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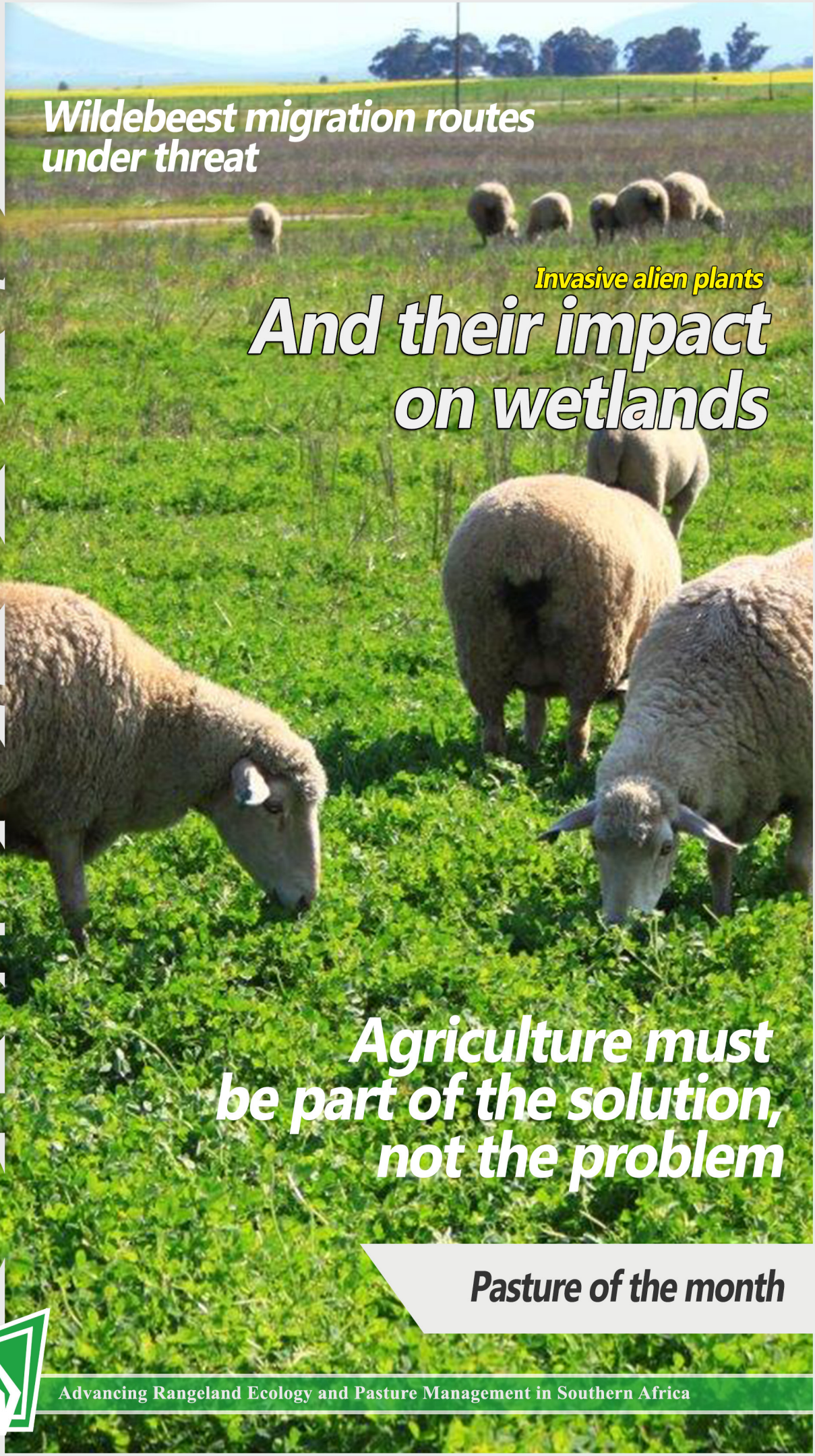
Grassroots

Newsletter of the Grassland Society of Southern Africa



Wildebeest migration routes under threat

Invasive alien plants

And their impact on wetlands

Agriculture must be part of the solution, not the problem

Pasture of the month

Advancing Rangeland Ecology and Pasture Management in Southern Africa

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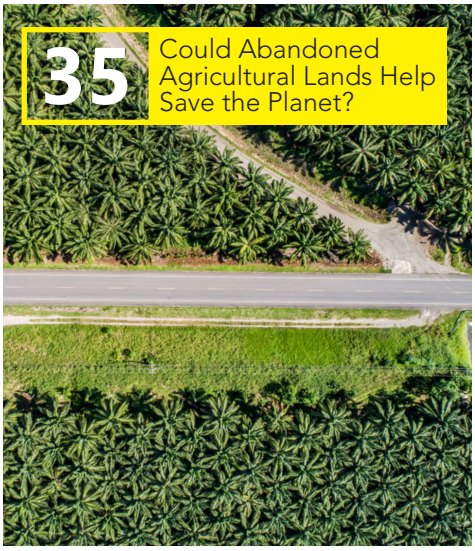

From our editor

Welcome to the first issue of Grassroots for 2020!

This first issue of the year begins well with two feature articles:

In the first article, Hugh Pringle, from Australia, questions whether gully erosion is a major issue for key biodiversity values. Pringle, and his colleagues have done some work on this in Namibia and feel that it is an important question which then links up with one of our news articles by Heinz Meissner on further perspective and results on high density rotational grazing. Secondly, Nelmarié Saayman presents her preliminary findings on the impact of rehabilitation of old potato circles on soil biology and seedbanks within the Western Cape Sandveld.

In this issue, we present a variety of news articles on current issues relating to grassland management, both locally and internationally. These range from climate change to alien invasive alien plants, fire and new pasture crops.

We also congratulate the society's current president, Debbie Jewitt, who is part of a team of drone professionals to publish a book on contemporary drone issues – a valuable book for any drone enthusiast.

We would like to alert all our readers to the first announcement of our next GSSA Congress. This will be held in **Jeffrey's Bay** from **29 June – 2 July**.

Calls for presentation and posters have already been sent out as well. There is an early bird discount for those who pay before 19 May 2020, so, if you interested in attending, get registering!

A reminder to please subscribe to Grassroots simply by clicking on this link: http://bit.ly/2SYFYJa and entering your details. You will then be notified, by email, when the next issue of Grassroots is released. You will not be sent any unnecessary spam. This is a free subscription and a great opportunity to keep you up to date with Grassroots.

So far, we have 488 active subscribers. Thank you to those who have subscribed. The last issue of Grassroots attracted readership from 185 subscribers in 28 different countries – thank you for your support!

Until next time,

Happy reading!

Janet

Contact us

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

@GrasslandSociety-ofSouthernAfrica

Is gully expansion a major issue for key biodiversity values in arid lands?

Hugh Pringle

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Context: My EMU colleagues and I have attended major regional biodiversity conservation workshops in Outback Australia aimed at identifying priority threats. When we raised the issue of expanding gully erosion and landscape droughting, it has been explained to us that gullies are more relevant to agricultural contexts (sheep and cattle stations). "Soil erosion is caused by overgrazing on cattle stations; that is not what we are talking about at this biodiversity workshop". The implied belief is that the management of the physical environment is not part of biodiversity conservation and perhaps that biodiversity conservation is not important on grazed lands? It is almost as if the biological interactions occur in the clouds regardless of landscape succession processes (Figure 1).

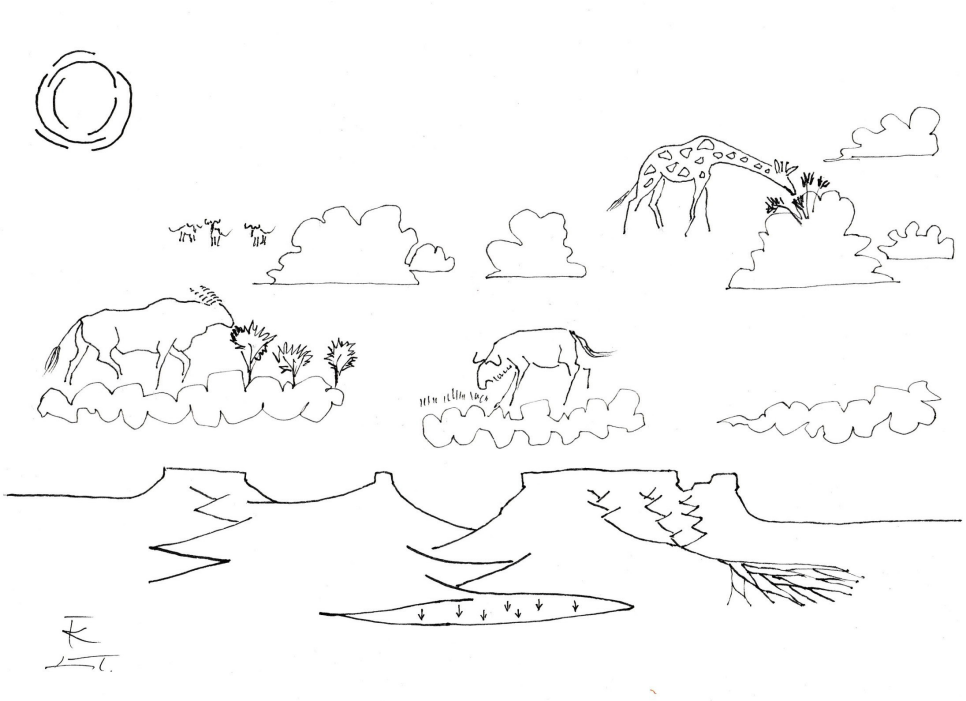

Figure 1: Biological interactions occurring in the clouds. Physical landscape form, function and trend are too often ignored! (Drawing by Ken and Lynne Tinley ©)

The importance of natural hydrological regimes to their habitats: Natural creeks usually start in uplands and spread out as they meet flatter land, distributing channel flow into fingers and sheet flow as fertile floodout fans (Schumm, 1977). Gullies generally form and grow wherever the land has been cut and "waterfalls" are developed that then cut back in the direction of strongest flow (Figure 2)(Pringle *et al.*, 2011). Natural creeks generally develop in steep country where small flows come together and gain energy (tributary pattern) and then rapidly lose energy on meeting flatter land and tend towards distributary flow. That flow then ends up gently soaking floodplains below (Figure 3). This natural pattern of tributary, then distributary flow and then bottomlands has local wetlands from the top of the catchment (e.g. local grassy drainage depressions) down to the floodplains with major swamps.

The different wetland "jewels in the crown" support a different suite of species to their wider landscape and have evolved together in an evolutionary partnership. Wetlands – be they small pans or large floodouts, swamps and floodplains - dry out last and are critical drought buffering habitats (McNaughton, 1983; Stafford Smith & Morton, 1990; Morton et al., 1995; Duguid *et al.*, 2005; Fynn & Bonyongo, 2011; Morton *et al.*, 2011). They are biologically distinctive and most vulnerable to livestock pressures as seasons decline.

Can these critical drought buffering areas and the broader landscape realistically be understood bio-centrically as suggested in some text books on ecology (Krebs, 2009) or do we need to return to a more holistic ecology in this specific regard (Cowles, 1901; Clements, 1916; Cole, 1963; Tinley, 1982)? Can earth sciences complement biological approaches in understanding landscape behaviour (Pulley *et al.*, 2018)? Should key biodiversity values be managed wherever they occur (Kain, 2008)? Has contemporary bio-centricity been adequate? The Wetlands Indaba in Kimberley, South Africa last year (2018) was exceptional in the attention paid to physical earth processes. Professor Fred Ellery epitomised a wide-eyed view of landscapes (Pulley *et al.*, 2018) and his students will benefit from this holism. He presented the idea that gully erosion could create wetlands in the specific contexts, which makes sense and begs different thinking in planning restoration. Should all gullies be "healed" or are at least some of them part of a long-term geological succession that created for instance upland valley floors with wetland systems? One might pragmatically err on the side of stabilising gully systems given that contemporary land use pressures are at least exacerbating, if not initiating landscape incision (Mabbutt *et al.*, 1963; Cooke & Reeves, 1976; Fanning, 1994; Pringle *et al.*, 2011).

