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AWNSOME research:

looking at Themeda triandra awn movement

Covid-19 or the pandemic of mistreated biodiversity

The ghost of fire regimes past (and future)

Advancing Rangeland Ecology and Pasture Management in Southern Africa

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In this issue

From our editor

Welcome to Issue 2 of Grassroots for 2020.

This issue brings a variety of topics in the hopes to cover the interest of you, all the readers!

We start this issue with some "AWN-SOME" research Craig Morris has been doing on *Themeda triandra* awns. In his article, Craig looks at how *T. triandra* awns work and whether long awns are better than short awns at transporting seed across the soil to a suitable germination site, and in the process, describes the intricacies of awn racing.

these unexpected and changing times, we also include an article on Covid-19 or the pandemic of mistreated biodiversity. Finally, a new book on holistic management was released late last year. Paulina Flores reviewed it for us and provides us with an in-depth summary of this latest handbook on holistic management.

We are also sad to announce the deaths of two of our members and we remember them with tributes from two of their colleagues and friends.

Due to the current Covid-19 circumstances, the GSSA Congress will be going digital and will have its first online congress ever! We will still have platform presentations, posters and question time. For South African delegates, you will still even be able to claim your CPD points required by SACNASP…so please get registering before it is too late.

This online GSSA Congress will be held from the **30 June to 2 July 2020**.

For Christiaan and me, this will be our last issue as Sub-Editor and Editor of Grassroots as we will both be stepping down in July. I would like to thank you all for your contributions and support over the time that I have been part of Grassroots and I wish the new Editor well in continuing the growth of the magazine.

Stay safe and enjoy this issue!

Janet

Contact us

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

@GrasslandSociety-ofSouthernAfrica

Let's twist again like we did last summer (of 1876)

Craig Morris

Current Address: ARC-AP, at the University of KwaZulu-Natal, Pietermaritzburg, South Africa
E-mail Address: morris@ukzn.ac.za

"My Dear Francis," said Charles Darwin, hesitantly, "your mother said it's time we had a little torque." "Come on, Father, don't you know I've been to school and already know all that stuff," snapped Francis (third son, seventh Darwin child) irritably. "Ah, but do you actually know how hygroscopic awns of grasses work and what mechanism gives them their torque – they must have some ecological purpose." "Right, Father, I'll go find out and tell you my results at lunch," offered Francis, helpfully.

So off went Sir Francis (M.B. FLS FRS FRSE) to explore the nature of the hygroscopic awn [he didn't make it back to lunch], producing one of the best pieces of investigative botany I've read in a long time: '*[On] the Hygroscopic Mechanism by which certain seeds are enabled to bury themselves in the Ground*' (Darwin 1876). Using a bell glass to carefully manipulate humidity, he examined how the awns of European feather grass (*Stipa pennata*) uncoil when wet, twisting again when drying, thereby burying their seed, and what physics underlie this process. He also got his engineer brother Sir Horace (KBE FRS, fifth Darwin son) to build him a sensitive awn hygroscope to measure angle of twist, which responded to his very breath: intriguingly it also moved towards the 'dry' end when the awn was cooled or dipped in alcohol.

Inspired by Francis and some Australians (more about them later) I decide to find out how the hygroscopic awns of our favourite productive and palatable grass, *Themeda triandra* (Fig. 1A), work and whether long awns are better than short awns at transporting seed across the soil to a suitable germination site. The bigeniculate (having two bends, or 'knees") seed awns of *T. triandra* vary from about 30 to 80 mm in length (Fig. 1B). The basal, helically coiled section below the last knee of the awn is the part that twists (see video: https://youtu.be/TYC_48b5No8), moving the awn across the ground. I expected that long awns would be able to move faster and further than short awns can because of their longer 'power unit', thereby conferring some ecological advantage.

So, I set up a track for 10 long and 10 short awns (Fig. 1C) and let them race it out over five days, wetting them and tracking their movement and distance travelled each day (Fig. 1E). The hot favourites to win the Blue race were the lanky Awnsain Bolt and Awnsafa Powell (later disqualified for imbibing an illegal substance: coffee) while Shelly-

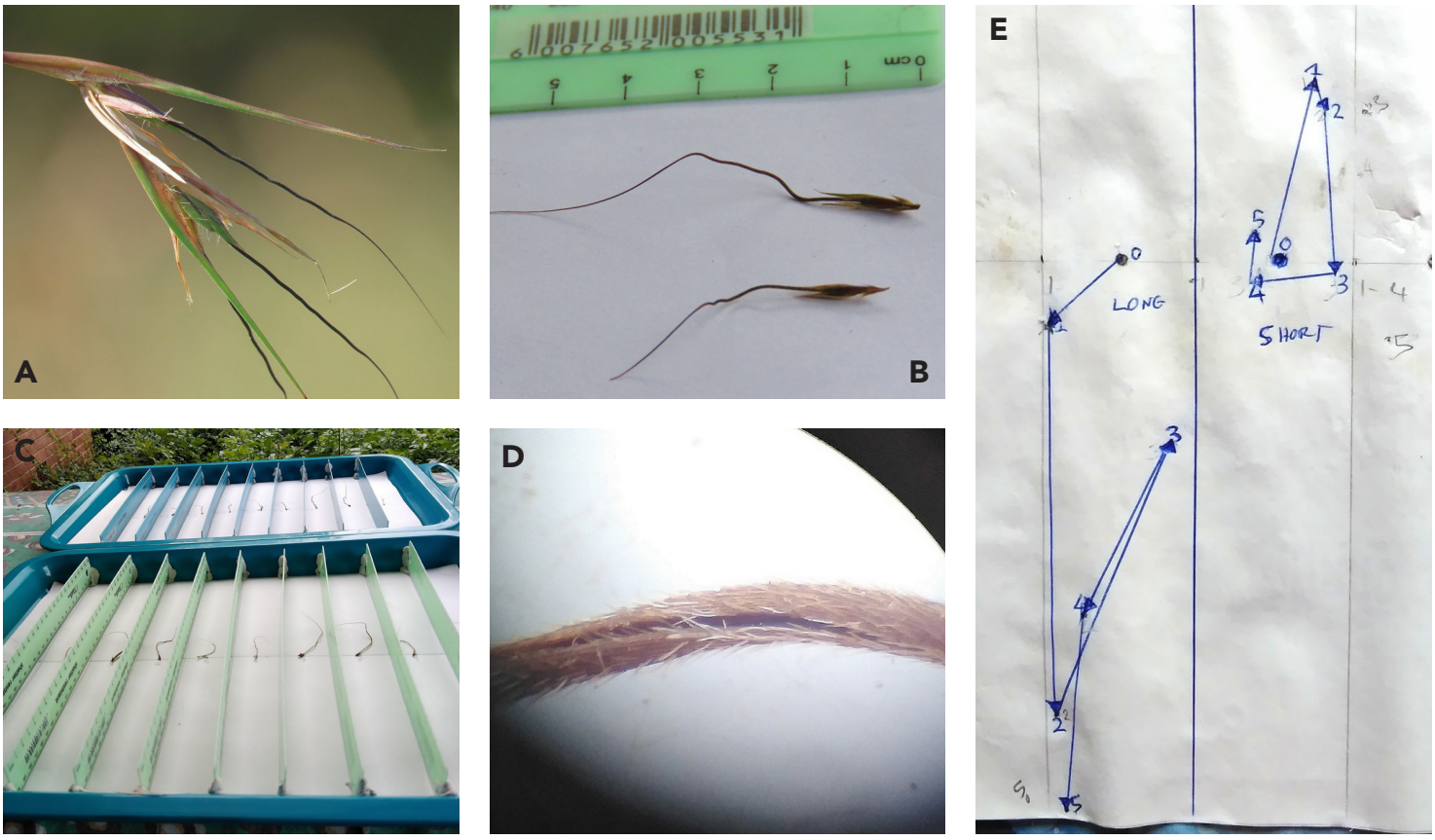

Figure 1: (A) *Themeda triandra*, (B) long and short awns, (C) the racetrack for comparing awn movement, (D) the deep groove in the helically coiled section of the awn, and (E) the daily movement track of a long and a short awn.

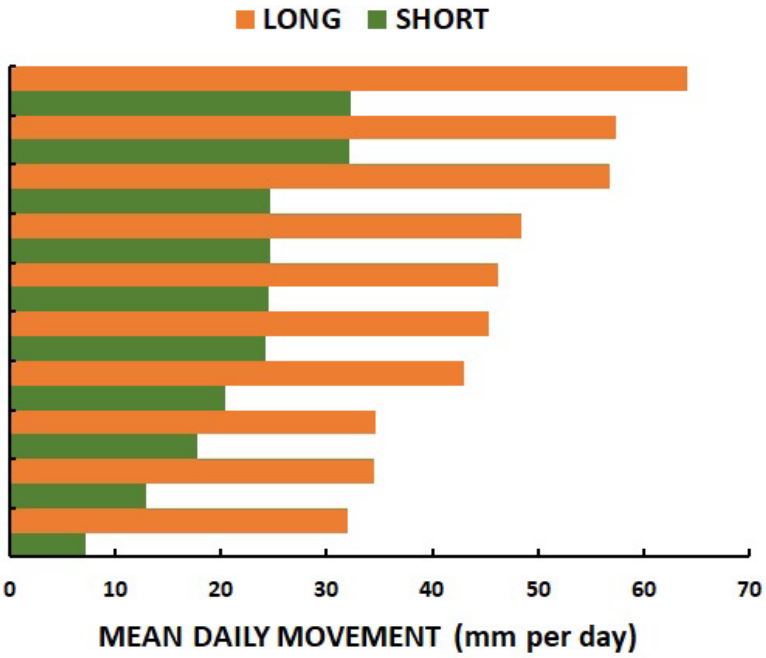

Figure 2: The mean movement per day of 10 short and 10 long awns of *Themeda triandra*.

Awn Fraser-Pryce was expected to again leave Florence Griffith-Awner in her dust on the Green field.

The results were sensational! The long awns covered > 120 mm more ground than the short awns during the race (231.3 vs. 110.4 mm), at double the pace (46.3 vs. 22.1 mm day^{-1}; Fig. 2). Awnsain Bolt produced a blistering performance of 122 mm in one day, completely obliterating the previous world record of 59 mm (Adams and Tainton 1990).

'What makes the long ones move so fast?', was obviously my next question. Guided by Francis, I anchored vertical orientated awns at their base and timed their rotation. Surprisingly, short and long awns twisted at the same rate (2 min 48 sec for a complete rotation), close to what Francis found (2 min 30 sec) and within the range of other results (2–4 min). According to physics, the length of the actively twisting basal section of the awn (which is effectively a torsion spring) plays no role in determining how fast it rotates but it, together with the length of the passive tip of the awn, both influence how much leverage a bent awn can exert. Therefore, a long awn will lever itself more effectively and faster across the soil than a short awn.

Not content with mere description and measurement, Francis delved right into the awn of *S. pennata* to see what makes it tick. He stripped it down to its constituent cells noting [that] "*under the microscope the torsion of the individual cells was beautifully seen; ... I have actually seen a single cell under the microscope untwisting and twisting up again as my hand approached and was withdrawn from its neighbourhood.*" He also identified bilayers of differentially water-absorbent cells, the oblique spiral arrangement of striae in the cell wall that lead to its unequal contraction, and observed strips of the awn could also twist like the whole awn, revealing the cellular and macro structural arrangement that confers torsion and enables overall awn movement. All these mechanisms as well as the whole macrostructure was confirmed using the latest expensive imaging techniques almost 140 years later (Elbaum and Abraham 2014). Not having Darwin's perspicacity and tenacity, nor access to an electron microscope during the COVID-19 lockdown, all I managed to do was to reveal by way of a blurred (but maybe the first ever) photograph taken with my cellphone through a stereomicroscope that the awns of *T. triandra* do have a distinct spiral groove in their hygroscopic region (Fig. 1D). How this deep groove contributes to twisting, perhaps by channeling water or acting as a contraction joint allowing swelling and shrinkage, remains to be determined.

Of course, you only understand something if you can build a working model of it. Sir Francis tied up awns into a bundle and observed that they twisted around each other like a rope when hydrated, proving a 'schema' for overall helical movement. Drawing on my childhood experience of building self-propelled elastic cotton reel cars, I too made a model to satisfy myself that I (partially) know how awns work: for live action watch https://youtu.be/Ua63OPVzOzw - Version 2.0 will be larger and faster and be activated by the slightest change in atmospheric humidity.

What is the ecological value of having long, speedy awns? Well, the Australians proposed that the longer awns that *T. triandra* plants have in the hot, dry interior of their country compared to the short-awned plants on the wetter coast could be an adaptation to enable seed to be quickly transported far across the soil surface to find a germination microsite before the rain dries up (Godfree et al. 2017). I tested whether their prediction that awn length should increase with decreasing rainfall (i.e., increasing aridity) by examining how mean awn length changed with mean annual rainfall across 16 sites in the midlands, interior and uplands of KwaZulu-Natal.

The result was another surprise. Awns tended to be shortest, though quite variable, in the driest areas and were consistently long in the wettest Drakensberg sites (for full results see the preprint at: https://t.co/hQamBqo4Sx). Perhaps poor rainfall restricted awn development in some of my driest sites or a long awn is best for transporting a seed through the dense maze of tufts in mesic grassland to find a good spot to germinate away from competitive established tufts?

Further research is also required to establish what determines awn length as well as other possible roles that awns could play, such as twisting the seed out of inflorescences or when trapped in the canopy (as Darwin speculated), or to perhaps make it difficult for predators to drag the nutritious seed away. Watch this space for some more awnsome findings.

Acknowledgements

This research would not have been possible without the enthusiastic assistance provided by Janet Taylor and Debbie Jewitt who kindly organised the collection of awns (and Colin Everson and Kevin Kirkman who also provided samples) as well as Anita Morris who helped with the experiments and tolerated me droning on about the wonders and mysteries of awns for a few months.

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GRASS OF THE MONTH

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

Setaria megaphylla

(Broad-leaved Bristle Grass)

S. megaphylla is a large robust grass species.
R. Taylor (https://www.inaturalist.org/observations/40948685)

Being one of South Africa's larger grass species, *Setaria megaphylla* is, as its name suggests, large-leafed. It is a robust tufted grass which mostly grows in shade and hence usually found in forest, plantation or dense bushveld. It is also often regarded as a weed in newly planted forestry plantations as it competes for sunlight and water with seedlings and is an incredibly hardy plant (Van Oudtshoorn 2002). *S. megaphylla* is a Decreaser climax grass species indicating that it is often abundant in good quality veld but decreases in numbers in veld that is over or under grazed. This grass is found in 8 of the 9 provinces of South Africa (excl. Northern Cape) and further north to tropical Africa (Fish et al 2015).

It is a category III grass species indicating that these grasses, mainly the wiregrasses, increase in abundance in veld that is selectively overgrazed. These species are not palatable and difficult to control once they are established in the veld.

The inflorescence is open panicle in shape and attracts seed-eating birds.

This grass grows in large tufts in shady and areas of wetness.
R. Taylor (https://www.inaturalist.org/observations/40948685)

Setaria megaphylla- uses:

- *S. megaphylla* is a palatable grass – with a palatablility score of palatability score of 6 (out of 10).
  And often utilized by the larger herbivores and is especially good for grazing when it is a young plant.

- *S. megaphylla* produces seed which are very popular to the small seed eating birds and therefore makes it a popular garden grass. The leaves are also used by weavers to build nests.

- The robust structure of this grass can make it a feature plant in any garden, and does not require much attention to grow.

- This grass is important for water purifation as it absorbs excess nutrients from the water. (PZA.sanbi.org)

!

Features of *S. megaphylla*:

- *Broad dark-green tufted grass*
- *Leaf blades can be up to 800 mm long*
- *Leaf blades are longitudinally pleated*
- *Flowers between September and May*

S. megaphylla is identified by its large pleated leaves.

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PASTURE OF THE MONTH

Author: Malissa Murphy | malissam@elsenburg.com
Western Cape Department of Agriculture (HET), Elsenburg, South Africa

Dactylis Glomerata

The toughest of the temperates

Cocksfoot (Eng.); Kropaargras (Afr.) Cultivars: Cristobal, Adremo, Hera, Cambria

Cocksfoot is a cool-weather pasture crop and mainly cultivated under irrigation. Not only is it a very persistent perennial grass, but it is the most drought-tolerant crop amongst the temperate perennial species. Although its production is lower than that of perennial ryegrass and tall fescue, its palatability and nutritional value hardly decreases with maturity. It is a versatile crop that can be used as pasture, hay, silage or foggage and grows especially well with perennial clovers.

What does it look like?

Leaves

- Bluish, green colour
- Hairless, no ribs or lamina
- Tiller is strongly flattened with leaves sharply folded

Inflorescence

- Compacted panicle
- Spikelets are crowded into dense one-sided clusters at the end of short branches

Other characteristics:

- Tufted, perennial grass
- High dry matter content (30-32%)
- Very palatable
- Can be used as pasture, hay, silage, and foggage

Growth requirements:

- Temperate regions with > 700 mm of rainfall
- Grows well on most soil types, but prefers light, fertile soil
- Tolerates soil pH (KCl) as low as 4.5 (pH of 5 is preferred)

References:

Gids tot volhoubare produksie van weiding. Alles oor natuurlike veld en aangeplante weidings vir kleinvee, groot-vee en wildboere. Prof Hennie Snyman, 2012.

