Water assessment, as well as the joint IPBES/IPCC report (launched June 2021).

DROUGHT, CLIMATE CHANGE AND THE AGRICULTURE / WILDLIFE SECTOR IN THE KAROO, SOUTH AFRICA: WHAT CAN WE LEARN FROM THE 2015 - 2020 MULTI-YEAR DROUGHT?

The Eastern Cape Province, and in particular, its interior western Karoo region, has long been subject to periodic droughts, with significant implications for its agricultural and biodiversity sectors, including wildlife management and allied tourism. From 2015, with some recovery in 2020, the area experienced a severe multi-year drought, with negative impacts for a range of sectors, including extensive livestock farming and wildlife management on the private and state reserves.

Here, we analyze how the drought evolved climatically, as well as its impacts on vegetation and farming conditions, including wildlife and game. The drought was considered to be extremely severe – with some local impacts found to be critical. Loss of production impacts, and loss of income, compounded by the difficulties resulting from the COVID19 pandemic (which has impacted the South African economy severely) are likely to continue to impact the agricultural and wildlife sectors in the Eastern Cape for some time – and given the likelihood of increased frequency of extreme events in southern Africa in the future, we may see more subsequent severe multi-year events.

Such a finding is particularly critical in the context of the latest findings on climate change and biodiversity, where not only are we concerned about climate change's direct impacts on biodiversity (for example on species); but where we clearly have to rethink what constitutes successful conservation in a changing future.

57th Annual Congress
Grassland Society of Southern Africa

25 - 29 JULY 2022

Call for abstracts

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Newsletter of the Grassland Society of Southern Africa

grassroots

submissions 2022:

Issue 1: 01 February 2022

Issue 2: 01 May 2022

Issue 3: 01 August 2022

Issue 4: 01 November 2022

Please visit

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