In some cases, landscape incision can create new local habitat elements such as scrub-lined channels in grasslands (Pringle *et al.*, 2013; Tinley, 2015). The inclusion of a new patch type would certainly increase habitat diversity, but that might be at the cost of the function of a vulnerable ecosystem (e.g. structural grasslands) with the addition of an assemblage of plant species thriving on human disturbance regimes and their commensals (e.g. birds that use that habitat patch)?

Some major causes of nested drought-buffering wetland decline: Landscape incision by gullies is not the sole cause of wetland dysfunction. Overgrazing can destroy local wetlands by flattening them out or filling them up with sediment without any involvement of gullies. A good example of this is on alluvial plains or plateaux with cracking clay soils that form gilgai ponds when healthy due to the wetting and drying cycle of clay minerals. When consistently overgrazed these wetland patches become part of flattened, water-shedding surfaces through compaction, but are recognisable as pale coloured patches in a darker mosaic of fine ironstone lag. Similarly in-channel pools can be filled with sediment from accelerated erosion in the hinterland.

The most biologically-impoverishing process is gully development and expansion because it targets all of the most ecologically important components of most rangelands that are active catchments (as opposed to vast, deep sand plains without much surface drainage) (Pringle & Tinley, 2003; Pringle *et al.*, 2006; Pringle *et al.*, 2011). The cause is usually a cut into the natural landscape base level, be that a broken rock bar across a river (Figure 4) , a poorly located watering point or farm road and the accelerator mechanism is the lack of ground cover that feeds gully heads and accelerates their expansion through increased runoff (Pringle *et al.*, 2011).

Any wetland that overflows to another system via a soft sill, the feature that acts as a natural dam wall, is vulnerable to reduced productivity and biodiversity through losing its capacity to harvest and pond water through breaching by gully heads ("pulling the plug out of the bath"). This can occur at small or large scales, for instance a small drainage basin (Figure 5) or a major wetland such as the Urema Lake at the base of the Great African Rift Valley in the Gorongoza National Park (Tinley, 1977). In both cases, animal paths or other linear incisions such as roads can "unplug" the system.

At Urema Lake, thousands of hippopotami travelling between the lake and pools in the Pungwe River, not livestock, initiated the gullying that breached the wetland. In increasingly fragmented "wild" landscapes dedicated to biodiversity conservation (Fynn, 2012), active biodiversity management may need to deal proactively with these issues. So do we need a more holistic understanding to solve these issues? Is erosion the particular problem of farmers and pastoralists or also of those who aspire to manage biodiversity values in an increasingly fragmented landscape (Fynn *et al.*, 2015)?

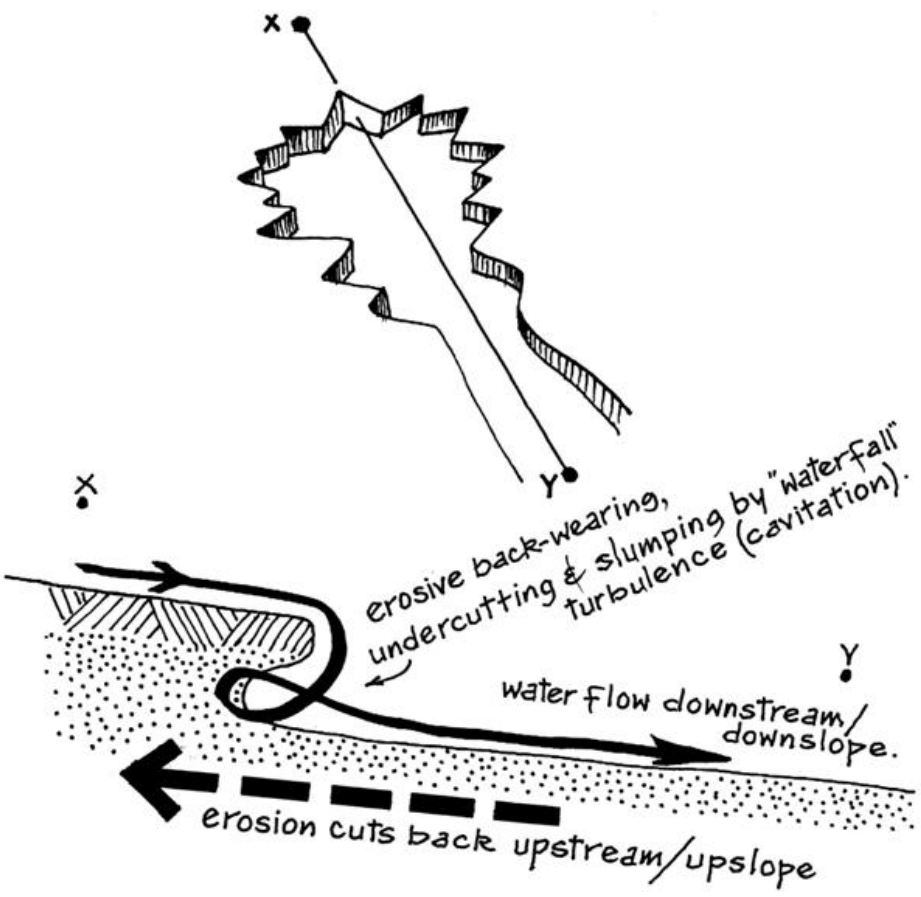

Figure 2: How most gullies are formed by cutting upslope from any type of incision.

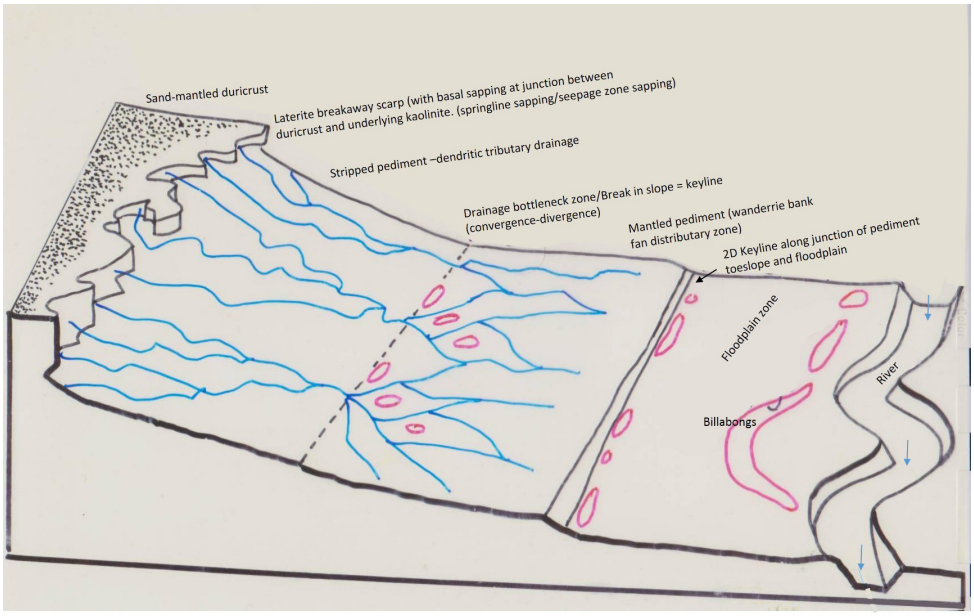

Figure 3: An example of how upland tributary flow spreads at the key line and then hydrates the bottomlands in a healthy system. This isn't always so simple in real, large catchments.

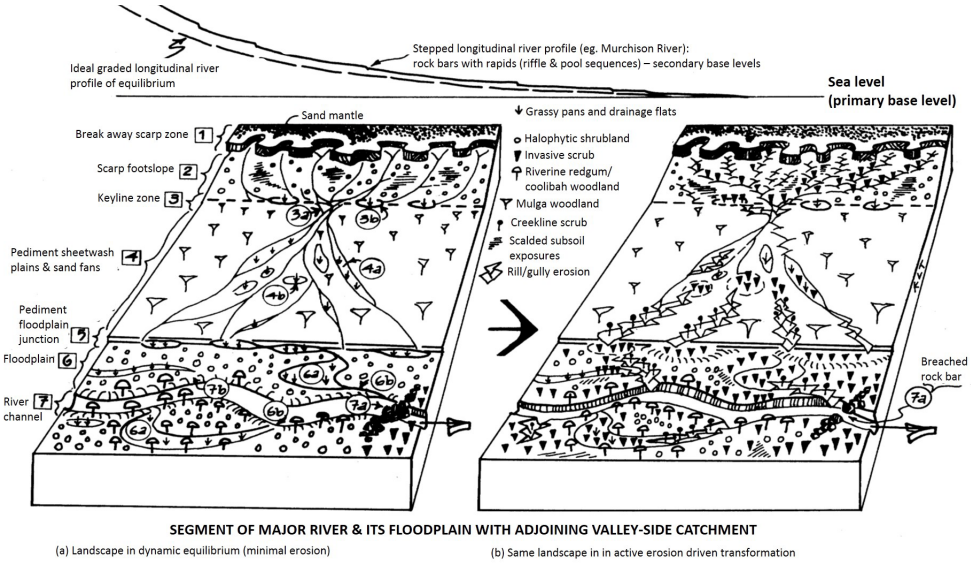

Figure 4: A functionally healthy valley sequence to its floodplain and then how the whole drainage ecosystem can become essentially a "tiled roof with drain pipes", etching out all the critical habitats in the process (Pringle & Tinley, 2003).

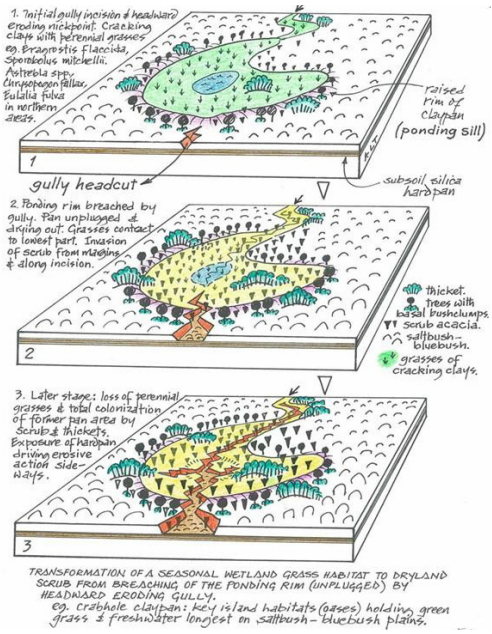

Figure 5: The unplugging of a wetland (Ken Tinley).

Prevention is better than cure: If one believes that prevention is better than cure, it is imperative that all activities that involve the unnatural cutting of the natural landscape are stopped, or planned very carefully. In particular, the sills that hold up the ponding of local wetlands should be protected on-site. For instance, by locating artificial watering points across slope rather than above or below wetland sills and avoiding track alignment near these fragile areas can minimise the threat of initiating gully head cuts into them from downslope or the diversion of flows elsewhere from upslope areas (Pringle *et al*., 2019). The key issue is to maintain critical natural landscape base levels that enable water retention, thereby supporting all of the key biodiversity values that result from nested patterns of small to very large wetlands, the "jewels in the crown" of any drainage ecosystem.