AGT Foods Africa: Cocksfoot – Dactylis glomerata: https://agtfoods.co.za/wp-content/uploads/2018/07/25.-Cocksfoot.pdf

Barenbrug South Africa: https://www.barenbrug.co.za/forage/products/perennial-temperate-grasses/cocksfoot/adremo.htm

Conservation efforts lead to rise in black rhino numbers

The International Union for Conservation of Nature report that black rhino numbers have risen from about 2,000 in the 1990s to the current level of 5,600.

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

Eyewitness News

A conservation project started nearly two decades ago to create new black rhino populations is paying off.

The WWF's Black Rhino Range Expansion Project (BRREP) was started in 2003 by far-sighted conservationists who saw the need to create new black rhino populations on large areas of good habitat.

It is now one of the reasons that the International Union for Conservation of Nature (IUCN) could recently report that black rhino numbers have risen from about 2,500 in the 1990s to the present 5,600.

The project is run in partnership with Ezemvelo KZN Wildlife, Eastern Cape Parks and Tourism Agency and various private and community landowners. It creates new populations by moving founders (of up to 25 black rhino at a time) on to properties large enough to maintain a significant population.

Often this involves neighbouring properties removing internal fences to create larger, unfettered reserves. There are 13 BRREP-created populations to date, on a total of more than 300,000 hectares of land.

"It's great to see nearly two decades

Figure 1: Two black rhino. Picture: Sharon Haussmann

of hard work on behalf of black rhino paying off,"said project head Dr Jacques Flamand.

"Our sites now have 256 black rhino on them. And they have been busy. We had seven calves, born on four different sites, over the Christmas period. We've had a year of good rain so far in most of our reserves. We hope this leads to even more calves next year."

Last year, half of BRREP's sites reached the 5% annual growth target set by provincial conservation authorities. Black rhino numbers in the game reserves from which they were removed to create those populations are also increasing consistently.

This is because consistently removing a certain number of animals from a population that is near carrying capacity helps to stimulate growth.

Project coordinator Ursina Rusch, who compiles data on all the different populations so that the best decisions can be made for the management of the species, explained: "That's the art of ecological management. You have to remove not too many and not too few to get it right."

Dr Flamand said this achievement had been a team effort.

"The creation of partnerships between landowners and conservation bodies was the key to making it happen. That involved many dedicated people. We rely very much on passionate people who have the resources to invest in protecting rhinos. Otherwise, no one would keep them.

"We still need much more land if the impetus is to be maintained. A successful increase in black rhino numbers means that there are more calves produced and those need places to be put into as they grow up."

But WWF said this did not mean that black rhino were out of the woods.

Although numbers are increasing, growth of most populations is slow in most regions, and poaching further slows that growth rate, even though white rhino take the brunt of poaching.

There are still only 5,600 black rhino on the African continent and WFF states that without concerted conservation efforts, the current growth would not have occurred.

"But there is still much to do, and much of it involves BRREP finding suitable large blocks of land for black rhino, and owners of that land prepared to devote it to black rhino conservation – a risky and costly endeavour," said Dr Flamand.

"This will be an ongoing challenge, particularly as wildlife tourism has been hard hit by the global coronavirus pandemic."

Figure 2: A camera trap showing a black rhino mother and her calf. Picture: Supplied.

The impact of Crop Pests on Food Security

Current Address: Stewardship and Operations Manager, CropLife South Africa
Reprinted From: https://bit.ly/2TQsbEp

Dr Gerhard H Verdoorn

Crop production and animal production probably provide 90% of the world human population's food needs. Very few people on earth live as hunter-gatherers (maybe those who do are the lucky ones) while the rest of us rely on agriculture to supply our food. Food crops are very sophisticated biological entities with high yield potential under ideal conditions but we are hampered not only by the challenges of climate change but also by the pressure of crop pests (invertebrates and vertebrates), weeds (competing plants) and plant diseases (pathogens and microbes). Historical events still reverberate in our minds to caution us against devastating crop pests, weeds and diseases like the late blight that killed potatoes in Ireland between 1845 and 1849 and caused severe famine and mass human mortality. The challenges of climate add the pressures of pests and makes life interesting if not stressful for modern farmers.

Can modern crops succeed under pest pressure without pest management?

A fair percentage of the world's human population have no idea what crop production means. People buy their food from the retail outlets and demand healthy, tasty and good-looking fresh produce and processed foods without understanding that it is produced in a constant "war" situation – that "war" is waged against crop pests, weeds and diseases. Question is why plant pests and diseases are in such competition with us? The answer is quite logical: we managed to select certain traits like high yields, growth form, short growth cycle in cultivation but in the process the natural compatibility or resistance against pests and diseases are sacrificed. A second rationale for the challenges we face with plant pests and diseases is the agricultural practice we use for food production, namely large tracts of land planted with dense stands of monocultures. Any arthropod species will cash in on such abundant food supply while pathogens are very easily spread between individual plants while proliferating in magnitude to epidemic proportions. Fact is that our modern crops are highly susceptible to plant pests and disease while weeds are omnipresent in crop production. There is no way in which we can produce enough food the 8.5 billion people without supporting our crops with sound pest management. Nature's little beasts are simply too numerous and competitive to be left without control.

Arthropod and nematode pests

Insects and arachnids like mites are considered serious crop pests. Nematodes are often forgotten due to their small size, but they can be totally devastating to many crop species.

Sporadic pest outbreaks

The recent red locust outbreak in central Africa is an example of how a single insect species can destroy virtually all crops in a short period of time. We have a similar species namely the migratory locust in South Africa that damages natural veld, but if left unchallenged it invades cash crops like maize. Another pest that occurs sporadic in many crops is the African bollworm. There were outbreaks in the Western Cape canola and wheat in 2018 and 2019 that caught farmers off guard. Our African armyworm is another sporadic pest that often "appears out of nowhere", damages veld and grazing and even spills over into crops. The sporadic pests are perhaps more dangerous than the endemic pests because the farming community does not expect such pests and are unprepared to deal with it. The agricultural sector and state agriculture organs need to develop efficient early warning systems for such sporadic pests to prepare farmers better to combat them.

Invasive pests

The fall armyworm that invaded South Africa in 2016 is a pest that sent the shiv-

ers through the agricultural network and destroyed cash crops of a large percentage of small farmers and some commercial farmers in South Africa. Had it not been for genetically modified maize that has an inherent control mechanism for Lepidoptera (worm) pests, the maize crop in South Africa would have been devastated. We also see other invasive pests like different fruit flies that arrive uninvited in South Africa and jeopardise fruit crops. The problem with invasive pests is that there are often no registered pesticides available, leaving farmers at a loss for suitable and effective control mechanisms.

Another problem is that such invasive pests establish themselves as endemic pests within a short period time and add to the frustration of farmers and costs of production. South Africa recently also experienced the arrival of the polyphagous shot hole borer that invades ornamental and crop trees, inoculates it with very the dangerous Fusarium fungus and we have not effective control mechanism for this pest yet.

Endemic pests

Farmers are usually acquainted with the "standard" pest like stalk borers, thrips, whitefly, loopers and various nematodes (there are many, many others!) and their cyclic nature coincide with crop cycles and spray programmes are established to control such pests. We seldom see a real problem with endemic pests that cannot be controlled effectively and if such problems do arise, it is mostly because of poor agricultural practices or incorrect application of pesticides.

The threat posed by and nematodes to food security

One may think that the physical damage caused by pests to crops is the only impact we are concerned about, and yes, physical crop damage either in the larger plant itself or the part that should be harvested like fruit or an ear of wheat, can wipe out a farmer's prospects of sending his produce to the market. Physical damage like nematodes in potatoes and bananas, worms in maize, whitefly in tomatoes and thrips in fruit crops can destroy a crop completely but the secondary effects may also be as devastating. That is when a biting and sucking insect inoculates the crop with a plant pathogen, virus or bacterium that kills the plant or damages it to the point where it is not able to yield a harvest. Thrips and plant lice are tiny plant pests that can destroy a crop by establishing a disease in a crop. Damage caused by such pests can be tertiary of nature when fungal spores are carried into the crop by wind and enter the damaged areas; it is not necessarily only insect borne diseases that damage crops. On the commercial scale the physical and secondary damage to crops may not really be a threat to food security but for a small farmer or the subsistence grower, it may take out his or her food supply for an entire season. If we, however, remove plant protection from commercial agriculture, as much as one quarter of the national crop may be wiped out by plant pests which leaves a serious national food security risk for a nation.

Weeds

Weeds may indigenous or exotic of nature and have the amazing ability always perform better than crops. There are several threats that weeds pose to crops namely competition for nutrients, competition for soil moisture, competition for sunlight, hosting pests and diseases, and allelopathy. The latter is when a weed species produces chemicals that negatively impact on a crop species' ability to germinate or grow; it basically poisons the crop plants. Another challenge that weeds pose to crops is contamination. Seeds of weed species that contaminate cereal crops for example, may render such cereals useless for humans or animals. Datura seeds are dangerous when found in any

cereal crop and such a crop may not be sold in market.

Invasive weed species

From time to time, agriculture is faced with an invasive weed species like the *Amaranthus palmeri* or Palmer amaranth that entered South Africa probably in 2016. It is frightening species because of its resistance to glyphosate and a lot of other herbicide active ingredients. Imagine if this weed invades the GM maize areas of South Africa: it may bring maize production to a total standstill due the impossible task of controlling it and that will be devastating to the nation's food security.

General resistance against herbicides

Some weed species in South Africa have developed resistance against some herbicides and cause headaches for farmers that grow cereal crops. Rye grass, wandering Jew and fleabane species are some of our current challenges. It may not seem a real threat to food security but if left uncontrolled these species may eventually take over large tracks of arable land and impact on productivity and profitability that leads to lower yields.

Every little drop in the bucket adds to the concern for food security and not just the large-scale challenges like Palmer amaranth.

Global production losses due to weeds

It is estimated that weeds account for as much as 40% of global crop losses. It is alarming that such a large impact is looming if weed control is left in the background. Weeds often harbour the insect pests that damage crops and in some areas the weed growth is so dense that harvesting the crop becomes nearly impossible.

Vertebrate pests

Rodents are the main vertebrate pests that impacts on food security while some bird species like the red-billed sporadically have devastating impacts on grains such as wheat, sorghum and millet. A three and half million strong flock of red-billed quelea will make short work of a 40 hectare wheat field and leave nothing to harvest. Rats and mice are pests of stored grain crops and it has been mooted that they consume as much as 20 million tonnes of stored grains in Africa alone. Apart from consuming grain that is grown for human, livestock and poultry consumption, they are also vectors for dangerous microbes like Salmonella and *Eschirichia* coli that may cause life-threatening diseases in human beings.

Plant diseases

During the plant's growth season, it is prone to fungal, bacterial and viral infections. Some viral infections like the banana bunchy top virus are extremely dangerous and can destroy vast tracts of bananas. Fungal infections can be controlled but it needs a very intensive scouting programme which includes an eye on the weather patterns. Fusarium, to mention but one pathogen, is a dreaded plant disease that can kill a crop in no time at all.

It is omnipresent like other fungi and lies waiting for the crop and the correct climatic conditions to infest and destroy a crop. The list of fungal diseases is awfully long but fortunately for farmers the knowledge base is exceptionally good and diseases can be managed effectively with the correct spray programmes. A factor to consider for food supply and food safety is post-harvest diseases. One often finds fresh produce on the shelf that is rotten and that is due to post-harvest pathogen infections. This becomes a big issue when post-harvest treatment is either not done or poorly implemented for fresh produce to prevent fungal and bacterial infection. No one likes to see green mould on citrus, and no one will buy or eat such foodstuffs anyway.

Effective and environmentally compatible pest management

Plant pests, diseases and weeds need to be managed to ensure sustainable crop production and food security. South Africa is blessed with a wide range of registered plant protection products that fulfils 95% of the needs of farmers to protect their crops. Changes in the climate, market demands, market preferences and government performance in terms of registering plant protection products all play a role in planning plant protection programmes. Lobby groups and disinformation often taint certain plant protection products with false information which leads to negative regulatory interventions.

Regulators often fail to take food security into account when wiping plant protection products off the table. A good example is the continuous fight about glyphosate and the potential impact of banning it on food security. One must also bear in mind that food security is not only having good supply to all people but also affordable supply of essential foodstuffs. Going organic may sound idyllic but what is the cost going of such foodstuffs going to be? Put your thinking cap on!

Climate change could cause abrupt biodiversity losses this century

Current Address: [1]Senior Research Fellow, University of Cape Town and [2]Research Fellow Genetics, Evolution & Environment Div of Biosciences, UCL
Reprinted From: https://bit.ly/3cdVN54

Christopher Trisos[1] and Alex Pigot[2]

The impacts of climate change on species and ecosystems are already evident. Poleward shifts in the geographic distributions of species, catastrophic forest fires and mass bleaching of coral reefs all bear the fingerprints of climate change.

But what will the world's biodiversity look like in the future?

Projections indicate that unless emissions are rapidly reduced the climate crisis will get substantially worse. Up to 50% of species are forecast to lose most of their suitable climate conditions by 2100 under the highest greenhouse gas emissions scenario.

But we still lack answers to some basic questions. When will species be exposed to potentially dangerous climate conditions? Will this occur in the next decade or only later in the century? Will the exposure of species accumulate gradually, one species at a time? Or should we expect abrupt jumps as the climate limits of multiple species are exceeded?

Our understanding of when and how abruptly climate driven disruptions of biodiversity will occur is limited because biodiversity forecasts typically focus on individual snapshots of the future. We took a different route. We used annual projections of temperature and precipitation from 1850 to 2100 across more than 30,000 marine and terrestrial species to estimate the timing of species exposure to potentially dangerous climate conditions.

Based on these projections, we estimate that climate change could cause sudden biodiversity losses. These could occur much sooner this century than had been expected. This new analysis indicates that a high percentage of species in local ecosystems could be exposed to potentially dangerous climate conditions simultaneously.

Rather than slowly sliding down a climate change slope, many ecosystems face a cliff edge.

Risk of abrupt biodiversity loss early this century

Abrupt biodiversity loss due to marine heatwaves that bleach coral reefs is already under way in tropical oceans. The risk of climate change causing sudden collapses of ocean ecosystems is projected to escalate further in the 2030s and 2040s. Under a high greenhouse gas emissions scenario the risk of abrupt biodiversity loss is projected to spread onto land, affecting tropical forests and more temperate ecosystems by the 2050s.

These dire projections use historical temperature models to find the upper limit that each species can survive under, as far as we know. Once temperatures rise to levels a species has never experienced, scientists have very limited evidence of their ability to survive.

It's possible some species, such as those with very short generation times, may be able to adapt. For species with longer generation times – such as most birds and mammals – it may be only a few generations before unprecedented temperatures occur. When this happens the species' ability to evolve out of this problem may be limited.

Why it matters

Abrupt losses of biodiversity from climate change represent a significant threat to human well-being. In many countries a large percentage of people rely on their immediate natural environment for their food security and income. Sudden disruption of local ecosystems would negatively affect their ability to earn an income and feed themselves, potentially pushing them into poverty.

For instance, marine ecosystems in the Indo-Pacific, Caribbean and the west coast of Africa are at high risk of sudden disruption as early as the 2030s. Hundreds of millions of people across these regions rely on wild-caught fish as an essential source of food. Eco-tourism revenues from coral reefs are also a major source of income.

In Latin America, Asia and Africa, large parts of the Andes, Amazon, Indonesian and Congo forests are projected to be at risk from 2050 under a high emissions scenario.

Sudden loss of animal communities could negatively affect the food security of people in these regions. It could also reduce the long-term ability of tropical forests to lock up carbon if the birds and mammals that are important for dispersing seeds are lost.

Urgent next steps

These findings highlight the urgent need for climate change mitigation. Rapidly reducing greenhouse gas emissions this decade will help save thousands of species from extinction, and protect the life-giving benefits they provide to humans.

Keeping global warming below 2°C flattens the curve of climate change risk to biodiversity. It does this by massively reducing the number of species at risk and buys more time for species and ecosystems to adapt to the changing climate – whether that's by finding new habitats, changing their behaviour, or with the help of human-led conservation efforts.

There's also an urgent need to ramp up efforts to help people in high risk regions adapt their livelihoods as climate change alters local ecosystems.

Projecting where and when species will be exposed to dangerous climate change throughout the century could provide an early warning system, identifying those areas most at risk of abrupt ecological disruption. In addition to highlighting the urgent need for reducing fossil fuel usage, these results could help guide conservation efforts, such as designating new protected areas in climate refugia.

They could also inform resilient ecosystem-based approaches for helping people adapt to changing climates. An example would be planting mangroves to protect coastal communities against increasing flooding.

The potential to continuously update and validate these near-term projections as ecological responses to climate change unfold should further refine projections of future climate risks to biodiversity that are so central to managing the climate crisis.