Concluding comment: Landscape incision is episodic but fast. It often works against natural, slow landscape succession processes that create areas of greater soil moisture balance and landscape productivity (Noy Meir, 1980) as well as critical, nested, drought buffering habitats (Newsome, 1980; McNaughton, 1983; Illius & O'Connor, 2000). Human-induced gullies and their devastating effects of landscape droughting and ecosystems' drought buffering are not an issue specific to commercial land use as causative processes also affect lands set aside for biodiversity conservation. Gully development adheres to the laws of physics everywhere and can affect any land where a nick point is created by the cutting of the natural land surface. Generally, the effects of gully development and expansion are at odds with most land management objectives, especially in relation to wetlands in their wide, arid context. Most importantly, gully head cuts are usually expanding their "stealing" of rangeland ecosystems' most valuable resource: soil moisture.

Acknowledgements

Ken Tinley (D.Sc.) opened my eyes to the importance of physical landscape succession processes in ecological land management whatever the primary and other objectives of those managing the land. He also drew all the diagrams in this article, in cases with help from his wife Lynne. The Tinleys and Russell Grant kindly reviewed the initial drafts in detail.

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Preliminary results on the impact of rehabilitation of old potato circles in the Sandveld, Western Cape, on soil biology and soil seedbank

Nelmarié Saayman[1]* and Craig Morris[2]

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[2]ARC-API, c/o University of KwaZulu-Natal, Pietermaritzburg

The arid Sandveld region along South Africa's west coast is known for its potato production circles since the 1980's. Some of these potato production lands became economically unviable, while others were located in ecologically sensitive areas and were withdrawn from the production cycle. Eight percent, or 5 800 ha of the endangered Leipoldtville Sand Fynbos vegetation type (FFd 2; Rebelo et al. 2006), are under central pivot irrigation for potato production and only 45% is still in a natural state (Rouget et al. 2004). Rehabilitation of these abandoned lands has become a priority. Due to years of cultivation and fertilization, potato production lands have high phosphorous (P) levels (up to 80 mg/kg) because phosphorous does not leach easily (Leake undated). These high P levels will likely inhibit the establishment of fynbos species, which normally grows in soil with relatively low P levels of around 8 mg/kg (Mitchell et al. 1984; Hawkins et al. 2008).

One way to lower the soil P levels is to plant an initial crop mixture that includes lupines, and harvesting and removing it at the end of the season (Hawkins et al. 2010). Lupines, like proteas, have specialised cluster roots that can mobilise P from poorly soluble P in the soil and, in turn, is taken up by the rapidly growing plants (Hawkins and Cramer 2007). The addition of annual crops in the mixture can also initiate nutrient cycling in the soil (Holmes and Richardson 1999).

This article addresses the question: "Does cultivation and sowing of initial crops have an impact on some aspects of the soil biology and soil seedbank one year after cultivation?"

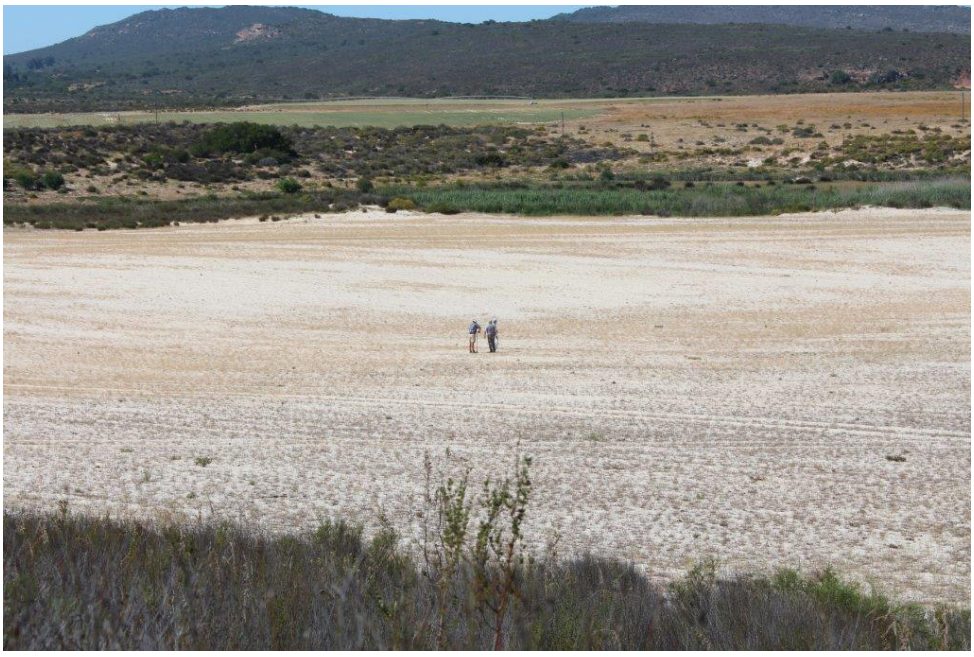

Figure 1: Abandoned potato production land at the Redelinghuys site.

The study was conducted at three different sites in the Leipoldtville Sand Fynbos, all on sandy soils with high soil P levels (35-63 mg/kg). The abandoned lands at Elands Bay and Sandberg lie fallow since 2010 and at Redelinghuys since 2012 (Figure 1). The long-term average annual rainfall for the area is 281 mm. The rainfall in 2017 was 50% of the long-term average and in 2018 it was 290 mm.

At each site, shallow-tillage (to a depth of 100 mm) with a tine-implement was done in June 2017 and an initial crop mixture was sown in twelve 5 × 5 m plots following a completely randomised design. Because of the low rainfall in the year 2017, it was repeated in May 2018. The crop was harvested and removed in September 2018 before seed set. The initial crop mixture included lupines, rye and vetch in 2017 and lupines, rye and serradella in 2018.

In each of these plots, soil samples were taken in May 2017 to determine the soil seedbank composition and soil health, using Solvita®C and BiologEcoplate™

tests. The Solvita®C test gives an indication of the microbial soil respiration and the Biolog test provide measure of the microbial diversity in the soil. The soil seedbank test was repeated in May 2018 and the soil biology tests in September 2018, after the removal of the initial crop.

A non-metric multidimensional scaling (NMDS) based on Bray-Curtis distances (log-transformed data) and a permutation multivariate analysis of variance (PERMANOVA) were used to analyse differences in the seedbank composition, and a principal component analysis (PCA) was performed on the BiologEcoplateTM test data, for each site and year. A one-way ANOVA was done on the Solvita®C data.

Due to low rainfall received during the study period, only a few plants from the initial crop established and it did not affect soil P levels. The addition of the initial crop did have a slight positive impact on initiating nutrient cycling. The microbial soil respiration increased significantly (Redelinghuys: p = 0.0023; Elands Bay: p = 0.015; Sandberg: p = 0.012) over time, although respiration levels are still very low (<5) to low (<12) (Figure 2). The microbial functional diversity was higher in the second year (Figure 3). This could in the long-term assist in the overall improvement of the degraded area.

There were no clear differences in soil seedbank composition between the cultivated and control sites (p = 0.398) in either years. The overall seedbank composition on the other hand changed

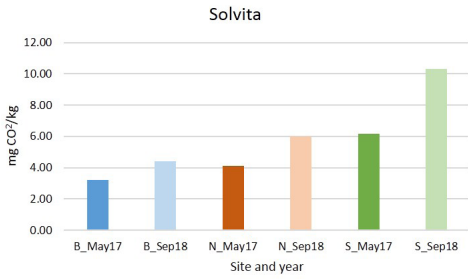

Figure 2: The microbial soil respiration at the different sites (B = Redelinghuys; N = Elands Bay; and S = Sandberg) for May 2017 (before cultivation) and September 2018 (after harvesting).

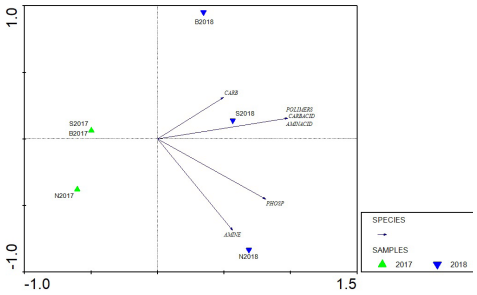

Figure 3: A Principal Component Analysis of the Biolog functional groups at the three different sites in 2017 and 2018 (Eigenvalues: Axis 1 = 0.758; Axis 2 = 0.114). B = Redelinghuys; N = Elands Bay; S = Sandberg. AMINACID = Amino acids; CARB = Carbohydrates; CARBACID = Carboxylic acids; PHOSP = Phosphorilated.

significantly from 2017 to 2018 (p = 0.002) because of the disappearance of some species and a marked decline in

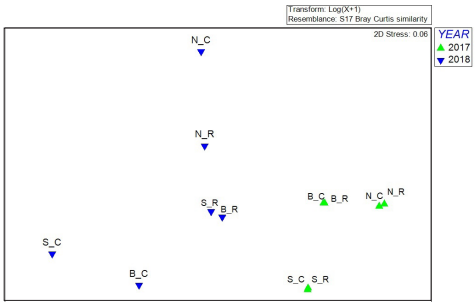

Figure 4: A NMDS plot of seedbank composition differences in 2017 and 2018 among sites (B, N, S) that were cultivated (R) or undisturbed (C). B = Redelinghuys; N = Elands Bay; S = Sandberg.

the abundance of others (Figure 4). The changes in the seedbank might be due to the low rainfall in 2017, with seeds germinating after the first rains, but not surviving until seed set, resulting in fewer species and abundance in 2018. These results could indicate that rainfall remains the deciding factor on the success of any restoration/rehabilitation project in these arid regions.

The next step in this rehabilitation process is to plant species that are indigenous to the area that are adapted to higher soil P levels. The absence of indigenous perennial species in the soil seedbank emphasises the need to add seeds of these species to the abandoned land. It is hoped that the soil microbial activity that seemed to have increased by the initial crop will assist in the establishment and survival of the indigenous species, together with sufficient rain.

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GRASS OF THE MONTH

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Aristida junciformis

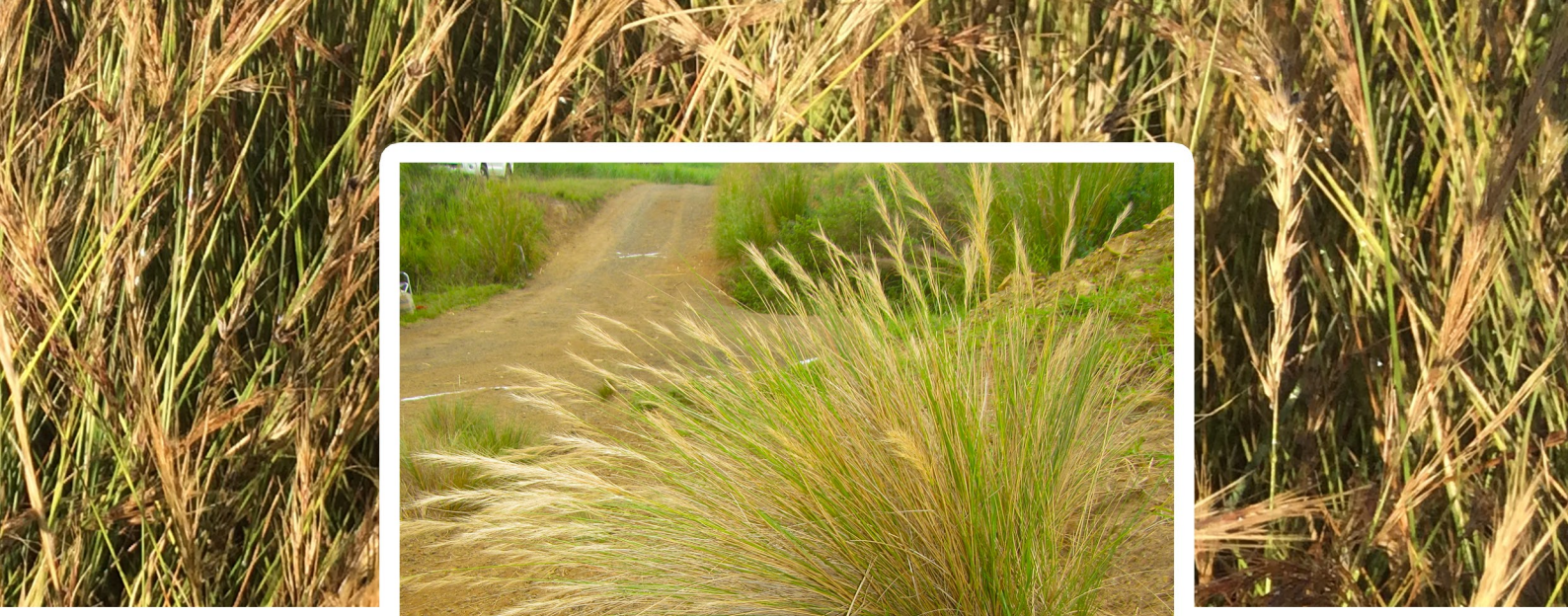
(Gongoni Three-awn)

Large tufts of *A. junciformis* are often seen growing on the side of the road.
Photo: JCO du Toit (https://www.inaturalist.org/observations/10884581)

Aristida junciformis is an extremely tough pioneer grass, which grows in large tufts. 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. *A. junciformis* is an extremely tough pioneer grass, which grows in large tufts.

Features of A. junciformis:

- Densely tufted perennial grass
- Can get to 900 mm tall
- Flowers between November and May
- Found on sandy/ clay/ stoney or shallow soils and often along roadsides or in disturbed areas (Fish et al, 2015)



A. junciformis often grows in large tufts.
Photo: R Taylor (https://www.inaturalist.org/observations/24581380).

Apart from the negative aspects of *A. junciformis*, it does have its uses too:

- *A. junciformis* is one of the best grasses for making brooms out of.
- It offers a good ground cover and hence good protection from erosion (van Oudtshoorn, 2012).
- With its fine leaves, tuftiness and feathery seed heads, it also makes a very attractive and hardy garden grass.
- Another attraction of *A. junciformis* – especially for those gardening in the drier areas of the country is that it is a water-wise species.
- It is easy to grow and can easily be germinated with a smoke primer.

Interesting Facts

In 1998, an estimated 200 000km² (17%) of the total land in South Africa contained A. junciformis *– this figure is likely to have grown fairly extensively since then.*

A. junciformis *produces a large number of caryopses (seeds) – where a mature plant can produce up to 19 000 (approx. 38 000/m²) – of which an estimated 60% are viable.*

The primary function of the three awns on the caryopsis is to orientate the seed correctly in its descent from the parent plant and aid in germination.

A. junciformis has a feathery inflorescence, which is very attractive in gardens.
Photo: R Ward (https://www.inaturalist.org/observations/28992436)

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PASTURE OF THE MONTH

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ANUAL MEDICS

The regenerating wonder of the Mediterranean region of South Africa

Annual Medics (Eng.); Eenjarige Medics (Afr) | Genus: Medicago
Two main species in South Africa: Barrel medics (Medicago truncatula) and Burr medics (Medicago polymorpha)

Medicago Polymorpha cv. Cavalier on the left and cv. Scimitar on the right
(Photographer: Piet Lombard)

Annual medics grow well in a Mediterranean climate where the winters are wet and the summers are hot and dry. It is often planted in rotation with cash crops such as wheat (*Triticum aestivum*), barley (*Hordeum vulgare*), canola (*Brassica napus*) and oats (*Avena sativa*) in the Western Cape province of South Africa. Medics are a low-grazing, prostrate but not rooting from the nodes, species.

Why are medics a regenerating wonder?

Annual medics have hard seeds, which means it will remain dormant in the soil for a year or two. This allows for pasture regeneration after a cropping phase. No establishment costs are therefore needed during the pasture phase. Different cultivars have different levels of hardseededness and it is recommended to plant a variety of cultivars to ensure its survival, especially under erratic rainfall conditions. Other hard-seeded species include clovers (*Trifolium* spp.).

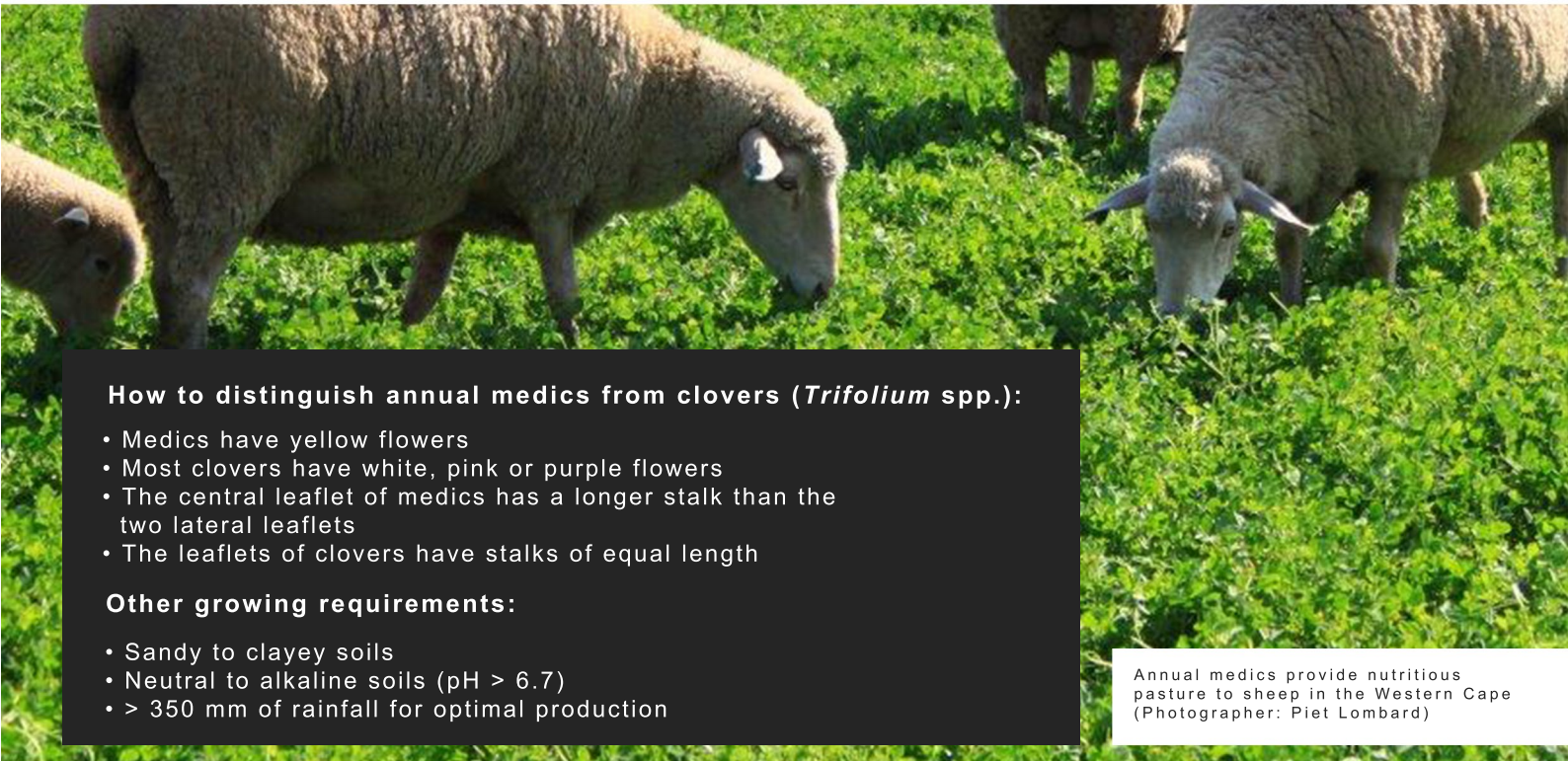
Annual medics' seed pods during the dry season (summer) in the Western Cape
(Photographer: Piet Lombard)

Emergence of regenerating annual medics
(Photographer: Piet Lombard)

Annual medics form part of crop rotation systems cultivated on the Langgewens Research Farm outside of Malmesbury in the Swartland region of the Western Cape.
(Photographer: Dr Johann Strauss)

Did you know?

Annual medics are legumes, which have the ability to fixate nitrogen. They must be carefully inoculated to ensure successful fixation. Nitrogen is one of the most important elements of pasture nutrition. Protein levels and the digestibility of pastures are improved by legumes, resulting in improved livestock performance.



How to distinguish annual medics from clovers (*Trifolium* spp.):

- Medics have yellow flowers
- Most clovers have white, pink or purple flowers
- The central leaflet of medics has a longer stalk than the two lateral leaflets
- The leaflets of clovers have stalks of equal length

Other growing requirements:

- Sandy to clayey soils
- Neutral to alkaline soils (pH > 6.7)
- > 350 mm of rainfall for optimal production

Annual medics provide nutritious pasture to sheep in the Western Cape
(Photographer: Piet Lombard)

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Barenbrug Product Guide:
https://www.barenbrug.co.za/forage/products/medics/medics

Wildebeest migration routes under threat – researchers

Reprinted From: http://bit.ly/31VuRmQ

Africa Geographic Editorial

Researchers have conducted a lengthy pre-published study indicating that the lesser-known wildebeest migration patterns throughout East Africa are facing grave peril. The scientists point to population growth resulting in: range restriction, degradation and loss of habitats, agriculture, poaching and artificial barriers such as roads and fences. They highlight the necessity of urgent conservation measures and commitment from the governments of both Kenya and Tanzania.

Understanding migration

The yearly Great Migration of over a million white-bearded wildebeest and zebra through the Serengeti and Maasai Mara ecosystems is perhaps the most renowned large mammal migration and generates enormous tourism revenue. **Importantly, the study notes that these populations are not under threat, and their movements are mostly unrestricted.** However, poaching is still a challenge for conservation authorities.

Though by far the largest, this is not the only wildebeest migration in East Africa. The scientists emphasise that conserving smaller populations and migrations is essential for several ecological and socio-economic reasons.

Protecting a migratory route involves complex analysis of the context in terms of the human populations of the land. Integral to this study was research into historical wildebeest migration patterns as well as their current status. Researchers attained historical information through literature reviews, colonial-era records, maps, GIS databases, records of GPS collared wildebeest and interviews with residents and researchers alike.

Figure 1: The results to this research indicated that the lesser-known wildebeest migration patterns throughout East Africa are facing grave peril. © Joseph Ogutu

For current movements and status information, 36 wildebeest across the study range were collared, and their movement tracked for two years. Wildebeest population estimates used external data compiled by aerial surveys and various governmental, development and wildlife organisations provided the data on the anthropogenic aspects of the analysis.