Our planet is still teeming with life. And with the right political leadership and daily actions that we take as citizens, we still have the power to keep it that way.

Video material

Biodiversity exposure to dangerous climate conditions:
https://youtu.be/hR7gKqThHqk

Rooting out 'monster' invasive weeds and pests from space

Reprinted From: https://bit.ly/3gC2hhu

Gareth Willmer

Parthenium hysterophorus is a highly invasive weed that has spread to about 50 countries worldwide, threating agricultural productivity, biodiversity, ecosystems, and human and animal health.

A major struggle to eliminate, parthenium can have heart-breaking impacts – it has been estimated to cause crop yield losses of up to 95 per cent.

But a solution to this ground invasion could come from space.

Among the countries hit is Pakistan, where one recent study estimated that farmers' individual losses from the weed can run into the thousands of dollars annually — with livestock fodder sites alone affected to the tune of about US$935 each. That means it is essential to get to grips with the issue.

"*Parthenium*'s rapid growth rate and prolific seed production make it highly troublesome," says Muhammad Ishaque Mastoi, national coordinator for plant protection in the Plant Sciences Division at the Pakistan Agricultural Research Council. "In severe cases, entire harvests become unusable. Controlling this weed is essential for agriculture, food security and human health."

"The weed is spreading and adapting rapidly, so we need to come up with some extraordinary solutions."

Ali Bajwa, research officer in weed science, New South Wales Department of Primary Industries, Australia

Figure 1: *Parthenium* is a highly invasive weed that threatens agricultural productivity, biodiversity, ecosystems, and human and animal health. Copyright: CABI

With a view to this, the Centre for Agriculture and Bioscience International (CABI, the parent organisation of SciDev.Net) has been running a project with the University of Manchester that harnesses Earth observation data, including satellite data from the European Space Agency's Sentinel-2 mission.

Although the use of satellites has surged in agriculture in recent years, Julien Godwin, project manager for the initiative at CABI, says satellites have not yet been widely explored for tracking invasive weeds in developing countries.

That means it is essential to get to grips with the issue.

As for the satellite technology itself, says Usman, a challenge is that *Parthenium* often grows in small patches where there are crops, making it tricky to detect.

But he thinks satellites have "huge potential" to help the situation, providing the chance to gather detailed data over huge tracts of land every few days in a way that is not possible with traditional approaches.

The key, again, is ensuring that relevant, digestible information is delivered to farmers, says Usman: "If those of us working on this can involve different stakeholders working with farmers, like extension departments and crop-reporting services, and build some kind of app or map, maybe we can engage farmers better."

Figure 2: A scientist examines *Parthenium* weed. Asim Hafeez/CABI

Putting the brake on locust outbreaks

Current Address: Manager, SAEON Arid Lands Node
Reprinted From: https://bit.ly/36EXM14

Joh Henschel

"For too long, the world has operated on a cycle of panic and neglect. We throw money at an outbreak, and when it's over, we forget about it and do nothing to prevent the next one."

Tedros Adhanom Ghebreyesus, Director-General of the World Health Organization (WHO), was talking about pandemics like the Coronavirus, but could just as well have referred to the desert locusts, *Schistocerca gregaria*, swarming across his home country, Ethiopia.

Locusts are polyphenic – they have two distinct phases that differ in terms of diet, ecology, reproduction, behaviour and morphology: antisocial Solitaria at low abundance and social Gregaria at high densities. Solitaria initiate Gregaria, whose phenology is, in turn, geared towards quickly propagating many migrant Gregaria.

Most research efforts have focused on curbing the billions of Gregaria by applying insecticides at high costs. By contrast, getting to understand the reclusive Solitaria has been considered to be less critical than destroying masses of Gregaria, even with significant collateral damage to ecosystems.

The reverse is true, as it is the Solitaria that trigger outbreaks.

Sahel researchers found that part of the problem emanates from the management of locust populations. Administering financial and human resources reactively cause them to lag behind the problem. One ends up trying to control what is already somewhat out of control.

By contrast, preventative management of locust populations, applied consistently and comprehensively over time and space, especially when densities are low, would be far more effective.

Furthermore, scientists found that overgrazing by livestock decreases the nutritional quality of grass, which boosts the population irruptions of locusts. Solitaria favour grasses that are low in nitrogen (proteins) but rich in carbohydrates, which allows the locusts to enhance resistance against pathogens and build up fat reserves that promote egg production and fuel flight.

Good rainfalls at the right time bring about the rapid growth of ephemeral grasses and trigger synchronised hatching of locusts from egg banks. Crowding stimulates the production of serotonin, a neurotransmitter ("happy chemical") that changes locusts from being antisocial to social.

Figure 1: Swarming locusts in Kenya (Picture: Jen Watson, Shutterstock)

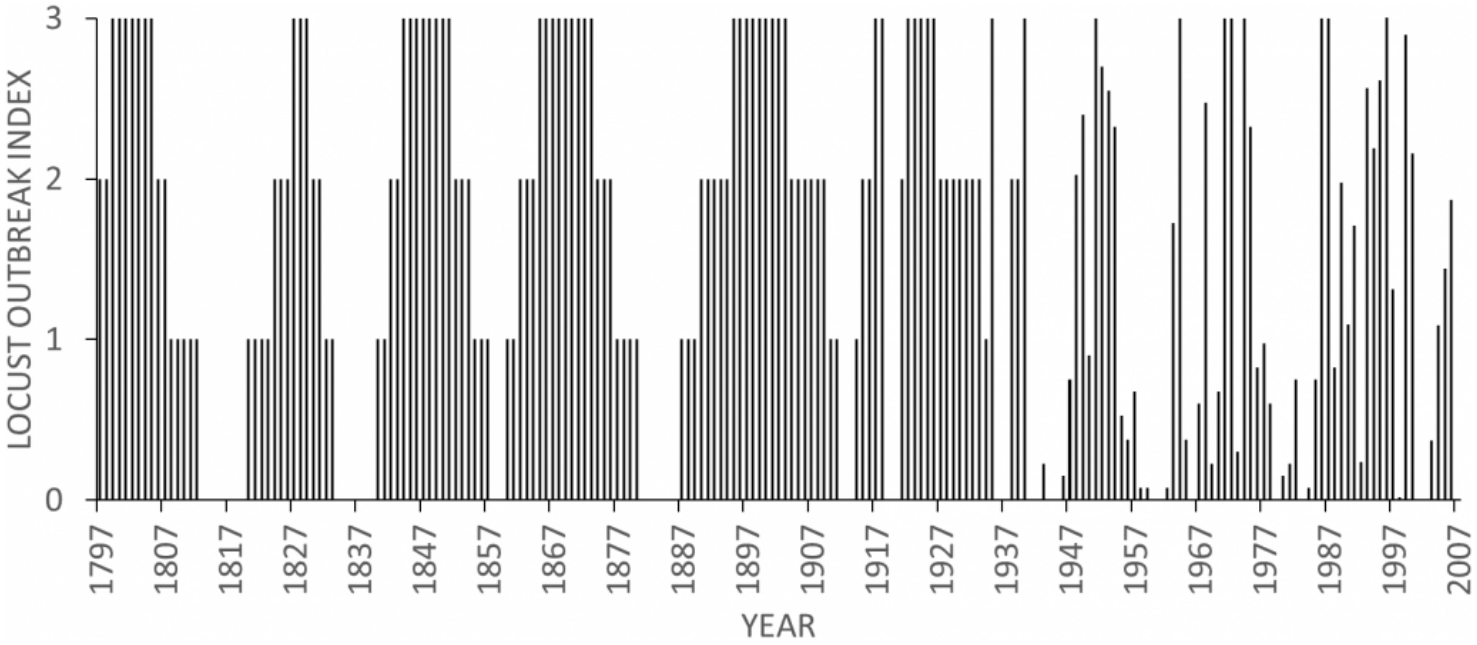

Figure 2: Incidence of brown locust swarms in South Africa, ranging from absent (0), present (1), moderate (2), to abundant (3). Information sources were a) 1797–1909, the number of municipal districts with swarms; b) 1910–1988, costs of insecticide application; c) 1988–2006, records of swarms subjected to control measures. Source:ARC

Gregaria eat indiscriminately, and when they have depleted their food, they fly away in search of more. Disturbances caused by insecticide application on locust swarms animates surviving Gregaria to move even further. Given their extraordinarily high reproductive potential, especially when they reach superabundant crops, swarms escalate, famines follow.

Thus, poor rangeland management in arid lands impacts crop production in distant areas. This connection clarifies why locust plagues have shadowed humanity since the First Agricultural Revolution.

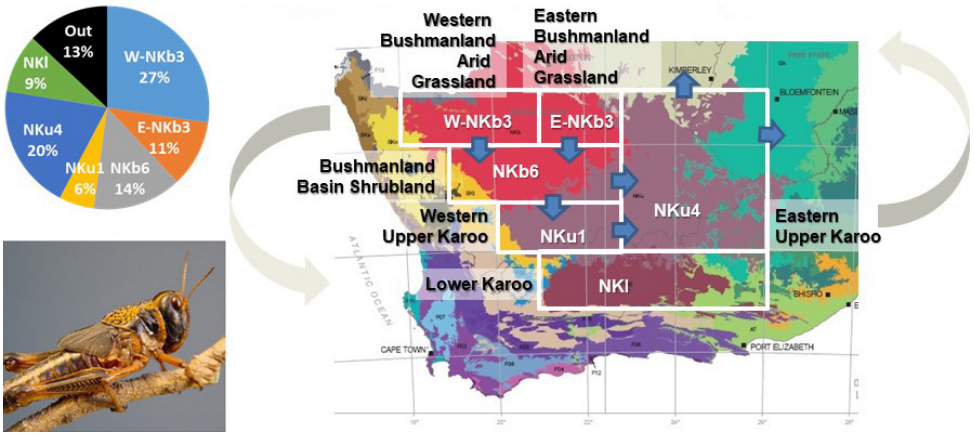

Figure 3: ARC records of brown locust swarms and hopper bands (n=469,900) in different Karoo vegetation types and out of the Karoo ("Out") indicate an anticlockwise progression of outbreaks. Source of map and codes for vegetation types: SANBI

Local impact

In South Africa, the last significant outbreaks of brown locusts, *Locustana pardalina*, were a decade ago. Many may have forgotten their existence, and the Locust Research Unit of the Agricultural Research Council (ARC) shut down after a century of its existence.

Preliminary analyses by SAEON of ARC records show that two-thirds of locust hopper bands and swarms occur in the Bushmanland region of the Nama-Karoo. The mean annual precipitation in this area is only about 100 mm but is highly variable (CV=49%).

Drought, heat waves and wet or warm winters inhibit hatching and allow egg banks to grow over many years. Mass hatching of Bushmanland eggs is preceded by good late summer rainfall, a dry cold winter and intermittent rainfalls in early summer. Such outbreaks can expand across South Africa and beyond.

It remains impossible to predict what triggers mass outbreaks of brown locusts, and when and where these will occur, even though years with and without outbreaks correlate with subcontinental climatic phases.

That makes it compelling for SAEON because of the potential indicator value of ecosystem status and because locusts offer us natural data loggers.

Solitaria deploy "smart eggs" into egg banks that record previous weather events over months to years. They remember sequences of stimulatory and inhibitory events of soil moisture and temperature conditions until they match "Open Sesame".

Currently, I am sitting in my office at home in Covid-19 lockdown. The world is experiencing the enormous costs of controlling the outbreak of the Coronavirus and realising that prior research could have avoided this outbreak at a fraction of the costs and risks.

The same goes for locusts. A paradigm shift is called for to manage potential problems without first letting them become actual problems, to brake outbreaks before they break us.

What Kenya must do to save its roan antelope population

Current Address: Senior Lecturer, Department of Wildlife Management, University of Eldore
Reprinted From: https://bit.ly/3gyUQYg

Johnstone Kimanzi

Roan antelopes are Africa's second largest antelope species. Their populations are stable and growing in some African countries, but in others – like Kenya – they're threatened with extinction. To address this, the Kenya Wildlife Service is launching a recovery plan. Johnstone Kimanzi sheds light on why their numbers are declining and what can be done to protect them.

Where can roan antelopes be found in the world today and how many are left?

The roan antelope, which is endemic to Africa, used to be one of the most common antelopes – found in almost all African savannas. It is found in 30 countries, mostly within western, central and eastern Africa.

Today there are an estimated 60,000 roan antelopes remaining in Africa. One-third of these are concentrated in four countries: Burkina Faso, Cameroon, Zambia and Tanzania. About 60% of them live in protected areas.

In general, the overall population trend of roan antelopes across countries is that they're decreasing in number - one-third of their population is stable or increasing.

What's caused a decline in their numbers?

In Kenya, there has been a huge decline in the number of roan antelopes, from 202 in 1976 to 19 individuals in 2019. Roan antelopes are now only found in Ruma National Park, in western Kenya.

This is primarily the result of killing for meat and traditional values – such as horns for musical instruments and skin for burial ceremonies.

Poaching is a major threat. In 2013 my colleagues and I revealed that the decline of roan antelopes between 1976 and 2008 was due to snares with an average of 10 roans poached each year.

Ruma National Park is highly accessible to poachers because of a public road and footpath that cut across it. High vantage points adjacent to the park also allow poachers to monitor wildlife and the activities of Kenya Wildlife Services personnel. In addition to this, there's not enough patrolling and monitoring. Poachers are able to use these advantages to lay their snares in the park. It should be noted however that since the translocation of black rhinoceros into the park in 2012, security patrols have been greatly increased.

Alongside poaching, there are other threats which limit the roan's population growth.

Too many young roan antelopes are being preyed upon by mainly hyena. For example, in one three-year period (1993-1995), six out of 16 calves born in Ruma were predated on. This is because young roans are kept away from roan herds for six weeks after birth by their mothers and are therefore exposed to predators.

Frequent fire outbreaks, caused by people, diminish the roan's habitat in Ruma National Park and may also burn and kill young, secluded roans.

Roans have also lost a lot of their habitat because of bush encroachment. Roan antelope are sensitive and will not survive well to any increase in the density of woody plants or reduction in grass cover as has happened in many protected areas.

In addition to this, a perimeter fence was put up around Ruma in 1994, isolating their habitat. They can't range freely, which would be ideal.

Fencing leads to more competition between grazers. It also means that they are exposed to mineral deficiencies and excesses in soil and plants. This could affect reproduction and death rates in roans.

The changes in weather – like more frequent, and longer, droughts – have made things worse. During dry seasons, the only source of water in Ruma national park is the Lambwe River, which dries up in extreme drought. This puts huge stress on the water-dependent roans, whose body condition deteriorates due to dehydration, making them more susceptible to disease and consequently death. When the river is in flow, the roans have the added threat of travelling through thick riverine vegetation, which makes them easy prey.

In areas where they come into close proximity with livestock, roan populations are susceptible to diseases, such as anthrax.

The current small population of only 19 roan antelopes in Ruma is at its lowest level in a decade. This may have already resulted in high levels of inbreeding, which would increase the antelope's vulnerability to disease and stress and reduce their fertility, growth rate and survival.

How can these threats be addressed?

There are a few steps that Kenya must take to establish, and maintain, a stable and growing population of roan antelopes.

New breeding individuals need to be brought in – for instance from neighbouring Tanzania – to mitigate the effects of inbreeding depression and increase the population in Ruma to at least 50.

This is the minimum number needed to maintain healthy population growth. The roan population dipped below 50 individuals in 1990 and hasn't been able to recover since.

Within the park, the roans need a

predator-free sanctuary with less competition from other grazers. Eventually, when numbers grow, the roans can be released into Ruma and other former ranges, like the Maasai Mara National Reserve.

To eliminate poaching, footpaths into the park must be closed and cars using the public road should be inspected. There needs to be routine monitoring and maintenance of the park's electric fence.

The park also needs intensive de-snaring operations, and intelligence networks need to be developed to put an end to poaching. Camera traps would be a useful resource.

To make the habitat more hospitable for the roan, the Kenya wildlife service needs to construct and rehabilitate small reservoirs that catch surface run-off water.

For good water supply, more must be done to protect existing springs and catchment areas from human degradation. This water can then be pumped to water troughs during the long dry season.

The park also needs a comprehensive fire management plan and plan that combats invasive species - such as Mauritius thorn, *Datura stramonium* and *Eucalyptus fiscifolia* - to protect the roan's grazing areas.

Vets should be brought in to diagnose and treat sick animals.

Another step is to find ways for nearby communities to generate income from nature conservation activities such as wildlife photography, bird-watching and tour-guiding. This will help support the long-term survival of the animals.

Kenya has a plan to protect the roan antelope. Is it too late?

No, it is not too late. The roan population was only 22 individuals in 1995 and they've managed to grow and survive.

In South Africa, intensive management of roans increased the population at a rate of 20% per year.

I've modelled that a population of 43 roans could reach over 550 roans in 45 years if a 32 km^2 intensively managed predator-free sanctuary is established in Ruma National Park.

This would be coupled with re-stocking roan groups from other countries, eliminating poaching and predation, improving habitat and increasing the human resources to protect them.