Disappearing wildebeest

This approach was made all the more complicated by the fact that irreversible changes to the migratory populations and routes that occurred as early as the beginning of the 20th century. With this in mind, scientists examined the Serengeti-Mara, Maasai-Mara, Athi-Kaputiei, Amboseli Basin and Tarangire-Manyara ecosystems and came to the following conclusions:

- Serengeti-Mara – as discussed, though the migratory routes have changed slightly, the numbers have remained stable (currently around 1.3 million animals) because the migratory pathways occur mostly within protected areas. Referred to by researchers as 'southern migration.'
- Maasai-Mara – during the dry season (July-October) as the Serengeti wildebeest move north into the Maasai Mara, wildebeest from the Loita Plains descend to the conservancies surrounding the Maasai Mara National Reserve. Their numbers have declined 80.9%, from 123,930 wildebeest in 1977-78 to less than 20,000 in 2016. Referred to by researchers as 'northern migration'.
- Athi-Kaputiei ecosystem – includes Nairobi National Park, Athi Plains and surrounding areas. This population has declined 95% from over 26,800 in 1977-78 to under 3,000 in 2014, leading to a "virtual collapse of the migration". It is important to note here that researchers believe that many of these wilde-

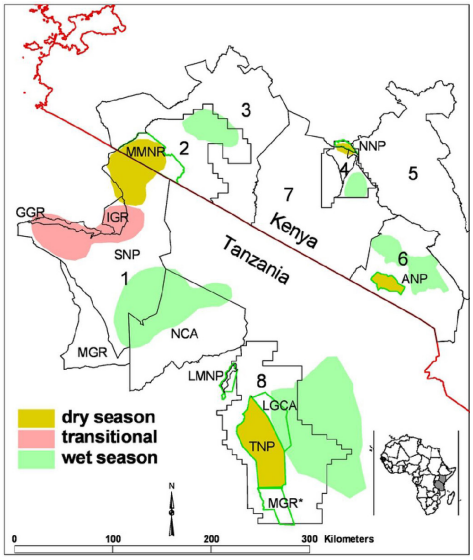

Figure 2: The study examined migrations in 5 different ecosystems. 1 = Serengeti Ecosystem, 2 = Maasai Mara Ecosystem, 3 = Narok County, 4 = Athi-Kaputiei Ecosystem, 5 = Machakos County, 6 = Greater Amboseli Ecosystem, 7 = West Kajiado and 8 = Tarangire – Manyara Ecosystem © F. Msoffe et al

beest have moved, rather than died in such enormous numbers.

- Amboseli Basin – includes Amboseli National Park and surrounding pastoral lands in Kajiado County. The population of the Amboseli ecosystem declined 84.5% from 16,290 in 1977-78 to 2,375 by 2014.

- Tarangire-Manyara ecosystem – incorporates both national parks and private conservancies in Tanzania. The population declined from 48,783 in 1990 to 13,603 in 2016 and shows no signs of recovery.

As can be seen from the above, four out of the five studied migrations are at the point of disappearing completely, particularly the Athi-Kaputiei population. As wildebeest numbers have dropped, the human populations have soared: a 673% increase in Narok County (including Loita Plains), 905% in Kajiado County (Incorporating the Amboseli Basin), and a 247% increase in Machakos Country – all from 1962 to 2009. Increased human numbers means increased agriculture, increased sedentarisation and settlement of formerly semi-nomadic populations, and more fences and roads that occlude grazing resources and routes. In Kenya, the increase of private land ownership has changed the game, and in Tanzania the Game Controlled Areas have been cultivated.

The study expressed frustration at what the researchers describe as "incoher-

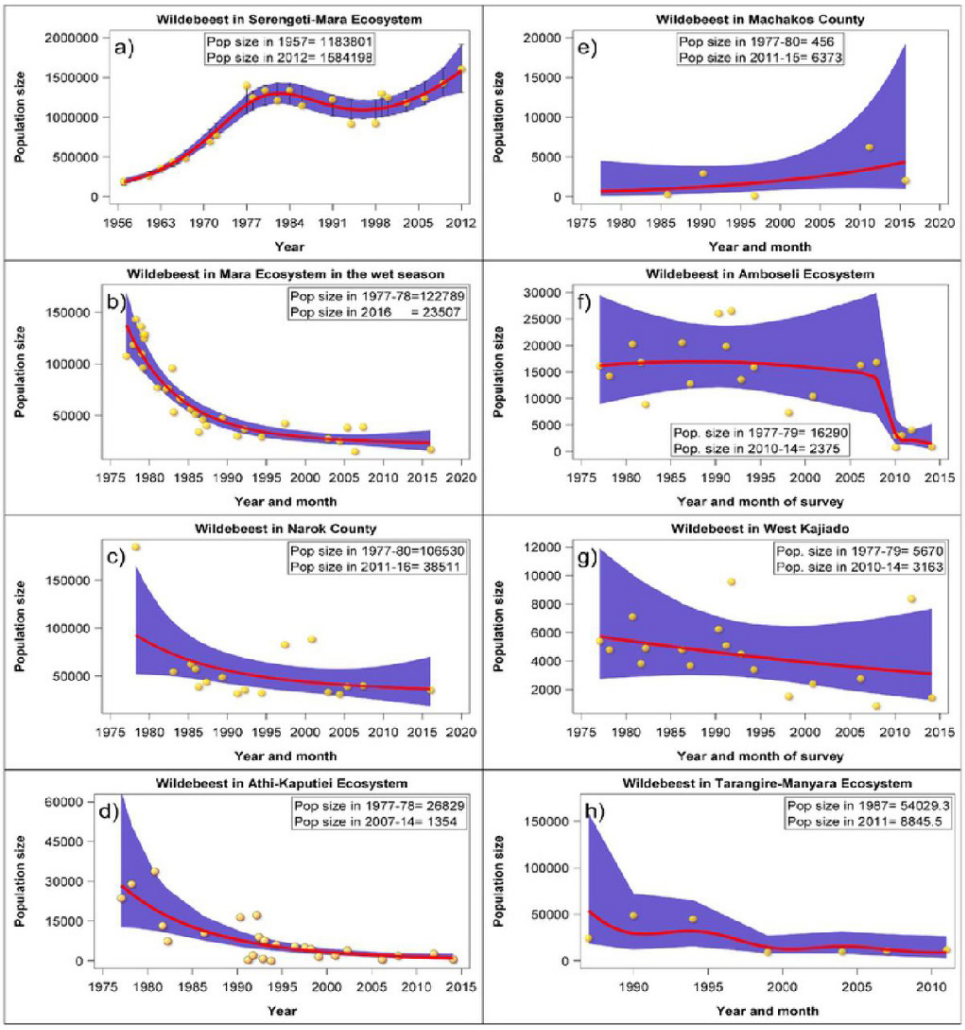

Figure 3: Population trends of migratory wildebeest populations: a) Serengeti-Mara ecosystem, b) Maasai Mara ecosystem, c) Narok County, d) Athi-Kaputiei ecosystem, e) Machakos County, f) Greater Amboseli ecosystem, g) West Kajiado and h) Tarangire-Manyara ecosystem © F. Msoffe et al

ent government development policies that promote incompatible land uses, such as promoting cultivation pastoral rangelands occupied by wildlife to combat food insecurity while also promoting wildlife-based tourism in the same areas".

In Kenya, landowners do not have access or user rights over the wild animals on their land and are often offered no compensation for the cost of supporting wildlife. While there are several changes in policy and legal framework, none of these has been adequately implemented.

Hope going forward

The study acknowledges the existing governmental and conservation efforts in both Kenya and Tanzania that have gone some way towards mitigating the effects of expansive population growth, particularly in the development of policies on corridors, dispersal areas and buffer zones to create habitat connectivity. The researchers highlight the system of conservancies within Kenya – private landowners (either individually or as an amalgamation) rent out large sections of land to tourism operators for game viewing. In Kenya, around 65% of wildlife occurs outside of protected areas, so the rapid growth in popularity of conservancies is a positive development.

They do, however, require a sustainable tourism potential. In Tanzania, the creation of the Tanzania Wildlife Authority as well as the reorganisation of the entire wildlife sector into paramilitary-style organisations to intensify the fight against run-away poaching, have both been positive steps. However, these efforts need to be enhanced by economic incentives to communities.

"The Kenyan and Tanzanian governments need to strongly promote and lead the conservation of the remaining key wildebeest habitats, migration corridors and populations and more

Figure 4: Fences and roads block historic migratory routes © Joseph Ogutu

conservancies or management areas should be established to protect migratory routes or corridors, buffer zones, dispersal areas and calving grounds for the species." The plight of the white-bearded wildebeest is one that represents a far more significant challenge facing the wildlife of Africa.

Full report: Wildebeest migration in East Africa: Status, threats and conservation measures: http://bit.ly/3bFgveX

Fortunata Msoffe, Joseph Ogutu, Mohammed Said, Shem Kifugo, Jan de Leeuw, Paul Van Gardigen, Robin Reid, JA Staback, Randall Boone – hosted by bioRxiv

Figure 5: An epic river crossing of wildebeest takes place in the Maasai Mara National Reserve, Kenya © Tom Thomson – Photographer of the Year 2018 entrant

Population, waste bigger environmental factors than livestock

Reprinted From: https://agriabout.com/

Agri About

As the world's population increases and the planet's temperature rises, many are pointing to animal agriculture as a leading cause of climate change, said Dr Robin White from the Virginia State University.

White said animal agriculture can and must become a significantly more sustainable industry. Much of her research focuses on sustainable beef production that considers human and animal nutrition as well as climate change, social justice, animal welfare and the impact of emerging ag-tech.

"We are expected to reach over nine billion people within 30 years and the estimates for the 2100 population are as high as 11 billion people or perhaps higher," said White. "However, we're also expecting changes in the demographics of that population.

"Economies in developing countries are beginning to mature, and incomes are rising, said White. "Historically, as people's incomes rise, their demand for animal products also rises. The projections suggest that we're looking at something like a 70 per cent increase in demand for animal protein products on a global scale."

Though this growth in demand will allow people the opportunity to grow markets and expand their businesses, the issue is that there is only so much land and water that the planet can provide. Beyond that, many countries are making commitments to reducing greenhouse gas emissions, and White said livestock products are often associated with high emissions of greenhouse gases.

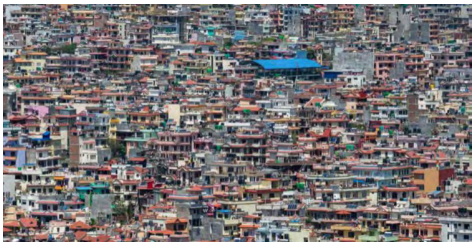

Figure 1: There is only so much land and water that the planet can provide.

Figure 2: Our population is often the cause of our environmental problems - as seen here on the beach.

"It's really our population that's causing our environmental problems — it's not necessarily the food production system," said White. "If animal agriculture was the major driver of increasing environmental impact over the last several years, we would expect to see their numbers to be much higher, which is just not supported by the data."

A lot of White's work deals with the environmental impacts of having global plantbased diets in order to understand whether the benefits of stopping the production of animal products outweigh the potential health risks to populations.

In one of her charts, White estimates that if animals were eliminated from agriculture, the production of legumes would need to triple, and there would need to be five times the production of nuts. There would also be a large increase in grain production. "The question then arises whether the planet can sustain so much more nut and plant production," said White.

This change in diet could pose a health risk for the population, especially those who are already vulnerable, like the elderly, growing children, and women who are pregnant or breastfeeding.

White said the population's intake of important micronutrients, like B12, calcium, Vitamin A and Vitamin D, would be greatly decreased.

Another issue is that many plants and nonanimal foods can't be grown just anywhere, so the possibility of having a global plantbased diet is simply not feasible due to these limitations.

White said there would not be that much of a decrease in greenhouse gases, especially when because the population would also be losing a great deal of micronutrients.

How Africa will be affected by climate change

Africa is more vulnerable than any other region to the world's changing weather patterns, explains climate specialist Richard Washington.

Current Address: School of Geography and the Environment at Oxford University in the UK
Reprinted From: https://bbc.in/2we8jSy

Richard Washington

The African continent will be hardest hit by climate change. There are four key reasons for this:

- First, African society is very closely coupled with the climate system; hundreds of millions of people depend on rainfall to grow their food
- Second, the African climate system is controlled by an extremely complex mix of large-scale weather systems, many from distant parts of the planet and, in comparison with almost all other inhabited regions, is vastly understudied. It is therefore capable of all sorts of surprises
- Third, the degree of expected climate change is large. The two most extensive land-based end-of-century projected decreases in rainfall anywhere on the planet occur over Africa; one over North Africa and the other over southern Africa
- Finally, the capacity for adaptation to climate change is low; poverty equates to reduced choice at the individual level while governance generally fails to prioritise and act on climate change

Is Africa sleepwalking into a potential catastrophe?

Monsoons altering

African climate is replete with complexity and marvels. The Sahara is the world's largest desert with the deepest layer of intense heating anywhere on Earth.

In June and July the most extensive and most intense dust storms found anywhere on the planet fill the air with fine particles that interfere with climate in ways we don't quite understand.

The region is almost completely devoid of weather measurements yet it is a key driver of the West African monsoon system, which brings three months of rain that interrupts the nine-month long dry season across the Sahel region, south of the desert.

For the decades following the 1960s and peaking in 1984, there was a downturn of rainfall of some 30% across the Sahel, which led to famine and the deaths of hundreds of thousands of people and the displacement of many millions.

No other region has documented such a long and spatially extensive drought.

Evidence points to Western industrial aerosol pollution, which cooled parts of the global ocean, thereby altering the monsoon system, as a cause.

The currently observed recovery of the rains is projected to continue through the 21st Century, particularly over the central and eastern Sahel.

But that change seems to depend on exactly where future heating in the central Sahara peaks, emphasising cruelly the region we least understand.

Figure 1: Africa is more vulnerable than any other region to the world's changing weather patterns © Getty Images

In southern Africa we are seeing a delay in the onset and a drying of early summer rains, which is predicted to worsen in forthcoming decades.

Temperatures there are predicted to rise by five degrees or more, particularly in the parts of Namibia, Botswana and Zambia that are already intolerably hot.

The East African paradox

Meanwhile over Kenya and Tanzania, the long rains from March to May start later and end sooner - leading to an overall decrease in rainfall.

This observed change sits uncomfortably next to predictions of a wetter future in the same season - a problem scientists have termed the East African Climate Paradox.

Central Africa, one of three regions on the planet where thunderstorms drive the rest of the planet's tropical and subtropical weather systems, lives perilously close to the rainfall minimum needed to support the world's second largest rainforest system.

Even a little less rainfall in the future could endanger the forest and its massive carbon store.

We know remarkably little about that climate system - it is scarcely even monitored - there are more reporting rain gauges in the UK county of Oxfordshire than the entire Congo Basin.

Africa's complex climate system is, unusually, influenced by the three main global ocean basins.

Emerging from one of those rapidly warming oceans, tropical cyclones Idai and Kenneth in March and April 2019 destroyed parts of Mozambique, Zimbabwe and Malawi, with Kenneth following a particularly unusual path over Tanzania.

Scientific breakthrough

But on the scientific front there is hope. In collaborative efforts we are working intensely hard to improve climate prediction.

Projections of climate change depend on climate models of which there are dozens, each as complicated to understand as the real world.

Through efforts such as the ongoing Future Climate for Africa (FCFA), a programme funded by the UK's Department for International Development and

Figure 2: It is not known how dust storms affect the climate in the long-term © AFP

Natural Environment Research Council, the experience and insights of African climate scientists have led to a discernible jump in our ability to understand and model African climate.

We have new insights brought through that scientific ingenuity.

Each region and sub-region of Africa is changing differently but an emerging commonality is a shift towards more intense rainfall - even where there is observed and projected future drying.

The rainfall arrives in shorter bursts, causing more runoff and longer dry-spells in between.

New models, developed as part of FCFA, are now run at extremely high resolution with grid spacing of around 4 km (2.5 miles) for the entire continent.

Understanding thunderstorms

The results point unambiguously to an increase in both rainfall intensity and the length of dry spells, and we have strong reason to believe them.

Central to that rainfall change is the behaviour of thunderstorms, which deliver around 70% of African rain.

Standard global climate models can only represent these key systems indirectly but the new models are capable of representing thunderstorms systems adequately for the first time.
This is part of the approach we are adopting - to find out exactly how the models simulate the changing weather.

From an extremely modestly resourced lab in Cameroon, for example, Wilfried Pokam and his team of researchers are exposing the way that the central African climate system and southern Africa are linked, thereby breaking the mould of our stubborn piecemeal, regional view of the continent's climate system.

Such breakthroughs are improbable when you consider that these researchers download massive data sets through cheap Sim cards in their mobile phones and analyse the output overnight.

By day, they keep the first Lidar system in central Africa running. The Lidar measures winds in the lowest few kilometres of the atmosphere, helping to fill the vast data void in central Africa.

They are part of a set of young scientists joining the race to set adaptation to climate change in motion before Africa is overwhelmed.

It is a matter of social justice that we succeed.

Africa will be hardest hit by climate change, but has contributed the least to causing that change.

Not everything needs to be a forest

Too often viewed as degraded forests rather than valuable grasslands, savannas are threatened by carbon-storing afforestation programs that might not even work.

Reprinted From: http://bit.ly/37tiK1t

Brandon Keim

It was in Africa's savannas that humanity's ancestors evolved to walk upright—yet these savannas are threatened by a human-dominated age, one in which they're officially designated as degraded forests and scheduled for replacement.

The plight of savannas is the subject of two recent papers, one about Asia and one about Africa, but both sharing an essential concern: that people are quick to see tree-dotted grassy plains as mere ecological placeholders for the forests that ought to be there.

"Asian savannas have been misinterpreted as degraded forest since the colonial period," write Dushyant Kumar, an ecologist at Germany's Senckenberg Biodiversity and Climate Research Centre, and colleagues in the journal Biological Conservation. "There is an urgent need for a correct interpretation."

Tropical savannas presently cover about one-fifth of Earth's land surface, write Kumar's team, but they are threatened. By suppressing naturally-occurring fire and eradicating shrub-munching large herbivores, people have allowed forests to encroach.

Savannas are also the target of afforestation programs that promise to sequester carbon in newly-grown forests—but whether these will work as intended is a subject of ongoing scientific debate, and "these agendas may omit the potential negative consequences for biodiversity."

The researchers modeled the vegetative future of South Asia's savannas from now until the century's end under a variety of climate scenarios. Forest area is expected to increase by about 44 percent; grasslands are expected to contract by nearly 40 percent. And that's not even taking into account climate-oriented afforestation projects. "The continuous effort to afforest savanna areas poses major threats to their biodiversity," write the researchers, depriving species adapted to savanna life of their only home. "Ecosystem management policies in South Asia should adopt a grass-centric perspective and prioritize grassland and savanna conservation."

Their sentiments are echoed in the journal Trends in Ecology & Evolution, where researchers led by biologist William Bond of the University of Cape Town lament that one million square kilometers of African savanna—an area roughly the size of France and Germany combined—is now targeted for so-called restoration by the year 2030.

"The target is based on the erroneous assumption that these biomes are deforested and degraded," they write. Among the landscapes formally mapped as degraded are the ancient savanna landscapes of the Serengeti and Kruger National Park, which have not been forests for several million years.

More than a billion dollars have already been pledged by Germany and the World Bank; 28 African countries have signed up for the AFR100, an offshoot of the Bonn Challenge, the international forest restoration and carbon sequestration initiative launched in 2011 with a goal of putting trees on 3.5 million square kilometers by 2030. Yet Bond's team, like Kumar's, also points to growing scientific debate over the climate impacts of afforestation—especially if new growth is, as will likely be the case in Africa, plantations rather than diverse forests.

They highlight recent research suggesting that the Bonn Challenge's 3.5 million square kilometers would, if covered by natural forests, sequester 42 gigatons of carbon, but that figure falls to a mere 1 gigaton if the forests are the pine and eucalyptus plantations expected in much of Africa.

Forests may also absorb more solar radiation than do grasslands, thus offsetting the extra carbon they store. And when eucalyptus and pine plantations, which are particularly vulnerable to high-severity fires, burn, most of the carbon they store is released back into the atmosphere.

In grasslands, argues Bond's team, most carbon is stored below ground and persists through fire. "Converting African savannas to plantations is pointless as a mitigation measure," they write.

Bond's team stresses that truly degraded forests ought to be restored and existing forests protected. But large-scale afforestation "is based on the wrong assumptions," they argue. "Far from being deforested and degraded, Africa's savannas and grasslands existed, alongside forests, for millions of years."

Rather than covering them with trees, people might "promote energy efficient cities in this rapidly urbanizing continent so that Africa follows a less carbon-intensive trajectory of development than other emerging economies."

Sources

Bond *et al.* "The Trouble with Trees: Afforestation Plans for Africa." *Trends in Ecology & Evolution*, 2019.

Kumar *et al.* "Misinterpretation of Asian savannas as degraded forest can mislead management and conservation policy under climate change." *Biological Conservation, 2019.*

Agriculture must be part of the solution, not the problem

As we move into 2020, the super year for biodiversity, achieving our global goals will hinge on making food production more sustainable while ensuring nutrition for all.

Reprinted From: http://bit.ly/3204wnR

Convention on Biological Diversity

Agriculture and biodiversity have been inextricably linked for as long as we humans have been producing our own food. As the source of all variety in our crops and livestock, biodiversity is the very foundation of agriculture. It is also a powerful force in our continued ability to produce enough food to feed a growing population, supporting farming through pollination, natural pest control, and soil health. In turn, agriculture supports all of humanity, producing an average of 23.7 million tons of food per day and providing livelihoods for 2.5 billion people.

But right now, we have a problem: agriculture poses an unprecedented threat to biodiversity worldwide. Intensified food production is damaging our environment through conversion of natural habitats to monocultures, soil degradation, unsustainable consumption of water, and unsustainable use of pesticides and fertilizers.

Although the value of agricultural crop production has almost tripled since 1970, indicators of nature's regulating contributions — such as loss of pollinator and soil biodiversity — have declined. These issues extend beyond agricultural areas, affecting forests, inland waters and coastal ecosystems.

Fortunately, agriculture is not only one of the problems we face — it can also be part of the solution. Sustainable agriculture can contribute to conservation of biodiversity while reaping the benefits. As we work to achieve our vision of living in harmony with nature, we must improve our agricultural systems to work with biodiversity, not against it. The good news is that many groups are already working to make this imperative a reality.

The Resilient Food Systems programme is part of the critical push to make agriculture more sustainable. A five-year initiative in partnership with the UN Environment Programme, the Food and Agriculture Organization of the United Nations (FAO), and the United Nations Development Programme (among others), this program is enhancing long-term sustainability and resilience for food security in sub-Saharan Africa with activities in 12 countries.

Figure 1: Although the value of agricultural crop production has almost tripled since 1970, indicators of nature's regulating contributions — such as loss of pollinator and soil biodiversity — have declined.

To tackle these issues, they are focused on engaging and bringing together stakeholders from both agricultural and environmental sectors, promoting proven actions, and tracking the results to inform decision making.

Through an Engage, Act, and Track framework, the program aims to increase genetic diversity of crops, reduce land degradation, recover natural vegetation, and increase the capacity of soils to sequester carbon.

Another step in the sustainable agriculture movement is the Global Symposium on Soil Biodiversity, taking place next year.

From bacteria to fungi to earthworms, the life in our soils is crucial to plant health (and therefore, to our health). The FAO is hosting this major meeting from 10-12 March in Rome.