Figure 1: Kenya has seen a huge decline in the number of roan antelopes. Cathy Withers-Clarke/Shutterstock

The ghost of fire regimes past (and future)

Current Address: SAEON Fynbos Node
Reprinted From: https://bit.ly/2zGz9EY

Jasper Slingsby and Glenn Moncrieff

Fire is a key disturbance affecting the structure, composition and function of many ecosystems around the world, and is essential for the healthy maintenance of the Grassland, Savanna and Fynbos Biomes of South Africa.

Alteration of fire regimes can have profound effects on ecosystems, driving shifts in the dominance of species and growth forms, or in extreme cases, causing transitions between fire-tolerant (or dependent) and fire-sensitive biomes, such as between Fynbos or Savanna and Forest.

While humans have influenced fire regimes in South Africa for tens of millennia or more, population growth and the spread of settlements and agriculture has seen this influence grow exponentially over the past few centuries and decades. Humans have become the most common source of ignitions, our farms, roads and houses limit the spread of fire, and we invest great effort in suppressing fires when and where they threaten our lives or property.

Unfortunately, detecting, understanding and managing our influence on fire regimes and the subsequent impacts on our ecosystems is incredibly challenging. While modern satellites allow us to detect and map fires in near real time, most records of fire activity extend back only a few decades, limiting our ability to detect change.

Even where we do have good records, by the time we can detect change in the fire regime the impacts on the ecosystem may have already occurred and may be irreversible, leaving few or no management options.

Using ignition catchments to predict change in the fire regime

Managing the impact our influence on fire has on ecosystems requires the tools not only to determine where we have altered fire in the past, but to predict where our ongoing activities are altering them currently and into the future. In short, long-term observation alone is not enough. We need conceptual, mathematical and/or statistical models that allow us to make defensible projections into the past and future. These are the issues that we begin to address with our collaborators in a study published this month.

We sought to identify factors that determine or alter the vulnerability of a site to fire a priori and use them to predict where we'd expect to see changes in the fire regime over time. To do this, we expanded on a concept proposed by van Wilgen et al. (2014) to explain why fire is less frequent in areas adjacent to major rivers in the Kruger National Park. Namely, because they have 'a smaller *ignition catchment*, as fires that originate on one side of a river rarely cross to the other side'.

While van Wilgen et al.'s concept was purely spatial, we expanded this heuristic to include both the spatial extent and temporal range where an ignition is likely to result in a site burning. In other words, sites are more likely to burn where ignitions are more readily available and where any ignition across a large area would result in the site burning under the dominant or a broader range of weather conditions.

Conversely, sites are less likely to burn

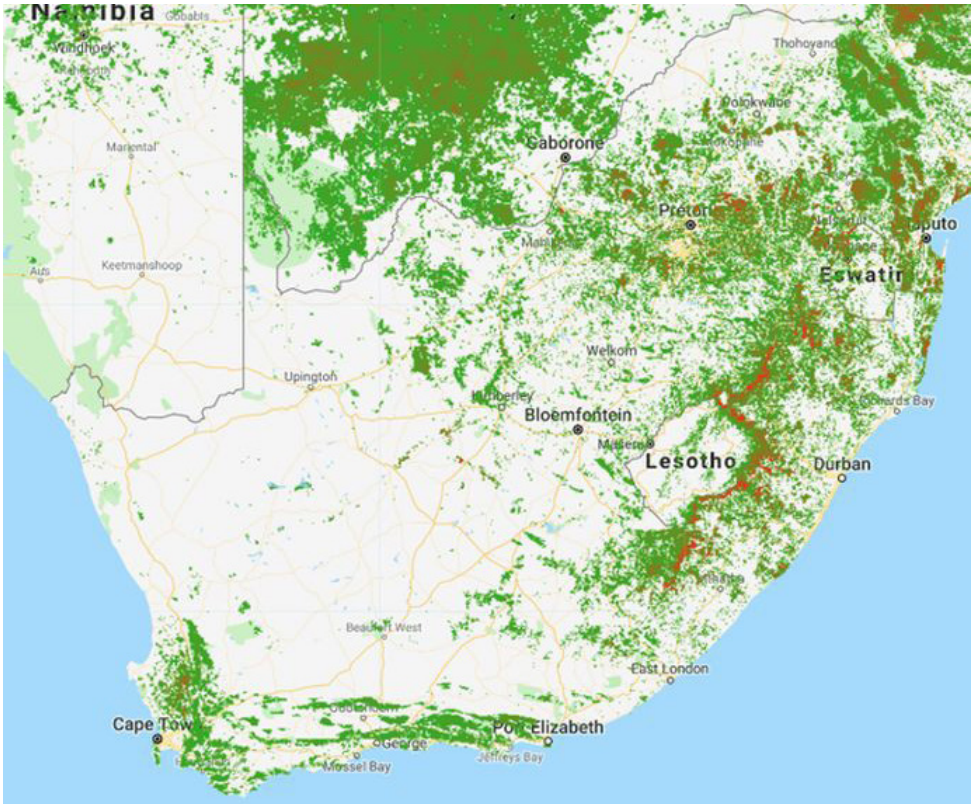

Figure 1: A map of the count of fires detected by the MODIS mission satellites over South Africa for the period 1 November 2000 to 1 July 2019. Fire is common across all but the most arid or densely forested areas.

Figure 2: Most Fynbos species are adapted to tolerate or even depend on fire. Here a recently burnt *Protea* species has released its seeds from the old inflorescences or "cones" in which they hold their seeds to protect them from fire. Without fire, recruitment is rare, and adult plants begin to senesce, causing a crash in the population and allowing forest or alien species to invade.

Figure 3: Much of the forest behind Kirstenbosch would once have been Fynbos, but the spread of agriculture and later suburbia has altered the ignition catchment and excluded fire. One can still find ancient individuals of fire-dependent Fynbos species like kreupelhout (*Leucospermum conocarpodendron*) clinging on in the newly forested areas.

when they are surrounded by barriers to fire such as rivers and other non-flammable boundaries, or if they experience few ignitions or only experience ignitions at times when fire is unlikely to spread.

Now consider how natural ignition catchments may be altered by human activities that change the frequency, timing and location of ignition sources or that affect fire spread through changes in land use and land cover. If one compared a landscape with and without these human influences, you'd rapidly be able to infer where the fire regime may be affected.

Take this one step further and compare the results of fire spread models run for the natural and human-altered landscapes, and you should be able to predict the change in fire regime with a high degree of accuracy. This is exactly what we did, using the Cape Peninsula as a case study.

Anthropogenic fire shadows and the spread of forest on the Cape Peninsula

The Peninsula provided the perfect location to test our ideas, because there is a 60-old year record of fire activity and urban expansion. There's also a record of the spread of fire-sensitive forest into fire-dependent Fynbos over the same period, providing us with a benchmark to validate our predictions.

We parameterised our fire spread models with the record of weather conditions (temperature, humidity, wind strength and direction) experienced during observed fires, topography (slope, aspect) and an existing Fynbos "fuel model" that describes the various parameters of vegetation that determine flammability and fire spread.

Running the models for many iterations allowed us to generate a map of the probability of fire occurrence (or burn probability) for each scenario. Comparing the two revealed the change in burn probability due to human influence. Finally, we used this map of the change in burn probability to predict the observed fire record and where forest has expanded into fynbos. It worked!!!

While our models weren't perfect, and could do with many refinements, that we were able to predict the fire record and change in forest extent with some confidence shows that the ignition catchment concept is a useful heuristic for predicting human influence on fire regimes past and future.

With improved models this approach could be used to inform fire and vegetation management in the face of the many global drivers of change, from direct human influence to invasive species (changes on fuel properties) or even climate change (e.g. changes in fire weather).

It is imperative that we improve our understanding of how and where we are altering fire regimes so that this insidious threat to biodiversity can be assessed and the potential impacts managed. Ideally, the ignition catchment framework would be used proactively, informing spatial land use decisions a priori to avert or minimise the impact of human activities on fire regimes and ecosystems.

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Grasses for Pastures

Reprinted From: https://bit.ly/2XLApyV

Marinda Louw

Grasses, also called monocot or narrow-leaf plants, are an important component of pastures. When mixed with legumes in pastures, grasses can reduce the risk of bloat when animals graze the pasture.

Grasses also limit weed growth, can help pastures survive winters and provide good yields. A wide selection of grasses for pastures means that there is a grass suitable to almost any climate or management style.

Grasses, also called monocot or narrow-leaf plants, are an important component of pastures. When mixed with legumes in pastures, grasses can reduce the risk of bloat when animals graze the pasture.

Grasses can be divided into tropical or summer-growing grasses and temperate or cool-season grasses.

Ask any seed company for guidance on the best grasses for pastures to grow in your area and on your soil type.

Summer-growing Grasses for Pastures

Grasses that produce its highest yield and growth in the warmer summers are called summer-growing grasses and are usually planted in the warmer regions of South Africa.

Tuft-forming summer grass

These grasses are not suitable for heavy grazing and have low digestibility. Digestibility is the amount of nutrients an animal can utilise from the pasture.

Examples of tuff-forming grasses are weeping love grass (*Eragrostis curvula*), the permanent pasture and extremely drought-resistant buffalo grass (*Cenchrus cilliaris*) and the finger grass species such as Smuts finger grass (*Digitaria eriantha*).

Weeping love grass is suitable for well-drained acidic soil with a pH of 4 - 7. Buffalo grass prefers soil pH 7 - 8, grows on sandy soil in the wild and is sensitive to aluminum and manganese. The tasty Smuts finger grass grows on shallow rocky soil and sandier soils with a pH of 6 - 7 but struggles on low-fertile soils.

Figure 1: Smuts finger grass (*Digitaria eriantha*) is a summer-growing grass, suitable for grazing, hay or silage. (Photo: © Pannar Saad)

Figure 2: Fast-growing Rhodes grass (*Chloris gayana*) is resistant against nematodes and often used as rotation crop with pineapples or tobacco. (Photo: ©Pannar Saad)

Fast-growing Rhodes grass is well-adapted to a wide range of conditions and produces high yields from its first year of planting. Ideally mixed

with Smuts finger grass.

Creeping grasses

These grass types recover well after heavy grazing but, typical of a summer-growing grass, it has a low digestibility.

Examples of creeping grass types include kikuyu (*Pennisetum clandestinum*) - which prefers fertile soils - as well as the drought tolerant and soil-binding bhai grass or the versatile star grass (*Cynodon species*).

Winter-growing Grasses for Pastures

Temperate pasture plants grow better during cooler seasons such as spring and autumn. These grasses stay green during winter, can tolerate frost and are often more digestible than summer-growing grasses.

Tuft-forming temperate grasses

Choose the right grass for the grazing intensity of your animals. For example, perennial ryegrass can tolerate heavy grazing, but cocksfoot grass (*Dactylis glomerata*) grows better when lightly grazed.

Italian ryegrass (*Lolium multiflorum*) may be grazed for longer than the Westerworld ryegrass.

Ryegrass as a pasture plant needs nitrogen and lots of water.

Tall fescue (*Festuca arundinacea*) is ideal for very wet soils and marshlands and can tolerate acidic soils.

Cocksfoot (*Dactylis glomerata*) is very tasty. This grass can withstand heavy grazing and grows well in southerly slopes and shaded areas, ideal for planting in vineyards and orchards.

Figure 3: An ewe and her twins grazing on Westerworld ryegrass pasture. (Photo: ©Pannar Saad)

From crisis to solutions for communities and African conservation (commentary)

Current Address: [1]Kenya Wildlife Conservancies Association, [2]Mara Wildlife Conservancies Association, [3]Honeyguide-Tanzania, [4]WWF-Namibia [5]Maliasili
Reprinted From: https://bit.ly/3diLuxF

Dickson Kaelo[1]; Daniel Sopia[2]; Damian Bell[3]; Richard Diggle[4] and Fred Nelson[5]

- *The COVID-19 pandemic has created a profound crisis for conservation efforts in eastern and southern Africa as a result of the sudden cessation of all international travel in a region where nature-based tourism and conservation are closely interdependent.*
- *Conservation leaders Dickson Kaelo, Daniel Sopia, Damian Bell, Richard Diggle, and Fred Nelson argue that the way that conservationists respond to both the near-term crisis and the longer term implications of the unfolding pandemic will be pivotal for the future of Africa's wildlife.*
- *The crisis, they write, is also an opportunity to question inherited assumptions, refine existing models, and improve conservation practices.*
- *This post is a commentary. The views expressed are those of the author, not necessarily Mongabay.*

Figure 1: Maasai landowners have earned nearly $5 million last year from conservancy lease fees. Photo: Felipe Rodriguez

The coronavirus (covid-19) pandemic has created a profound crisis for conservation efforts in eastern and southern Africa as a result of the sudden cessation of all international travel in a region where nature-based tourism and conservation are closely interdependent. The region's unique wildlife populations and other natural assets — centered on spectacular landscapes such as the Serengeti and Okavango — underpin a multi-billion dollar 'wildlife economy' that has surged in recent decades.

The growing economic value of wildlife tourism across the region has helped spur governments, private landowners, and local communities to all make growing space for wildlife through conservation areas and investments.

One of the most important regional trends is the expansion of conservation initiatives on community lands, often as a result of the interest by local people in creating new economic opportunities from wildlife tourism. In Kenya, local conservancies created by private or community landowners now span over six million hectares, an equivalent land area to the entire extent of the country's national parks and reserves.

A recent World Bank report found that these areas earn about $12 million annually from tourism, while helping build a national tourism industry that accounts for about 9% of the country's GDP. Around the Maasai Mara, Kenya's most important wildlife area, over 14,000 Maasai landowners earned nearly $5 million last year from lease fees paid by tourism ventures operating on about 15 conservancies.

Namibia, which created communal conservancies in the mid-1990s as a way to grant rights over wildlife to rural communities, now has over 16 million ha - about 20% of the country's total land area - in these locally managed wildlife areas. These conservancies have played a key role in the recovery of the country's wildlife, including the tripling of its elephant population since the early 1990s, and in catalyzing tourism investment and other wildlife utilization in remote rural areas. Communal conservancies generated roughly $11 million in

Figure 2: Wildebeest. Photo: Felipe Rodriguez

returns and benefits from wildlife, and over 5,000 jobs, in 2019.

Other countries, such as Tanzania, are also recording important progress and evidence of wildlife recoveries in community-managed areas. Ultimately nearly every country in the region depends on local communities valuing wildlife and supporting conservation, if the large landscapes and free-roaming wildlife are to persist as a unique feature of eastern and southern Africa.

It is against the backdrop of growing regional momentum for community conservation that the current crisis is unfolding. In the near-term, the loss of nearly all tourism revenue may lead to a near-term surge in poaching and illegal wildlife use, and potentially the conversion of private and community conservancies to alternative land uses. In the longer term, the crisis poses major challenges around the economic model that has driven conservation in eastern and southern Africa over the past 20 years, and its future viability.

The way that conservationists respond to both the near-term crisis and the longer term implications of the unfolding pandemic will be pivotal for the future of Africa's wildlife. The stakes are high not only in conservation terms, but for billions of dollars of economic investment and future opportunities related to tourism and other nature-based enterprises.

As in any crisis, the pandemic creates urgency for conservationists to be creative and responsive, even while overcoming the many practical challenges that have accompanied the public health measures instituted over the past two months. The crisis is also an opportunity to question inherited assumptions, refine existing models, and improve conservation practices. While it is still early in the response, a number of important themes are emerging from the crisis that may help mitigate near-term fallout, but also ultimately pave the way for a more resilient approach to conservation efforts across the region.

Diversifying Income

Even before the current pandemic, conservationists working in eastern and southern Africa were increasingly concerned about the need to diversify revenue sources for communities from wildlife beyond tourism, to encompass a wider suite of nature-based products and enterprises. A recent report from the Luc Hoffmann Institute documents a range of different models for generating conservation incentives, and is even more timely in light of the current loss of tourism revenue.

As a recent Mongabay article featuring Carbon Tanzania's work describes, new markets such as forest carbon that can diversify incomes from conservation efforts beyond wildlife tourism can be a key part of negotiating the current crisis and laying the basis for more resilient nature-based economies. Other innovative measures to link external payments to wildlife conservation outcomes, such as camera trapping payment schemes or the 'wildlife credits' initiative in Namibia, also need to be refined and expanded.

Despite the current collapse of tourism, the tourism sector cannot be written off, as its resilience and capacity to rebound presents an opportunity for the future. However, tourism models need to be rethought and redesigned to maximize benefits for conservation and local economies. The pandemic's disruption, as well as the likely future constraints on travel from climate change, creates pressure for the kind of high-value, low-volume tourism models that countries such as Botswana have championed.

Indigenous Values and Livelihoods

Critically, not all community conservation initiatives depend on commercial economic values as the main driver of local stewardship. Thousands of indigenous and local communities around the world protect their territories due to a combination of cultural values and locally rooted livelihoods.

In East African savannahs, wildlife living outside national parks and protected areas lives alongside pastoralist communities' livestock, and in landscapes that have long been managed through indigenous grazing systems.