CropLife SA warns of possible Lepidoptera pest outbreak

Reprinted From: http://bit.ly/2SwGL3O

Press release, CropLife SA

Current weather patterns in Southern Africa may be conducive to the outbreak of certain insect pests such as *Lepidoptera*. Moist air from the tropics may bring another infestation of the fall armyworm into the Limpopo, North West, Free State and Northern Cape provinces. In addition, the current conditions in these provinces and KwaZulu-Natal are conducive to the outbreak of African armyworm in veld and grazing paddocks.

Small possibility of migratory locusts

CropLife SA has been notified of massive clouds of small moths visible early evening in the northern parts of Namibia around Otjiwarongo. Sunflower growers in the North West province of South Africa have also reported a large-scale caterpillar infestation. Although the Karoo remains extremely dry in most parts, it is possible for the migratory locust to appear. However, it is unlikely at this stage.

Crop and livestock farmers should be extremely vigilant in the mentioned provinces and scout late afternoons in cash crops, fruit orchards, grazing paddocks and natural veld for swarms of small moths as the first signs of *Lepidoptera* pest outbreaks.

Farmers who grow non-GM maize and cotton, as well as vegetable farmers, are very vulnerable to fall armyworm and need to make a special effort to scout for the pest. Scouting can be done visually in the early evening.

However, it is advisable to also use pheromone traps that are registered and available in South Africa.

Effective control of large-scale outbreaks

Should farmers suspect the presence of fall armyworm or any other large-scale invasions of *Lepidoptera* pests, they are urged to take good quality, close-up photographs of the moths, caterpillars and egg parcels and send it via WhatsApp to +27 (0)82 446 8946 (Dr Gerhard Verdoorn, CropLife SA) for assistance with identification.

Farmers are also encouraged to contact CropLife SA for advice on the effective control of any such large-scale outbreaks. In addition, the resources section of CropLife SA's website www.croplife.co.za contains guidelines for managing specific pests, including fall armyworm.

Figure 1: Many crops within South Africa are at risk of being invaded by insect pests

Invasive alien plants and their impact on wetlands

Current Address: Deputy Director: Planning, Monitoring and Evaluation, Working for Wetlands
E-mail Address: ftererai@environment.gov.za
Reprinted From: http://bit.ly/3204wnR

Farai Tererai

Invasive alien plants multiply rapidly once they are established in an area, which increases clearing costs and compounds adverse effects on the environment. These species have established sustained self-propagating populations and spread considerable distances from the site of introduction.

Invasive alien plants are introduced either intentionally or unintentionally. Plants that were introduced intentionally were brought into the country for horticulture, aquaculture, agriculture and forestry. Plants that were introduced unintentionally entered the country as commodity contaminants, or as stowaways on trucks, aeroplanes and ships.

How alien plants spread

Once these species arrive, some naturalise to the local conditions, including climate factors. They accomplish this through superior competitive capabilities, which include fast growth, high reproductive output and the ability to adapt to a wide range of physical environments. In many cases these invasive alien plants establish dominance and form monocultures or homogeneous populations. These species spread rapidly in rivers or streams and their margins, collectively known as riparian zones, as well as wetlands, because these systems are inherently highly dynamic and connected.

Riparian zones and wetlands, which usually cover only a small part of the landscape, experience much disturbance due to the natural processes of flooding, erosion, deposition, river damming, and land use next to rivers. Consequently, they are highly susceptible to invasion.

Rivers serve as conduits for substantial fluxes of materials and energy, thus dispersing alien plants. Wetlands are known for trapping material transported by rivers, which is why rivers and wetlands are the most heavily invaded ecosystems. This phenomenon causes substantial changes to ecosystem structure and function.

Common invaders of wetlands

Approximately 26 alien plant species are listed as invasive in the inland aquatic ecosystems of South Africa, which includes wetlands. *The Southern African Plant Invaders Atlas* database indicates the most common invaders of rivers and their fringes. These plants include:

- Weeping willow (*Salix babylonica L*).
- White poplar (*Populus alba*).
- Grey poplar (*Populus × canescens*).
- Black wattle (*Acacia mearnsii*), silver wattle (*Acacia dealbata*), Port Jackson wattle (*Acacia saligna*).
- Honey mesquite (*Prosopis glandulosa var. torreyana/velutina*).
- Bugweed (*Solanum mauritianum*).
- Red sesbania (*Sesbania punicea*).
- Common lantana (*Lantana camara*).
- Siam weed (*Chromolaena odorata*).
- River red gum (*Eucalyptus camaldulensis*).

Common invasive in-stream species include giant reed (*Arundo donax L.*), water fern (*Azolla filiculoides*), and the notorious water hyacinth (*Eichhornia crassipes*).

The top five wetland invaders are water hyacinth, water fern, spear thistle (*Cirsium vulgare*), honey mesquite and purpletop vervain (*Verbena bonariensis L.*).

Table 1: Invasive species known to have adverse effects on South Africa's inland aquatic biome. (Source: National Biodiversity Assessment, 2018)

Species	Regulatory category	Extent (Quarter-degree grid cells occupied)	Examples of impact
Silver wattle (*Acacia dealbata*)	2	240	Forms closed-canopy stands, excluding most other species in riparian zones. Uses excessive amounts of water.
Long-leaved wattle (*Acacia longifolia*)	1b	53	Forms closed-canopy stands, excluding most other species. Uses excessive amounts of water.
Black wattle (*Acacia mearnsii*) and its hybrids	2	369	Forms closed-canopy stands, excluding most other species in riparian zones. Uses excessive amounts of water.
Port Jackson willow (*Acacia saligna*)	1b	126	Forms closed-canopy stands, excluding most other species.
Creeping bentgrass (*Agrostis stolonifera*)	Context specific*	Offshore islands	Forms extensive clonal patches by means of long stolons, which affects indigenous plant species on offshore islands.
Velvet mesquite (*Prosopis velutina*)	Context specific*	5	Many well-documented impacts on biodiversity, groundwater supplies, rangeland productivity and human livelihoods.

* Applies to species that have been placed into various categories depending on their location.

Loss of biodiversity

Invasions by alien plants have been shown to cause a displacement of native indigenous plant species – in some cases replacing them with less usable single-species stands (monocultures), such as river red gum and black wattle.

Highly diverse ecosystems often have high grazing value compared to single-species stands. A typical example of an invasion problem in grazing is that of dense, widespread famine weed (*Parthenium hysterophorus*). Invasions are common in KwaZulu-Natal and Mpumalanga.

Famine weed is poisonous to animals and humans and invades crops and pastures. It owes its common name to the fact that farmers must often abandon their land when it invades crops.

A secondary effect of famine weed invasion is high farm costs. Loss of biodiversity often results in multiple-use ecosystems and habitats being replaced by those that have a single use. Areas that were used for indigenous medicinal use and grazing may now be used for timber, and diverse wetland ecosystems might be replaced by a stand of river red gums, as is the case in the Berg River area. Some invasive alien plants have been associated with pollination disruption in crops, which reduces crop yield.

The unique and diverse habitats of many flora and fauna are also lost to the detriment of farms that depend on ecotourism. For example, indigenous bird species are less diverse in stands of *Eucalyptus* species. Some invasive species alter the physical and chemical characteristics of soil and some of them, such as *Eucalyptus* species, are known for depositing chemicals that are harmful to other species, which not only restricts land use but also limits unassisted restoration after removal of the main invader.

Threat to water security

Invasive alien plants are known for excessive water consumption due to their high transpiration rates. This poses a significant threat to water security, particularly in water-scarce areas. The impacts are devastating during drought, and this is a major threat to irrigated agriculture and animal watering.

Wetlands are known to buffer these effects because of their ability to store floodwater and release it slowly after rain has fallen, but invasive plants threaten this regulating service. The nutrient and chemical contaminants that are generated on farms need to be flushed regularly, but invasive alien plants' excessive water consumption also threatens this function and the availability of clean water on farms for various uses. Honey mesquite, which is known to invade the Karoo and arid savanna, reduces native species' diversity, depletes groundwater and reduces rangeland quality.

Figure 1: Wetlands provide water for animals during dry seasons. (Photo: Farai Tererai)

Figure 2: Single-species stands have replaced indigenous species in this riparian zone.

Changes in fire regimes

Fires are a natural phenomenon that farmers use on their land to stimulate grazing, especially in the grassland and savanna biomes. However, invasive alien plant species generally produce much more plant material that is highly flammable, such as the leaf and twig litter of pines and wattles, which substantially increase the frequency, magnitude and intensity of fires. The result of such fires is a significant loss of farm property and life.

The vicious Knysna and George fires in 2017 and 2018 were compounded by the dense pine and hakea invasions in the mountains. Such fires result in indigenous species not coping with the new fire regimes and other species completely burning out with their soil seed stores. New fire regimes favour the propagation of species such as black wattle over that of indigenous species.

Invasions cause wetlands and peatland,

Figure 3: These photos show riverbank erosion due to falling invasive trees in the riparian zone (a) and consequent channel blockage by debris (b), which causes further erosion, in the Berg River in the Western Cape.

a type of wetland with high carbon content, to dry up. When a fire breaks out in peatland, it burns carbon stored in these wetlands, and these fires can last a long time. Many peatlands in South Africa, along with their associated benefits, have disappeared because of peat fires.

The role of landowners

Seeing that invasions in wetlands have potentially significant impacts locally, landowners or users have a role to play in the management of these invasions.

If each landowner manages invasive alien plants on his or her land, the landscape could be free of these species and their harmful effects. Landowners can participate in the management of invasive alien plants by avoiding certain pathways of introduction of these species, clearing and following up, and whistleblowing.

The responsibility to maintain land that is free of invasive alien plants primarily lies with landowners, as stated in the *Conservation of Agricultural Resources Act*, 1983 (Act 43 of 1983). However, it is acknowledged that the magnitude of invasions may be beyond the capacity of individual landowners and the sources of these invasions may be beyond landowners' boundaries, which warrants support from the government.

The Department of Environment, Forestry and Fisheries (DEFF) has been clearing invasive alien plants through the Working for Water programme since 1995. The department has cleared vast tracks of land in various land tenure systems, but some of the biggest challenges relate to inadequate follow-up and landowner co-operation.

For more information, send an email to the author at ftererai@environment.gov.za.

One of the 330 demonstration plots for thicket replanting with spekboom (Portu-lacaria afra) across the Eastern cape. (Photo: Florian Fusstetter) (www.ipsnews.net/2019/06/south-africas-first-carbon-farm/)

South Africa needs a fresh approach to managing invasive trees like Eucalyptus

Current Address: Postdoctoral research fellow, Stellenbosch University
Reprinted From: http://bit.ly/2uQCpLx

Heidi Hirsch

For thousands of years, trees and humans have maintained an intimate connection. It's therefore not surprising that many tree species were moved around the world, following the footprints of human civilisation.

Globally, however, more tree species are becoming invasive, with detrimental ecological and socio-economic impacts. Understanding their invasion history and ecology is essential to developing effective management approaches.

Vast areas of Africa's southernmost country are characterised by invading tree species. These include wattles, pines, mesquite and eucalyptus. Such invasions are especially worrying in drought stricken South Africa because most invasive trees use more water than other plant groups.

Among the invasive trees with the most severe effects, particularly when it comes to water consumption, are several Eucalyptus species. More than 200 Australian eucalypt species have been introduced to South Africa since the 1800s, most for forestry growth trials and cultivation. They are fast growing and useful – providing timber, paper, poles, firewood, shelter, ornamental value, and nectar and pollen for bees.

Some species, however, escaped cultivation and started to establish populations outside plantations. There are six eucalypt species listed as invasive by the country's environmental legislation: forest red gum, karri, river red gum, saligna gum, spider gum, and sugar gum. Their listing means they should be controlled or retained, depending on the habitat in which they occur.