Conservation initiatives that build on these locally-rooted land management practices, such as those in Kenya's South

Figure 3: Photo: Felipe Rodriguez

Rift Valley, are inherently less reliant on tourism revenues and more grounded in local communities' day-to-day livelihoods. Strengthening these links between pastoralist livestock production, rangeland management, and wildlife conservation- and amplifying the value of healthy rangelands to livestock in these savannah landscapes- will make community conservation areas more resilient.

Moreover, the current crisis is a reminder of the importance of local ownership and rights in the design of community conservation ventures. Namibia's communal conservancies were originally premised not entirely on material values, but on the post-apartheid social justice imperative of returning ownership of wildlife to local communities who had been dispossessed of those rights by a colonial regime, just as took place all across Africa during the colonial era.

Devolving rights over wildlife and other valuable natural resources back to local communities has proven to be a major political challenge across Africa, sometimes resulting in tendency to avoid these deeper governance issues and focus primarily on economic values and benefits.

But the current crisis, when government resources for law enforcement will be stretched to the breaking point and local community decisions will largely determine conservation outcomes, highlights the importance of giving communities greater legal authority for making those decisions.

The current crisis is an opportunity for conservationists to return to a greater focus on these core issues of legal and policy reform and local ownership over wildlife and other natural resources.

Stronger Collaborations

To solve the challenges facing many conservation efforts, diverse actors such as local communities, government agencies, researchers, businesses and NGOs all need to come together to develop shared solutions. With the right leadership, the pandemic could lead to improved relationships and lasting new collaborations that in the longer run can achieve the kinds of large-scale changes that conservation needs.

For example, government, conservationists, and private tourism interests in Namibia have come together quickly to develop strategies to address the massive loss of tourism and trophy hunting revenue for conservancies and the potential unemployment of thousands of community game scouts, as well as local tourism lodge employees. This has built on Namibia's strong long-term partnerships between government, leading local Namibian conservation organizations, and international groups such as WWF.

Similarly, in Kenya government and civil society leaders have been meeting frequently to develop collaborative and coordinated responses to the crisis. In the Maasai Mara, where local conservancies face the loss of millions of dollars of income, private tourism companies, grassroots organizations such as the Maasai Mara Wildlife Conservancies Association, and international funders have rapidly come together to develop an emergency response that aims to keep the conservancies afloat through a range of financing structures.

Financing Conservation

The pandemic highlights the importance of having long-term financing for conservation efforts that are not solely dependent on month-to-month tourism revenues. While there has been a rapid growth in long-term conservation trust funds around the world over the past decade, there are relatively few that support community areas on a meaningful scale.

In Namibia, the Community Conservation Fund of Namibia was recently launched to fill that gap, and provide long-term financing for conservancies. The crisis has similarly brought a similar conservancies financing mechanism — called for in the 2013 Wildlife Conservation Act — back onto the government agenda in Kenya, as policy makers now recognize the critical importance of conservancies in places like the Maasai Mara to a national tourism industry worth over $1.5 billion annually.

More broadly, navigating the crisis will require African governments to pro

vide greater public investment in tourism and wildlife, in order to enable the sector's recovery over time. Wildlife tourism delivers huge value in jobs, tax revenue, and wider impacts across the economy, but tends to receive very little public investment. While creating new targeted financing mechanisms, as with the Namibian and Kenyan examples, is ideal, governments can also more easily remove financial disincentives, such as high levels of effective taxation of community wildlife ventures, which have long constrained such initiatives in countries like Tanzania and Zambia.

As the pandemic unfolds, the ability of critical conservation initiatives on the ground to adapt and sustain Africa's unique wildlife will depend on collaborative local efforts coupled with strong national leadership from both civil society and government.

Even while the focus remains on near-term mitigation of the most pressing threats, such as a rise in poaching and human-wildlife conflict, conservationists in Africa need to look at the crisis as an opportunity for strengthening existing models, mindsets, and investments in conservation. Approached in this way, the crisis could lead to more resilient and effective strategies for lasting conservation of the region's wildlife.

Figure 4: Zebra in Rwanda. Photo: Rhett A. Butler

Figure 5: Sunset in East Africa. Photo: Felipe Rodriguez

Slowing down the rotation protects pasture yield

Current Address: [1]Forage and Grazing Specialist, Field Crop News [2]Omafra Beef Cattle Specialist
Reprinted From: https://bit.ly/2zA9ZYT

Christine O'Reilly[1] and James Byrne[2]

Grass doesn't just happen. Maximizing pasture yield requires management, and one of the most important decisions a manager can make is to give their grass enough time to fully recover after being grazed. Pastures have fully recovered from a grazing event when the grass plants have 3-4 new leaves. At this stage they are palatable, nutritious, and have had time to store energy in their roots and lower stems to fuel regrowth the next time they are grazed.

However, sometimes pastures do not recover from grazing as quickly as producers would like. Often this happens when there is a lack of sunlight, cold conditions or not enough rainfall. In these situations, grazing managers should look for ways to slow down their rotation, which is another way of saying that they are making the rest period for each paddock longer. But this also means how animals are fed must also change to meet their nutritional needs.

There are two primary ways producers could slow down their rotation: add acres to the grazing platform or feed supplemental forage.

Add acres to the grazing platform

Increasing the acreage being grazed enables producers to give each paddock a longer rest. Grazing a hay field is one option, particularly if the yield potential of the hay crop is low. In these situations, it may be difficult to justify the cost of running equipment across the field, even though the crop must be harvested to prevent the plants from reaching maturity. Once forages set seed, their regrowth potential is much less than if they are maintained in the vegetative growth stages. While many producers normally take a first cut and graze the regrowth, consider changing the order in which these are done to maintain yield potential and forage quality. The decision to graze a designated hayfield must account for the likely impact on future winter hay supplies of not cutting that field for hay, considering the yield potential of that hayfield balanced against the cost of providing stored forage on the existing grazing platform.

Annual crops are another way to increase the size of the grazing platform. Cereals and Italian (annual) ryegrass can be managed much like perennial grasses in a managed grazing system, although the amount of regrowth depends very much on rainfall. Warm-season grasses, like sorghum-sudangrass or millet, can also be grazed. Because sorghums,

Figure 1: Cattle in a rotational grazing management system

sudangrass, and their hybrids produce prussic acid when stressed, these grasses need to be strip-grazed with a back fence to prevent livestock from eating the new regrowth before it is 60 cm (24 in.) high. Forage brassicas contain lots of protein and very little fibre, so are best planted in a mixture with grasses or cereals to prevent bloat.

It must be borne in mind that the grazing of small grain cereals or warm season annuals requires planning, (as these crops must be sown and allowed a number of weeks to grow before grazing), and so are best used in situations where forage shortages are expected.

Winter wheat fields that did not overwinter well may be an option, but producers need to clear the change of use on insured acres with Agricorp before they start grazing. Carefully read the labels of any crop protection products used on the wheat to ensure the crop is safe to graze.

Often expanding the grazing platform involves using fields that do not have livestock infrastructure in place. For cattle, a semi-permanent exterior fence can be constructed from high-tensile wire and T posts, then subdivided using reels of polywire and step-in posts.

For sheep, electric netting or multiple strands of polywire are options. Regardless of species, producers need to train their livestock to the electric fence before putting them onto these fields, and make sure that the fences stay hot the entire time livestock are grazing.

While water trucks are a labour-intensive option, they are often the cheapest way to bring water to livestock on fields without infrastructure. Depending on the field, it may be possible to run temporary, above-ground water lines from a well source, or pump from a body of water. Each situation is unique, so producers must cost out the options available to them.

Feed supplemental forage

It may seem counter-intuitive to protect forage inventories by feeding stored forage on pasture. But if the goal is to maximize the amount of forage grown on the farm, sometimes this is necessary to prevent overgrazing, protect pasture yield and to provide livestock with enough feed to meet their nutritional requirements.

The trick to making this work is to be proactive about feeding forage and use it as a tool to slow down the rotation. Waiting until the pasture has run out of grass results in feeding more stored forage overall.

The amount of stored forage that needs to be fed depends upon the daily feed requirements of the livestock and how quickly your pastures are growing. Pasture growth rate will determine how long you need to feed and consequently the total amount you require.

In the case of beef cattle, mature beef cows will consume approximately 2% of their bodyweight in DM every day, whereas beef cattle under 2 years of age consume approximately 2.5% of their bodyweight in DM every day. Therefore, it's important to have a good estimation of the bodyweights of the animals on your farm to determine your daily requirements.

Where feeding supplemental forage is a short-term solution to a short-term problem, the impact on livestock should be minimal and no additional feed, apart from the supplemental forage, will be required. But, if the lack of available pasture is a more long-term problem, place thinner animals and cows with very young calves into a separate group and provide some concentrate feed in addition to supplementary forage.

To maintain performance on older calves that are closer to their sale date considering providing an area separate from the cows where these calves can access some concentrate feed. This will have the duel effect of both maintaining animal performance and reducing forage demand.

Avoid the temptation to feed old musty forage. This will create more problems than it solves. In addition, animals should have access to both salt and mineral to maintain good animal health.

Slowing down the grazing rotation provides a longer rest period for pastures. Achieving this can be done by increasing the number of acres grazed, feeding supplemental forage on pasture, or a combination of the two. It is never too late to start rotational grazing, and the grass will be more productive for having a rest.

Grass veld of the Free State (near Vrede)
© Malissa Murhpy

Covid-19 or the pandemic of mistreated biodiversity

Current Addresses: [1]Directeur de recherche CNRS, systématicien, ISYEB - Directeur de l'Institut de Systématique, Evolution, Biodiversité (CNRS, SU, EPHE, UA), Muséumnational d'histoire naturelle (MNHN) & [2]Professeur, UMR ISYEB (Institut de Systématique, Évolution, Biodiversité), Muséum national d'histoire naturelle (MNHN)
Reprinted From: https://bit.ly/2XduflB

Philippe Grandcolas[1] and Jean-Lou Justine[2]

The whole world has been affected by the Covid-19 pandemic – we all fear for our own health, that of our loved ones and also those who are most vulnerable. In the span of just a few weeks, Covid-19 suddenly become more urgent than the crises of ongoing climate change or the dangerous decline in biodiversity.

Catastrophic events that once monopolised world attention, such as the forest fires in Australia, suddenly seemed less serious than a pandemic that could touch all of us, immediately, in our own homes. However, like other major epidemics (AIDS, Ebola, SARS, etc.), the emergence of the coronavirus is not unrelated to the climate and biodiversity crises we are experiencing. What do these pandemics tell us about the state of biodiversity?

New pathogens

Humankind is destroying natural environments at an accelerating rate. Between 1980 and 2000, more than 100 million hectares of tropical forest were felled, and more than 85% of wetlands have been destroyed since the start of the industrial era. In so doing, we put human populations, often in precarious health, in contact with new pathogens. The disease reservoirs are wild animals usually restricted to environments in which humans are almost entirely absent or who live in small, isolated populations.

Due to the destruction of the forests, the villagers settled on the edge of deforested zones hunt wild animals and send infected meat to cities – this is how Ebola found its way to major human centres. So-called bushmeat is even exported to other countries to meet the demand of

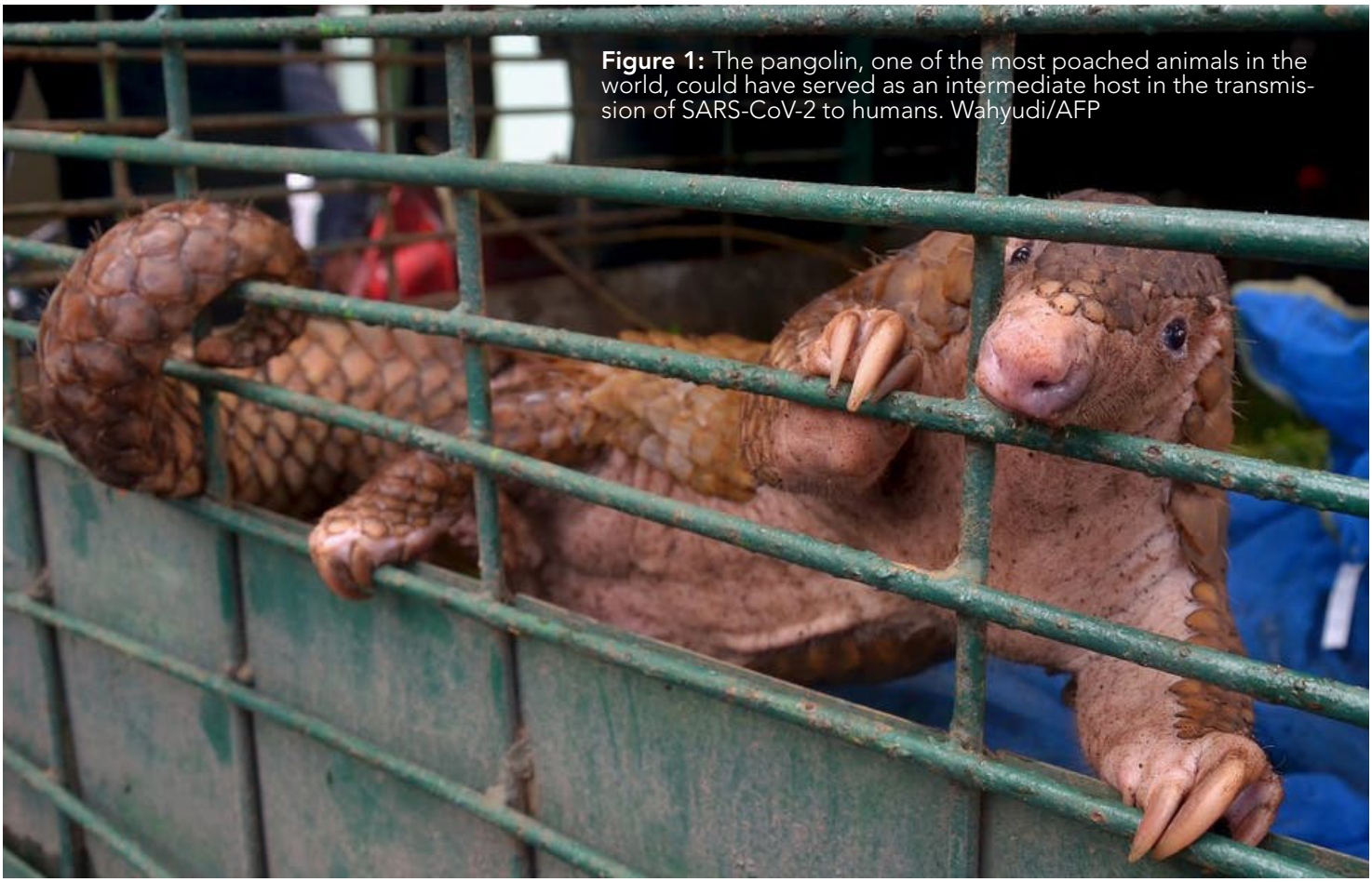


Figure 1: The pangolin, one of the most poached animals in the world, could have served as an intermediate host in the transmission of SARS-CoV-2 to humans. Wahyudi/AFP

expatriates and thus spreads the health risk far from remote areas.

We shamelessly hunt exotic and wild species for purely recreational reasons – the appeal of rare species, exotic meals, naive pharmacopeia, etc. The trade in rare animals feeds the markets and in turn leads to the contamination of urban centres by new maladies. The epidemic of severe acute respiratory syndrome (SARS) rose out of the proximity between bats, carnivores and gullible human consumers. In 2007, a major scientific article stated:

"The presence of a large reservoir of SARS-CoV–like viruses in horseshoe bats, together with the culture of eating exotic mammals in southern China, is a time bomb."

This time bomb seems to have exploded in November 2019 with the Covid-19.

The danger of zoonoses

The consumption and import/export of exotic animals have two major consequences. First, they increase the risk of an epidemic by putting us in contact with rare infectious agents. While they're often specialized by species and thus cannot defeat our immune system or even penetrate and use our cells, trafficking and confinement of diverse wild animals together allows infectious agents to recombine and cross the barrier between species. This was the case for SARS and may have been the case for Covid-19. Beyond the current crisis, this risk is not marginal: It should be remembered that more than two-thirds of emerging diseases are zoonoses, infectious agents that can pass between animals and humans. Of these, the majority comes from wild animals.

Second, capturing and selling exotic animals puts enormous pressure on wild populations. This is the case with the pangolin, recently brought to light by the Covid-19 pandemic. The eight species of this mammal, which is found in Africa and Asia, are poached for their meat and scales despite their protected status. More than 20 tonnes of meat are seized each year by customs, leading to an estimate of around 200,000 individuals killed each year for this traffic.

Humanity is thus doubly endangering itself: We are enabling the creation of emerging diseases and also destroying the fragile biodiversity that provides natural services from which we benefit. The circumstances of the emergence of these new diseases can be even more complex. This is how Zika and dengue viruses are transmitted by exotic mosquitoes transported by humans through international trade. The trade in used tires in which water collects and allows aquatic mosquito larvae to develop and be transported is particularly criticized. Here the disease does not spread by a first direct contact between the human species and reservoir animals followed by intra-human transmission, but it is transmitted to the human species by vector mosquitoes, the latter moving efficiently with our help.

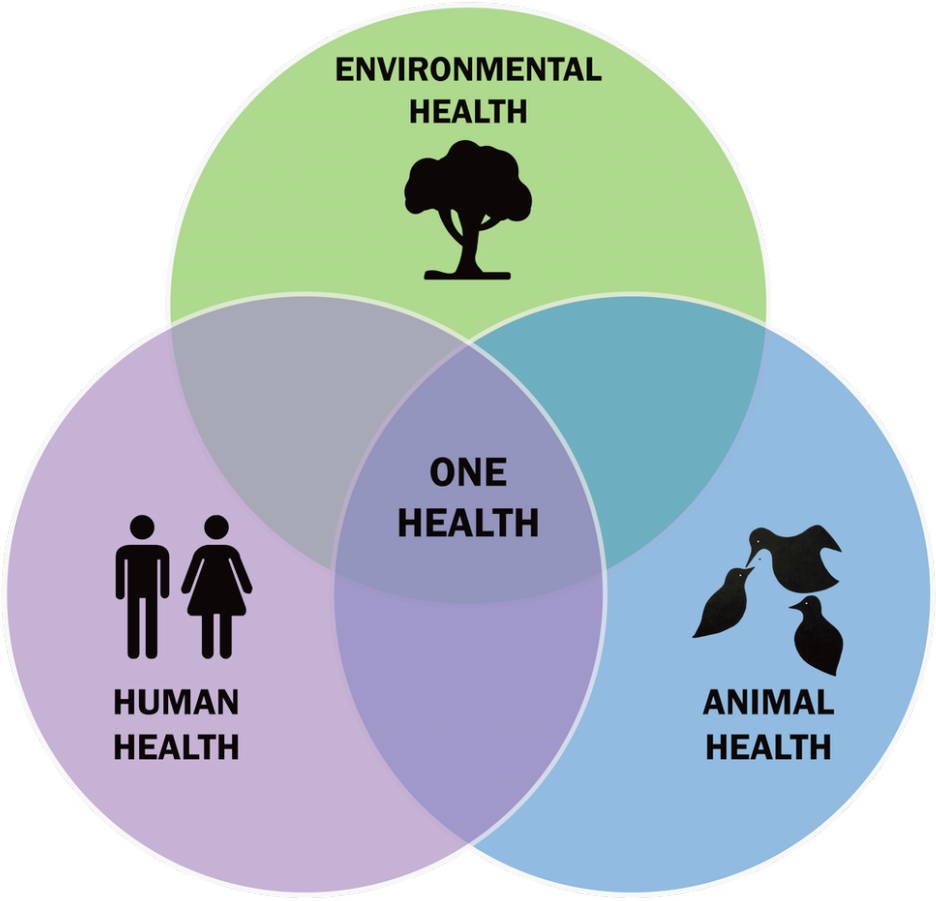


Figure 2: The 'One Health' initiative seeks to promote optimal health for people, animals and the environment. Wikipedia

Managing human and environmental health

The World Health Organization's "One Health" initiative advocates managing the issue of human health in relation to the environment and biodiversity. It has three main objectives: combating zoonoses, ensuring food safety and fighting antibiotic resistance.

This initiative reminds us that we cannot live in an artificial cocoon, never be in contact with biodiversity whether it be wild, raised or grown. Two of the initiative's three targets – food security and zoonoses – are directly related to the current Covid-19 crisis. We should not create dangerously unsustainable food circuits, whether it be importing exotic species or feeding unnatural products to farm animals – this was what led to mad cow disease, after all.

The causes of the biodiversity crisis are well known and so are the remedies. First and foremost is stopping the destruction of the environment – deforestation, the world trade in any commodity or living species, the transport of exotic animals – for short-term gain, often just a few percentage points of profitability compared to local production.

The world after Covid-19

Voices are starting to be heard that that the "world will not be the same after Covid-19". So let's integrate into this "next world" a greater respect for biodiversity. It's our greatest immediate benefit!

The world that we will leave to our children and grandchildren will experience deadly new pandemics, that is unfortunately certain. How many will there be depends on our efforts to preserve biodiversity and natural balances, everywhere on the planet. Beyond the current human tragedies, one can at least hope that Covid-19 has had the positive effect of raising this awareness.

This article is published in collaboration with researchers from the ISYEB (Institute for Systematics, Evolution, Biodiversity of the National Museum of Natural History, Sorbonne Université).

Taking stock of the impact of the 2014-9 drought on the biodiversity of Phalaborwa

Current Addresses: SAEON Ndlovu Node, Phalaborwa Gate, Kruger National Park
Reprinted From: https://bit.ly/2ZS6kAe

Dr Anthony M Swemmer and Rion Lerm

The small town of Phalaborwa (Limpopo Province) is encircled by a diversity of land-use types, including a national park, private game reserves, rural rangelands and mining.

From 2012 to 2019, staff and students of the SAEON Ndlovu Node conducted a range of surveys on various plant and animal groups inhabiting these areas, and the recent drought provided a rare opportunity to record how ecological disturbance interacts with drought.

While numerous plant species have suffered, results of many of the animal taxa show a surprisingly high level of resilience.

Much of this work was funded by the Palabora Mining Company, and the project focused on comparing the biodiversity of the extensive rehabilitation areas of the mine with neighbouring protected areas.

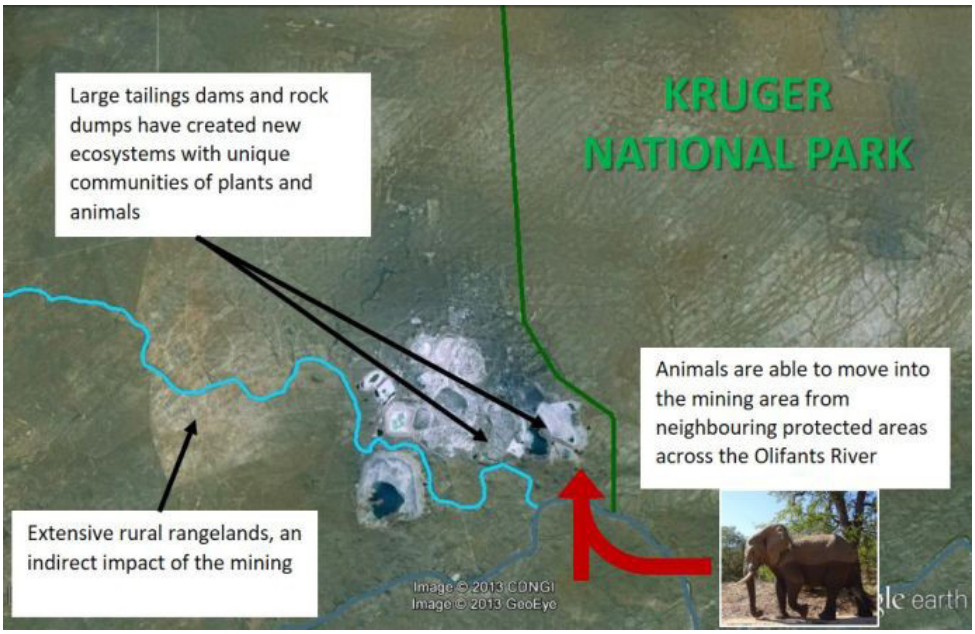
The largely unrestricted movement of animals into the mining area has meant that rehabilitation in these areas has proceeded in the presence of natural herbivores such as elephant, buffalo, kudu and blue wildebeest, which regularly move up onto man-made structures to feed.

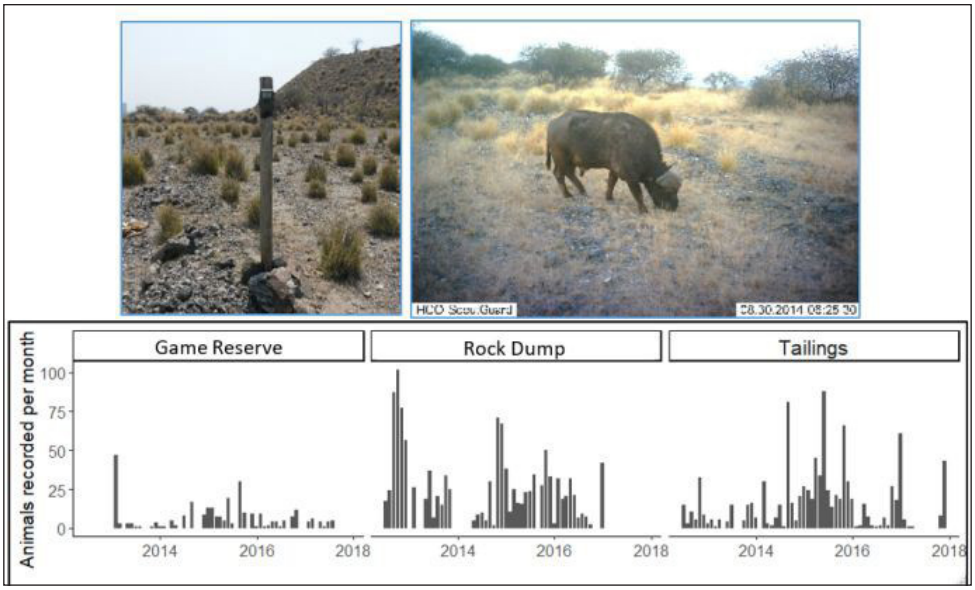
A camera trap network operated by SAEON from 2012 to 2018 recorded a remarkable 22 species of large mammals on each of the mine rehabilitation areas, compared with 33 in a neighbouring game reserve.

A few of these species, such as buffalo, were recorded more frequently on the rehabilitation areas than in the natural areas next door, including during the drought years.

Bird surveys conducted by the node's technician, Rion Lerm, revealed that the diversity of birds was little affected by the drought, with more species recorded at the end of the drought than at the start at some sites.

Figure 1: The recent drought in the Phalaborwa area provided a rare opportunity to record how ecological disturbance interacts with drought (Photo: Shutterstock)





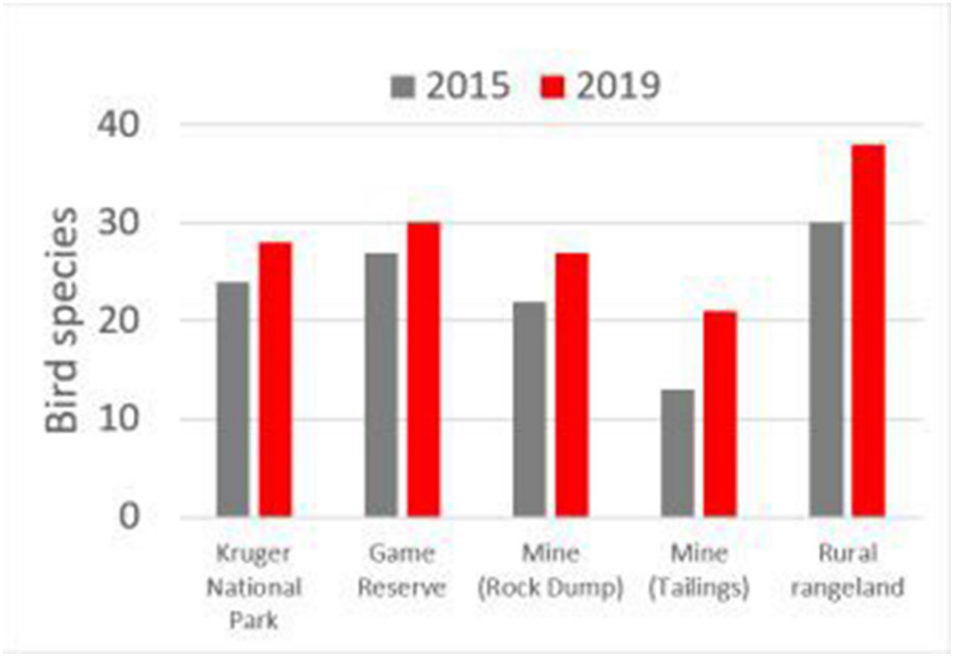


Figure 5: Bird surveys revealed that the diversity of birds was little affected by the drought

Vegetation surveys initially conducted by SAEON students from North-West University, and recently repeated by SAEON MSc student Clarissa Minnaar, revealed the severity of the impact of the drought on the productivity and diversity of herbaceous plants (grasses and forbs). While the rehabilitation areas have always supported a far lower number of species, reductions in species richness were fortunately not as severe there as in the neighbouring protected area.

Other surveys conducted over the past seven years, on dung beetles, dragonflies, reptiles, amphibians and rodents, have produced additional baseline data which can be used for future studies on long-term changes in the biodiversity of competing land uses.

Figure 3: The sabota lark, one of the common bird species in the area (Copyright: Rion Lerm)

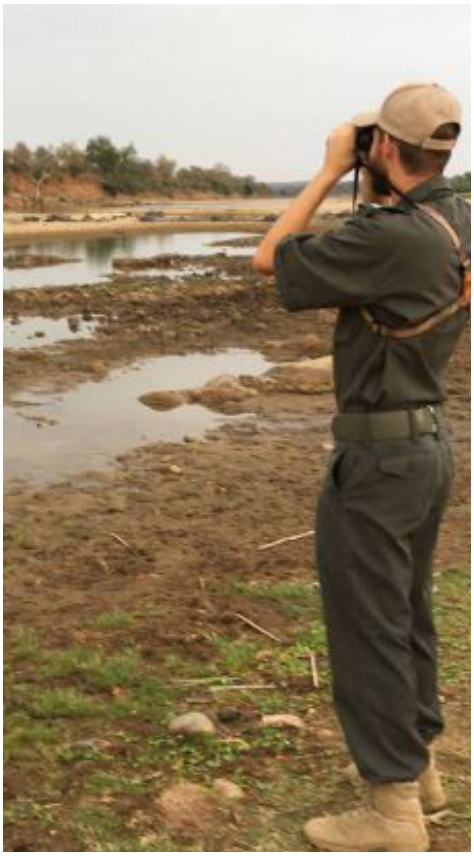


Figure 4: The Ndlovu Node's technician, Rion Lerm, conducts a bird survey (Copyright: Rion Lerm)

Put down that veggie burger. These farmers say their cows can solve the climate crisis

Current Address: CNN

David McKenzie and Brent Swails

Reitz, South Africa (CNN) Danie Slabbert points toward the cattle that brought his farm back to life. Down the slope ahead of him, 500 black Drakensberger and mottled Nguni cows graze cheek by jowl.

The Free State farmer gestures with his giant shepherd's crook.

"If cattle are part of nature, like they are now, then my cows are keeping the system alive," he says. "How could you think that meat is the problem?"

Calls for plant-based diets to save the planet from the climate crisis are growing louder. But there is another, quieter, revolution reshaping the agricultural world. Farmers like Slabbert and their supporters say that what people eat is not as important as how they farm. They believe cattle and cropland could help save the planet. "I have become a steward of this land and the cows are the key," Slabbert says.

Mimicking the migration

Before settlers arrived with their guns and wagons, this part of what is now South Africa's Free State province was an immense grassland. More than 30 species of grass anchored the rolling plains; fodder for millions of migrating antelope.

Over time, the wild herds were shot out and much of the plains became corn and potato fields.

There is still plenty of grassland here, or veld, as South Africans call it. Farmers such as Slabbert are looking back to those immense herds to recreate the natural cycle. "What we are doing is trying to mimic nature," he says, explaining that 200 years ago, huge herds of animals would have moved over this veld, avoiding predators in their tightly packed groups."

Slabbert says he has rejuvenated the land

Figure 1: Danie Slabbert walks along a low voltage wire that keeps 500 cattle grazing in a dense herd to replicate bison or antelope herds. The high-intensity grazing helps with natural fertilizing and grass health.

Figure 2: Five hundred cows and a few oxen graze in tight formation in a penned off part of Danie Slabbert's veld. The cows must eat all the grass, allowing better grasses to survive. Counterintuitively, though well proven with multiple studies, the more cattle he has in this system (to a point), the better the soil and grassland health.

Figure 3: In this farming system, the corn is tightly packed. The fields can look less uniform, but the yields are often strong.

Figure 4: A tiny Dung Beetle crawls over Danie Slabbert's hand. "These are one of the heroes of the story, he says. By limiting pesticides, natural biological systems that include dung beetles, earth worms and micro-organisms help rejuvenate soil health.

by drastically increasing his cattle herd. He hems the animals into a rectangular patch of grassland with a low-current wire. For several hours, they eat all of the grasses they can find before the wire lifts, and the cattle rapidly move into a new section.

They are always moving, never selectively eating, just like a migratory herd. The method is called ultra-high density grazing. "These cattle are replenishing the land," Slabbert says.

As they eat, the cows do what livestock do. Slabbert kneels down, pulls apart a pile of cow dung, and tenderly picks out a beetle. It lies dormant for a second, then uncurls its legs and strolls across his hand. "These guys are one of the heroes of the story," he says, as he gingerly places the dung beetle into its hole. The small insects break up the dung, the big ones haul the natural fertilizer deeper into the soil.

Conventional thinking says that cows are bad for climate change. After all, livestock contribute to around 14% of all global emissions. Researchers at UC Davis estimate that a single cow can belch around 220 pounds -- roughly 100 kilograms -- of methane each year. There are more than a billion cows on the planet, so that is a lot of (greenhouse) gas.

But cows didn't evolve to sit in feedlots getting fat. Their wild relatives were out in the grassland in large numbers, just like on Slabbert's farm.

Researchers at Texas A&M University led by Professor Richard Teague found that even moderately effective grazing systems put more carbon in the soil than the gasses cattle emit. Around 30% to 40% of the earth's surface is natural grassland, and Teague says the potential for food security is immense. "We studied farms and ranchers that had the highest soil carbon, and, with no exception, they managed their land following the principles where they were trying to do exactly what the bison did. They were trying to improve their land and their profits," Teague said.

It's all about the soil

The key to climate sustainable agriculture is the soil, because soil has an extraordinary ability to store carbon. There is more than three times as much carbon in the world's soils than in the atmosphere, and scientists say that with better management, agricultural soils could absorb much more carbon in the future.

Even a change of a few percentage points would make a huge difference to the battle against the climate crisis. There is an upper limit to how much carbon soils can carry, but it can take decades to get to that point.

Plants absorb carbon from the atmosphere through photosynthesis, and then put it in the soil through their roots. More carbon is stored in the ground through organic matter and microorganisms. Taking CO^2 out of the atmosphere is important, because humans put so much of the greenhouse gas in, for example through burning fossil fuels.

But to be able to store carbon, soil needs to be alive and left relatively undisturbed.

For decades, farmers across the world have ploughed their fields, pumped them with fertilizers and sprayed herbicides. Soil doesn't need to be alive with modern agriculture; it became a medium for inputs. But it also lost its carbon along the way.

Many farmers and scientists say that the chemical revolution came at a cost and they want to bring the soil back to life. They believe that living soil harnesses sustainable yields and will help the planet.

And to do that, they must combine cattle with crops.

In North America and in South Africa commercial agriculture, crop farming and cattle ranching are generally done by different farmers on different land.

The key to regenerative farming is combining the two. Slabbert never ploughs his corn fields or leaves them fallow, so he is able to keep the carbon in the soil. The corn is tightly packed -- he doesn't need to get in there to spray.

In this farming system, the corn is tightly packed. The fields can look less uniform,

Figure 5: Farmer Danie Slabbert stands in one of his corn fields. The corn is tightly spaced, and he grows a cover crop under the corn that rises when the corn is harvested. In the winter, cows graze on the remaining plants. "Using the livestock is about closing cycles," he says.

but the yields are often strong.

In winter, his cattle herds will come here too and eat the residual corn, depositing natural fertilizer as they go. Slabbert has reduced his fertilizer and chemical input costs drastically, but his yields stay strong.

This begs the question, why isn't everyone doing it?

Stacked against their favor

For one, shifting away from chemicals takes time. It can also lead to reduced yields in the short term. The pressure to produce more crops has transformed the agricultural land. Large swathes of land are now used to grow just one crop at a time.

In production terms, that recipe has worked. In the US alone, agricultural production grew by 170% between 1948 and 2015 according to the US Department of Agriculture.

But while it leads to higher yields in the short-term, multiple studies show that ploughing, fertilizing and using chemical pesticides on the soil dramatically inhibits its long-term health.

The US Department of Agriculture estimates that in 2015, US farmers used 22 million short tons of fertilizer for plant production, or around 44 billion pounds (nearly 20 billion kilograms).

For Art Cullen, a Pulitzer-prize winning journalist reporting from the heart of Iowa's corn country, the industry servicing agriculture is the problem itself. Cullen has spent a career living among, listening to and reporting on farmers.

The editor of the Storm Lake Times, his writing has challenged powerful industrial agricultural interests in the state. "What is really preventing the change, is all the money that is lined up. There is a lot of money invested in the agri-chemical supply chain," says Cullen.

He says there has historically been little incentive for companies to embrace farming that limits chemicals and rejuvenates soil. And in the US, farmers are subsidized by the government to plant more corn and other crops than the market demands.

"We can actually solve the climate crisis by sequestering carbon in the soil and paying farmers to do it. And if you say to a farmer that you will pay him a dollar more to plant grass and sit on his butt, then he is going to take that deal every time," he says.

Cullen says that strategy depends, in part, on who occupies the White House, but he says market forces will eventually drive widespread change in North America just as natural forces are driving change in Southern Africa.

"We cannot ignore this issue much longer. Nature is demanding that we change," he says.

Surviving the crisis

Unlike in the US, South African farmers don't get any subsidies to speak of. They need to make their farms work or they will be out of a job.

In the area where Slabbert farms, temperatures are rising at a rate double of the global average. Severe droughts in recent years have wiped out multi-generational farms and livelihoods. "In Africa especially, we are feeling the heat. So climate change is an issue for us. I am not really a biologist or a scientist, but I can see the change in my short lifetime," says Slabbert.

Research has shown that when droughts hit, regenerative farmers often survive while others go under. Their land retains water better and grazing systems make the grass more robust.

Slabbert's farm is better at surviving climate change. And on a global scale, farming like this could help solve climate change.

"We need to go back to our roots as farmers and as people connected to the land and soil," he says. "Change is very difficult and it will take time. But change will happen -- it will have to happen."

Rootin', poopin' African elephants help keep soil fertile

Reprinted From: https://bit.ly/2TT3KWK

Erik Stokstad

The iconic wildlife of the African savanna—zebras, gazelles, and other grazers—has for decades been under pressure from some unnatural rivals. Ranchers' cattle compete with local wildlife for food and water, and they starve much of the soil of nutrients. But a new study suggests wildlife and cattle can coexist—if elephants remain to help distribute nutrients into the soil, via their poop and their habit of knocking over trees.

Cattle ranching, which has been intensifying across the savanna, can lead to overgrazing, eroding and impoverishing the soil and helping shrubs invade the grasslands. The damaged ecosystem provides less food for wildlife and cows alike. A significant cause is that cattle herds don't "give back" to the land in the form of fertilizer. Instead, their dung and urine accumulate in small corrals where they spend their nights sequestered from lions and other predators. In general, when livestock numbers in the savanna increase, wildlife numbers go down.

To investigate the ecological effects of ranching—and the role of elephants in the ecosystem—scientists launched a long-term experiment in 1995 at the Mpala Research Centre in central Kenya. There, herds of up to 120 cows graze in fenced areas, each about the size of four soccer fields. (The cattle still spend nights in corrals outside the experimental plots.) Some of these grazing areas exclude all wildlife. Others have tall electrified fences that let in gazelles, zebras, and similar-size grazers, but not elephants. And still others included cattle, medium-size wildlife, and elephants. "Creating those kinds of combinations [of cattle and wildlife] is really, really difficult to do," says Mark Ritchie, an ecologist at Syracuse University who was not involved in the research.

Judith Sitters, an ecologist at the Free University Brussels, visited Mpala in 2015. She analyzed soil and vegetation samples from each of the areas - plus a plot that had no cattle - to see the impact of livestock and wildlife on nutrient levels. She was surprised to find nearly twice as much carbon in the soil in grazing areas that included elephants, compared with those without them. Soil nitrogen was also much higher when elephants were present, providing additional nutrients for plant growth, she and colleagues reported last month in *Nature Sustainability*. Those levels were similar to measurements for plots that had no cattle at all. "We didn't expect that there would be such a positive impact from these elephants," Sitters says.

Figure 1: Elephants at Mpala Research Centre help keep the soil fertile even though cattle remove nutrients. © Dino J. Martins

More soil nutrients had a knock-on benefit. Sitters and colleagues found that a common grass (*Brachiaria lachnantha*) contained about 50% more nitrogen in the grazing areas with elephants than the areas without them, making that grass more nutritious. That should benefit both cows and wild herbivores, Sitters says, but it's especially good for smaller wildlife, such as gazelles. All of this emphasizes the key role of elephants in the functioning of an ecosystem, Sitters says. Ritchie calls their impact "pretty surprising and striking."

One reason is that elephants don't remove many nutrients from the soil because they defecate in the plots where they graze. That's true of the other wild grazers, but elephants have another important habit: They sometimes knock over trees to eat leaves and branches. That vegetation decomposes, adding nutrients to the soil. Sitters estimates that such vegetation is enough to account for about 19% of the extra nutrients. (The team wasn't able to account for all the sources of extra carbon and nitrogen). Elephants also chow down on grasses that cows prefer, reducing the amount of grass - and nutrients - that cattle in the mixed plots could remove.

The findings add to evidence that wildlife can coexist sustainably with livestock. "If you have elephants, then it's no problem to also have cattle, as long as you don't overstock them," Sitters says.

The study can't say whether elephants can compensate for damage caused by larger herds. The number of elephants in Kenya has been increasing, but populations remain threatened by poaching in other countries. Elephants sometime annoy people, especially when they raid crops. So the finding that the giant animals help keep soil fertile and the land productive might improve their reputation, Ritchie says.

How protecting nature can protect us

Current Address: Post-doctoral research fellow, University of KwaZulu-Natal
Reprinted from: https://bit.ly/2ZPHz7R

Yvette Ehlers Smith

As South Africa grapples with the tragic effect of the coronavirus on people, the economy and society it's increasingly clear that our status as a megadiverse country is a blessing, but that our reliance on nature tourism is a risk.

In good times and bad, our natural places are our greatest assets. In addition to offering beauty and a source of mental health, our grasslands, shrublands, forests and coastlines shield us from hunger and poverty, safeguard us from pollution and climate change, and supply us with medicine and leisure. Researchers estimate that these services provided — for free — by nature are worth R275-billion each year.

Our abundant biodiversity also attracts millions of visitors from across South Africa and the world. The game industry alone generates R7-billion every year.

But the tourism industry — especially ecotourism — does so much more than generate cash. Our world-famous national parks, including Kruger and Karoo, protect lions, rhinos, and countless birds under threat from poaching and habitat loss.

They have done so through partnership with farmers in the vicinity of the parks. Successful programmes supply people with jobs or provide them with resources and they may aid with anti-poaching activities and operations.
When local residents view protecting nature as an economic opportunity, they are less likely to risk their lives and jail time to poach, a source of income that's hard to resist when no other income is available.

A dip in poaching numbers reveals this strategy works. Before the coronavirus pandemic hit, South Africa saw a drop in the number of poached rhinos for the fifth year in a row. On the cusp of the coronavirus outbreak, four suspected poachers were arrested at Kruger.

But the onset of the coronavirus pandemic has pushed the pause button on our tourism industry overnight, revealing just how dependent rural people and our biodiversity are on a well-functioning tourism infrastructure for their survival.

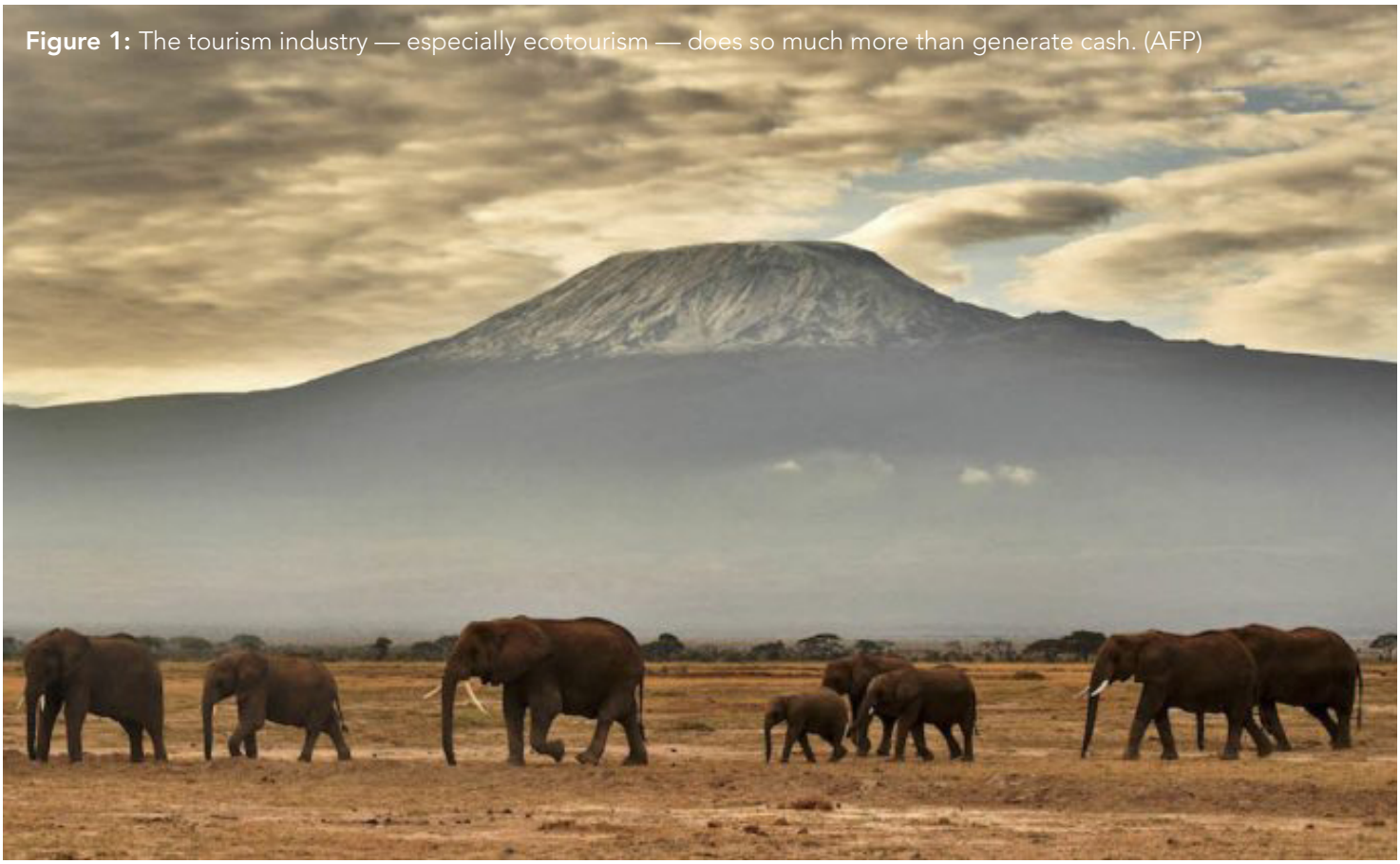


Figure 1: The tourism industry — especially ecotourism — does so much more than generate cash. (AFP)

Lockdowns stopped the flow of tourists, curtailed incomes for thousands and refuelled threats to our biodiversity. Poaching of rhinos, for example, has spiked since the country's lockdown began on March 23.

In times of economic hardship, poorer people may turn to natural places for a safety net. Animals, fish and forests offer a free source of food or income for people suddenly without jobs or other resources.

They also turn to traditional medicine, which uses plant and animal parts. It's likely there will be a surge in demand for traditional healers during the Covid-19 pandemic. These practices have the potential to imperil species used to treat respiratory problems.

Even during stable times, bushmeat hunting and consumption is a common practice in South Africa, with 30 to 60% of households consuming bushmeat they hunt themselves. This legal practice, as well as illegal poaching, is likely to rise as the country's economy goes through rocky times.

South Africa is already aware that these interactions with nature put us at risk by exposing us to diseases that stay self-contained in nature when it is left undisturbed.

Long before Covid-19 exploded in our borders, South Africa has suffered again and again from the spread of disease that comes from our close encounters with wildlife. We've dealt with Ebola, Rift Valley fever, Crimean Congo hemorrhagic fever, the West Nile virus and many other deadly ailments that result from close contact between wild animals and people.

If we were to do a better job of protecting nature — in good times and in bad — nature will protect us. Viruses in the wild are only dangerous to people when they come into close contact with wildlife through our destructive activities such as mining, building roads and expanding cities — as well as poaching, hunting and selling wild game. But when biodiversity thrives, abundant animals, plants, insects and microbes can limit the spread of disease.

Eventually, this outbreak will end and the tourists, especially South African tourists — will return to our national parks. How long it will take for these parks to return to what they were just three months ago is uncertain.

To address this uncertainty, the government must invest in better and more protection of our natural world that isn't dependent on tourism dollars. Protecting 30% of land and oceans by 2030 would be a good place to start. And the government could do so affordably through a system that has already seen success: stewardship agreements, which involve the government paying private and communal landowners to protect and manage land in biodiverse areas.

If South Africa were to establish a nature conservation philosophy that is less dependent on tourism and benefits public health, people and the economy, the advantages would be enormous in the long run. That is why it is imperative that we do everything we can now, before it's too late, to ensure our biodiversity doesn't become a casualty of the pandemic.

Sustainable Beef Cattle Farming

Current Address: National Technical Manager, Ruminants for RCL FOODS
Reprinted From: https://bit.ly/2TQsbEp

Dr Vlok Ferreira

Research published by Dr Jude Capper in of Animal Science shows that beef's environmental footprint is shrinking. Each kilogram of beef raised in 2007 (compared to 1977) used:

- 9 percent less feed;
- 33 percent less land;
- 12 percent less water; and
- 9 percent less fossil fuel energy;

- The carbon footprint of beef was reduced by more than 16 percent from 1977 to 2007.
- With the world population officially more than 7 billion people and projected to reach 9.5 billion by 2050, farmers must continue to find ways to sustainably feed a growing world population using fewer natural resources.
- According to Capper's research, improvements to the way cattle were raised and fed in the U.S. between 1977 and 2007 yielded 13 percent more total beef from 30 percent fewer animals. More beef from fewer animals maximizes resources like land and water while providing essential nutrients for the human diet.
- The United Nations Food and Agriculture Organization (FAO) projects in 50 years, the world population will need 70 percent more food. Seventy percent of this food must come from efficiency-improving technologies.
- U.S. cattlemen raise 20 percent of the world's beef with 7 percent of the world's cattle, making the United States a leader in raising sustainable beef.
- According to Capper's research, much of the reduction in beef's carbon footprint is due to raising cattle on grass pasture then finishing them on an optimal, balanced diet of roughage, grains and proteins in a feedlot.
- According to previous research conducted by Capper, it takes 226 more days for grass finished cattle to reach market weight than grain-finished cattle. More days on grass may mean greater environmental impact.
- Each kilogram of grain-finished beef requires:

  - 45 percent less land;
  - 76 percent less water; and
  - 49 percent less feed;

  And generates:
  - 51 percent less manure; and
  - 42 percent fewer carbon emissions.

- There are a variety of beef choices such as grain-finished, grass-finished, natural and certified organic beef to choose from. Cattle farmers make smart use of the diverse natural resources, like water and land, available in their local areas to produce nutritious, safe and delicious beef that they're proud to serve to their own families.
- Beef is environmentally and nutritionally efficient. Each serving today requires less land, water and energy than in the past while providing essential nutrients to our diet.
- All choices of beef are excellent or good sources of essential nutrients.
- Several of the key nutrients in beef like iron are known to be lacking in the diets of many people, especially women and children. Research shows beef offers several health benefits including heart health, muscle development and weight management.

Holistic Management Handbook: Regenerating your land and growing your profits, 3rd ed.

By Jody Butterfield, Sam Bingham, and Allan Savory
2019, Island Press, 2000 M Street, NW, Suite 650, Washington, DC 20036
250 pages, hardcover and Ebook
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Current Address: Escuela de Graduados, Facultad de Ciencias Agrarias, Universidad Austral de Chile, Casilla 567, Valdivia, Chile.
E-mail Address: paulina.flores@postgrado.uach.cl

Dr. Paulina G. Flores

In "Holistic Management Handbook", Jody Butterfield, Sam Bingham and Allan Savory offer a fascinating step-by-step method for running a farm using a holistic management approach with tangible results. In this third edition, the authors bring their vision to the responsibility to restore our environment, and describe how to do it. This vision has clear instructions that focus on: plan-monitor-control-replan.

The handbook has been thoroughly revised and explains the planning procedures described in the book "Holistic Management: a Common Sense Revolution to Restore Our Environment" (Savory & Butterfield, 2016). The core of "Holistic Management Handbook" is 250 pages of easy to read text accompanied by worksheets, checklists, planning and monitoring forms, and detailed examples of typical scenarios a user might encounter on a daily basis.

The first part describes holistic financial planning. The tagline of financial planning is: "Money is the ruler" because it is essential to plan profit first, rather than expenses. This is the single most important activity for ensuring that all the money earned and spent is in line with the holistic context proposed. The chapter also reveals that every enterprise has a weak link at any moment in time, and the importance of having an action plan to strengthen it in the chain of production.

Part two describes holistically planned grazing and the term "Grazing unit", which is described as any piece of land with moving livestock across the landscape. Division of grazing unit into grazing areas commonly called paddocks. The concept Animal-Days, is described as a measure of the forage quantity an animal eats in a day.

Herds of different sizes may spend varying lengths of time in paddocks of different sizes. Grazing planning deals with the challenge of creating land suitable for the purpose of the business. The animal impact is the primary subject of grazing planning. Planning decisions have to take into account stocking rate, time for grazing and recovery periods, stock density, and herd effect.

An essential part is the division of the grazing units into grazing areas or paddocks. The grazing plan proposed should consider the creation of a farm in a holistic context factoring in animal-days of grazing, animal physiological state such as dry pregnant, lacting, calving, overgrazing, poisonous plants, and pasture recovery time.

Drought periods and winter can be unpredictable and negatively affect the forage growth rate. Reserving an emergency strategic area to accommodate animals is a valuable practice to keep animals in good condition.

The chapter concludes with an overview of both the growing and the non-growing seasons plan and gives examples of worksheets for cropping plans, grazing unit plans, growing and non-growing season plans, paddock forage quality, and livestock and land performance.

The holistic ecological monitoring process and the collection of previous history details of the land are the keys to creating the future landscape (Part 3). This means training yourself to evaluate the fragility of the environment. The introduced terms of brittle and non-brittle come from that insight which described a simple scale 1 to 10 in any environment according to how well humidity is distributed throughout the year. 1 being non-brittle e.g. tropical forest, and 10 being very brittle e.g. arid desert. Before starting planning, one needs to know where, when, why, and what to monitor.

Once the first monitoring is done, it is necessary to describe the four ecosystem processes: community dynamics, water cycle, mineral cycle, and energy flow. These four ecosystem processes indicators are specified in detail and are recommended as a user help guide of monitoring. This chapter

also analyses the effects of over-grazing, over-browsing, and over-resting plants, and how important it is to recognize plant and animal species as part of the ecosystem.

Next, the authors continue with a guide to monitoring procedures such as: mini-trials; photo monitoring; ecological data; comprehensive ecological monitoring like soil surface, animal sign, perennial grass condition and non-grass plant species; recording observations; data analysis; and interpretation of results.

The fourth and last part of this book describes holistic land planning for a grazing operation and the role of time in grazing and trampling. Considerations that need to be taken with the movement of a large herd of animals require attention to fencing, water points, roads and handling corridors.

The authors establish that the first move in planning is the creation of a checklist of natural and social problems, and then identifying management needs related to the production of aspects like livestock, crops and wood. The authors insist that the production of a map with a sheet of transparent paper superimposed is essential for land planning. The greatest plan is the one that selects the best ideas and opinions, reviews checklists, and continually re-checks the plan.

Therefore implementation of the plan requires a gradual process of change, and the cost of the change itself could be a major limiting factor. Finally, the authors offer, in Appendix 1, a check list with seven points to ensure decisions have been made in the holistic context proposed. A second appendix introduces some financial planning forms that help keep the holistic plan updated. Appendix 3 is about grazing planning, herd size and grazing periods.

Appendix 4 introduces a method for calculating grazing periods based on herd size, Appendix 5 displays several grazing planning forms, and Appendices 6 and 7 describe five scenarios of monitoring the land and ecological monitoring forms respectively. The handbook includes a comprehensive glossary of terms.

This handbook is an essential companion for those seeking to manage land holistically. The book will be very helpful to agronomists, researchers, practitioners, farmers, and students

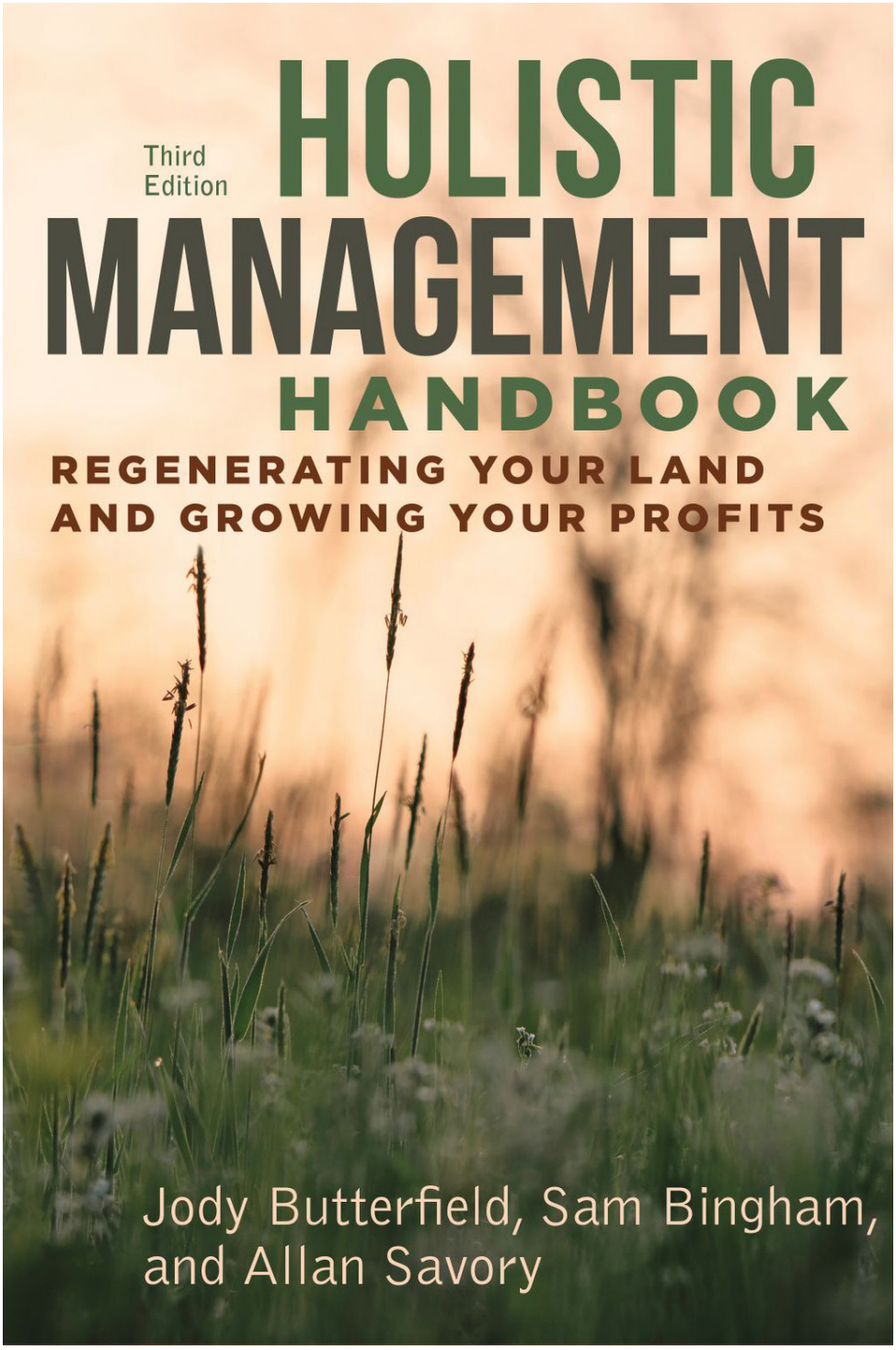

Figure 1: The new Holistic Management Handbook is now available

working in agricultural and environmental resource resilience. The book has few negatives, none of which detract from the achievement.

Chapter summaries are useful but inconsistent in purpose to give a brief statement of the main points. Some black and white photographs were low quality.

The book has a strong land regenerating focus set within solid scientific evidence where any sceptical reader can apply and test the methods described on the guidelines. The details of the information assist and propose alternative methods for enriching the land, wildlife, and profits. Every instruction reflects the authors' efforts dedicated to producing this outstanding work.

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Savory A, Butterfield J. 2016. Holistic management: a common sense revolution to restore our environment. Washington DC: Island Press.

A tribute to Pieter Johannes (Johann) du Preez

Leslie Brown and Andri van Aardt

Pieter Johannes du Preez passed away on the evening of 29 December 2019 in Hermanus after a short fight against cancer. Johann as he was known to everyone, was well educated in ecology and had a passion for nature. His knowledge of the environment and willingness to share that with colleagues, students and the general public is how he will be remembered.

Johann's passing came as a huge shock to all with whom he has worked and who has known him. He has left a huge gap within the scientific world especially within the field of vegetation science where he was well known and regarded as one of the top plant ecologists in the country. He will be remembered for his endless passion to study nature and obtain more knowledge on the functioning of ecosystems. His love for nature and conservation could be felt in his presence. He was modest, humble, understanding, supportive and always willing to walk that extra mile for the people that crossed his path.

As an academic he influenced the lives of several students who became successful vegetation scientists and researchers under his supervision. He also contributed to literature in various fields of ecology mostly specialising in the mapping of vegetation and investigating various ecological community compositions. He is well-published and has contributed numerous publications, book chapters, conference presentations and technical reports on the vegetation of southern Africa. He has produced a detailed vegetation map of the Free State Province and was co-author of the widely acclaimed ecology book "Life and the Environment: an African perspective" for which he received the Golden Merit award from the South African Academy for Science and Arts for his contribution to science. Johann collaborated on the vegetation surveys of the Stevenson Hamilton Research Super Site near Skukuza in the Kruger National Park with colleagues form the University of the Free State. Here he contributed towards our understanding of the interaction between vegetation and the environmental factors that influenced the various plant communities in the area.

At his passing, Johann was an active Research Fellow at the Department of Plant Sciences at the University of the Free State, where he was still involved in supervising students and playing his part in research with colleagues from other South African Universities. He was cited by many people for his many achievements.

Johann has played a quiet, yet profound role in the advancement of vegetation science in southern Africa and we will remember him for his huge contribution not only in terms of scientific knowledge, but his energetic and positive approach to life.

Remembering the late Sauli Ramatla

Mokitjima J. Tsilane

The late Sauli Ramatla attended the Lesotho Agricultural College (LAC) in 1991-1994 where he completed a Diploma in General Agriculture. In 1997, Mr Ramatla advanced his studies with the University of Fort Hare in 2002-2005 where he completed a BSc Hons in Botany. Mr Ramatla met his untimely death on the 1st of March 2020 while he was studying MSc in Range Science with the National University of Lesotho.

Mr Ramatla started his employment career in the range sector as a Range Management Area Advisor for Qhoali Range Management Area (RMA) in 1994-2000, under the then Ministry of Agriculture and Cooperatives. He was engaged by the Department of Range Resources Management (DRRM) of the then Ministry of Forestry and Land Reclamation as a Range Management Officer (RMO) from 2006-2008. He was then deployed on a secondment basis to Millennium Challenge Account (MCA) as a head of Natural Resources Section from 2009-2011 under the auspices of the then Ministry of Natural Resources. His deployment was extended from 2011-2013 where he was acting as a project manager to MCA Lesotho.

In 2014, he resumed his duties as the Range Management Officer in the then Ministry of Forestry and Land Reclamation (MFLR). He was promoted to the position of Senior Range Management Officer from 2015-2017 in the Cattle-post and Wetlands Area Management unit of DRRM. His career advanced further when he was elevated to the position of Principal Range Management Officer in the Rangeland Health Assessment and Monitoring unit of DRRM in 2018 to the end.

During most recent position, he represented DRRM of Ministry of Forestry, Range and Soil Conservation in the Maloti Drakensberg Transfrontier Conservation Programme (MDTP) where he was chairman of bilateral Biodiversity and Protected Area working group. He was a founding member of the Integrated Catchment Management Project Coordination Committee under the support of EU and GIZ. Mr Ramatla had was also represented DRRM in the National Climate Change Committee. He was also a kingpin member of the inter-ministerial task team that developed the Lesotho Land Cover Atlas through the support of FAO. He was employed on a part-time basis as a lecturer of Range Science subjects in the Lesotho Agricultural College.

Mr Ramatla was a member of several associations including Grassland Society of Southern Africa (GSSA), University of Fort Hare Alumni, and Centre of Climate Change Ecological Training Association (CCCETA) where he was founding member and second secretary assistant.

Mr Ramatla will be missed greatly by his colleagues and friends and will be remembered for his support and commitment to his work in rangeland ecology.

Upcoming events

30 June - 2 July 2020: FIRST VIRTUAL CONGRESS!

55th Annual Congress of the Grassland Society of Southern Africa.
For more information contact
info@grassland.org.za.

2 - 7 August 2020

Ecological Society of America meeting in Salt Lake City, USA.
This year's theme is "Harnessing the ecological data revolution".
Visit the website https://www.esa.org/saltlake/ for more details
MAY BECOME A VIRTUAL EVENT

9 - 11 September 2020

42nd Fynbos Forum
VIRTUAL ONLINE EVENT
More details to follow soon.
Visit https://fynbos forum.org.za
for more info.

2 - 6 November 2020: Virtual Congress

The Conservation Symposium. For more information see
https://conservationsym2020.conservationsymposium.com/index.php
or Contact Freyni du Toit by email at
secretariat@conservationsymposium.com

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

Upcoming events

POSTPONED UNTIL SEPTEMBER 2021

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

POSTPONED UNTIL 6 - 10 September 2021

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

POSTPONED UNTIL October 2021

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

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FutureLearn: www.futurelearn.com/subjects/nature-and-environment-courses/ecology

Alison: https://alison.com/courses/life-science

Principles of modelling with spreadsheets through the University of Vermont:
www.uvm.edu/rsenr/vtcfwru/spreadsheets/?Page=pom/pom11.htm

Animal Health: https://www.coursera.org/browse/health/animal-health

GRASSLAND SOCIETY OF SOUTHERN AFRICA

CONGRESS 55

VIRTUAL EVENT
30 JUNE - 2 JULY 2020

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- **NON-MEMBER REGISTRATION - R2 300**
- **STUDENT / INTERN / RETIREE OVER 65 REGISTRATION - R1 750**

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