Invasive eucalypts account for 16% of the 1,444 million cubic metres of water resources that South Africa loses every year due to invasive plants.

Figure 1: Invasive eucalypts account for 16% of the 1 444 million cubic meters of water South Africa loses annually to invasive plants.

Of the listed eucalyptus species, river red gum (*Eucalyptus camaldulensis Dehnh*) is considered to be the most widespread and aggressive. It has the largest native range among Australia's more than 700 native eucalyptus species and is also one of the most widely planted around the globe.

But there's a lot that isn't known about the river red gum in South Africa. To bridge the knowledge gaps, we compiled a comprehensive species profile on river red gum. This involved a comprehensive literature review as well as consulting experts such as foresters, researchers and invasive species managers.

We gathered information on the trees' introduction and planting history, current distribution and value for commercial forestry. Also, aspects about it as an invader, associated pests and pathogens, people's perception of the species and conflicts of interest were considered.
We also collected information on management and restoration options, knowledge gaps and further research needs.

The outcome of all these endeavours was recently published in an extensive dossier on river red gum.

With this review, we were able to define the knowns and unknowns on this iconic tree to pave the way towards a national management strategy. Besides area-specific control measures, such a strategy should also consider percep-

tions and needs of different stakeholder groups to minimise conflicts of interest.

The eucalyptus

River red gum became popular after its introduction to South Africa around 1870. This was because it was useful for a variety of products and services like wood, shade and shelter.

Nowadays, river red gum is a major problem along many river courses, especially in the Western Cape. Over the past two decades the government has spent more than R400 million trying to clear the species.

However, little is known about the species' history in South Africa. Nor is very much known about its exact abundance, the specific environmental conditions which trigger its invasion, and how associated pests and diseases might influence its future success as invader. This lack of knowledge clearly hampers the development of effective and sustainable management options.

Our work shows that river red gum is a poster child example of a conflict-generating species in the country. This is because it brings benefits (such as nectar and pollen for bees, habitat for raptors, wood), but can also have huge negative effects (such as alteration of river structure, impact on local biodiversity).

But management approaches have mostly followed a "one-fits-all" philosophy and proved in several cases inefficient. Most approaches in invaded riparian areas entail the removal of all woody invasive plants with the assumption that the ecosystem will recover by itself.

Also, we found that the current legislative listing of river red gum is very complicated and confusing. This makes the enforcement of the listing for this species difficult and has also the potential to fuel conflicts of interest.

New approach needed

Our research shows that the complexity that evolves around river red gum in South Africa needs to be addressed in future management options. Specifically, interventions must be regulated and coordinated at national level as well as regional and landscape scales.

And, to be effective, stakeholders (such as beekeepers and landowners) need to be encouraged to get involved to solve conflicts of interests.

We also suggest options for improved management approaches that use principles of vegetation succession – that is where trees are replaced over time rather than simply cleared away. This is a much more sustainable way of approaching the problem, particularly where the restoration of the natural riparian forest vegetation is the end goal. Although this approach takes longer than complete clearing, it's more sustainable because it allows for the development of income-generating entrepreneurship and can help reduce conflicts of interest.

We also recommended a simplification of the legislative listing of river red gum.

Our work shows how important it is to move away from demonising certain species by considering not only what impacts they have, but also their benefits and geographic dynamics. Our findings also show that it's important to engage with different stakeholder groups to develop meaningful management goals.

Overall, our review provides a blueprint for the types of information needed for developing management strategies for non-native tree species in different parts of the world.

Disclosure statement

Heidi Hirsch receives funding from the Centre for Invasion Biology, Stellenbosch University, South Africa. She is a member of the Australian Trees Working Group, South Africa.

Rietvlei wetland reserve (Photo: Abu Shawka) (https://www.farmersweekly.co.za/agri-technology/farming-for-tomorrow/saving-land-importance-wetlands/)

Red grass phenomenon has farmers scratching heads

Current Address: Stockfarm
Reprinted From: http://bit.ly/2SS1sXT

Izak Hofmeyr

"Our red grass did not seed this year," said Cas Human of the Van Reenen area a few months ago. Arthur de Villiers, a well-known stud breeder, confirmed this statement shortly thereafter at a farmers' day: He noticed the same problem with red grass in the area where he farms between Memel and Vrede in the Free State.

Stockfarm spoke to Rick Dillon of Waterfall Farm near Van Reenen, hoping to find some answers. Years ago, Rick completed his master's dissertation on red grass under Prof Neil Tainton.

Rick grew up in the region and was an extension officer in Harrismith for many years. He has a burning passion for the environment and was instrumental in the establishment of the 60 000ha conservation area on the Van Reenen escarpment.

Figure 1: Red grass has been under great pressure due to management practices in the region.

Regenerative agriculture

According to Rick, there can be several reasons why the red grass did not seed. This occurrence, however, compelled him to remark on the concept of regenerative agriculture, a practice that is gaining traction in especially crop farming.

The first point he makes is that red grass has been under enormous pressure for decades due to grazing and management practices commonly applied in the region.

"There are stretches of veld that have been severely trampled. These areas appear white in winter, compared to the reddish colour of the red grass, and are usually unused fields, places where livestock have spent the night, or overgrazed areas. In short, the veld is showing significant damage. If you look at the winter veld today, the white areas are much more extensive than the red areas. Red grass should actually represent 75% of the veld."

Influence of fires

His second point is that fires have a huge effect on the veld. Whereas fires used to occur due to lightning that set the veld ablaze in early spring and late summer, the current situation very different.

"Farmers burn their own veld every year to utilise the newly sprouting grass, known as the 'spring flush'. The veld does not really get a chance to build up organic matter. This leads to severe erosion, water that cannot penetrate the soil and veld degradation."

The third point Rick emphasises is the fact that the use of urea has brought about a complete revolution in the utilisation of sourveld on the Highveld.

"Traditionally farmers had to move to sweeter parts in winter because the veld couldn't sustain the animals throughout the season. Urea has completely changed this; it is now possible for livestock to overwinter on the veld where they can utilise dry, unpalatable grass. However, this has increased pressure on red grass.

"We are now faced with a situation where red grass has not only been burned, but also severely overgrazed. Instead of moving livestock to Natal for the winter as was traditionally the case, the veld is now continuously utilised."

Nature of the red grass tuft

His fourth point pertains to the nature of the red grass tuft. "The growing points of other grass species in the area are found underground. The growing point of red grass, however, is situated in the tuft above the ground. This means that intense fire or even intense frost can destroy the growing point," he explains.

The question as to why the red grass did not seed this year, he says, can have several answers. It could have been caused by intense fire or by intense frost during late spring. Both these phenomena, however, will likely be localised.

"It is also possible that the drought, which only truly broke in January this

Figure 2: Rick Dillon

year, resulted in a shortened growing season, which would have prevented the grass from following its normal physiological cycle."

A clear wake-up call

Rick believes that the lack of red grass seed is not due to climate change. "Many other factors can lead to this phenomenon. It should, however, be a wake-up call for us to do a thorough assessment of the condition of our veld.

"Climate change is a reality and its effects will be harsh. For that reason, we need to ensure we have all the weapons in our arsenal to combat it. And healthy veld is a very important weapon in this fight." According to Rick, something is very wrong with the veld if you or your horse often stumble over uneven tufts. "The tufts grow on a 'soil platform' and the ground level is significantly lower between these tufts. This is a sign of erosion and a low percentage of organic matter.

"These soil platforms are indicative of the original soil level. The soil, however, is gradually being blown and washed away. With each fire, more of the organic matter that could help mitigate erosion is destroyed. It also drastically reduces moisture penetration as the rain is washed away instead of penetrating the soil surface."

Important questions

Rick says the following four questions should be posed in the context of healthy veld:

- Are there bare patches between grass tufts?
- Are grass tufts elevated on soil platforms?
- Does the grass produce seed?
- Is there a layer of organic matter between grass tufts?

"The answers to these four questions will indicate what your goals for healthy veld should be. Firstly, you need to have as much organic material as possible on the soil between the grass tufts.

Secondly, the number of red grass seeds reaching the soil must increase and thirdly, there should be no soil platforms," he explains.

Rick believes that grass farmers should have sound knowledge of what regenerative agriculture entails. "It is necessary to study existing management practices very carefully and assess its merit according to how well the veld has responded over time."

Pillars of regeneration

In the crop industry, the general approach to regeneration is based on several pillars, including a top layer of organic matter on the soil, living roots in the soil every day of the year, and the effect of livestock on the soil. This includes the recirculation of manure and urine, as well as the trampling effect of hooves that break down the soil's compaction layers. These goals are equally applicable to the veld. The goal is to build up as much carbon in the soil as possible, which improves water-holding capacity and increases potential.

"Although I do not really have an answer as to why the red grass did not produce seed, I'm convinced it should serve as a warning to us about the way we 'empower' our veld to overcome climate change challenges," he says. – Izak Hofmeyr, Stockfarm

For more information, phone Rick Dillon on 082 564 9404.

Figure 3: Note the grass tuft on the 'soil platform', with the bare soil at a significantly lower level. This is a clear indication of erosion and soil degradation.

Veld, weeds and fire: The good, the bad and the ugly

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Reprinted From: http://bit.ly/2Te25Kb

Jeremy Goodall

A sizeable part of South Africa's native vegetation has naturally adapted to burn quite often and fynbos, grassland and bushveld all burn at some stage during their growth cycles. Preventing this vegetation from burning results in massive accumulation of biomass that can cause devastation when the next wildfire occurs. Farmers are accustomed to preparing fire breaks in the dry season and burning old veld to stimulate the regrowth of grazing.

The advantages of the controlled burning of veld outweigh the disadvantages. Consider alien vegetation, especially species that invade native vegetation. Invasive plants affect native vegetation in many ways. This article illustrates the effect fire can have on various invasive plant species.

Black and silver wattle

Wattle trees are especially problematic in the Drakensberg region. Black wattle (*Acacia mearnsii*) and silver wattle (*Acacia dealbata*) are the main culprits. Since the inception of the Working for Water programme in the mid-1990s, there have been large-scale attempts to bring wattle trees under control with ringbarking and chemical control (Figure 1).

Figure 1: A stand of wattle in Bulwer, KZN, which has died from being ringbarked

Studies that evaluated the impact of clearing wattles in the Drakensberg, found that most infestations where standing trees were treated, had experienced destructive wildfires one to three years following treatment, and the soil surfaces had been scorched. The burnt soil surfaces became water repellent and prone to surface wash. This resulted in large-scale soil erosion, the worst of which included the formation of dongas.

Wattle seeds have a hard seed coat that protects the embryo from the heat of fire. However, the heat stimulates the germination of seeds in the burnt area within days after the fire (Figure 2). The intensity of these wildfires is enormous, and little vegetation other than wattle regeneration remains to bind the soil (Figure 3).

Grassland areas that are invaded by wattles become wattle forests that burn fiercely during wildfires and afterwards turn into impenetrable wattle thickets that are of little use. Felling trees, using the wood, planting grass between staked brush lines and controlling seedlings would be more beneficial to the environment.

Wattle control also needs careful planning because old wattle stands are valuable sources of timber that can be utilised for energy and building material. In some areas the removal of wattle trees has resulted in local communities relying on indigenous forests for firewood.

Paraffin weed

Paraffin weed (*Chromolaena odorata*) is a tropical shrub that invades forests, bushveld and grasslands in KwaZulu-Natal, Swaziland, Mpumalanga and Limpopo (Figure 4). The oil in this weed makes it flammable in the dry season, when plants become moisture stressed.

Indigenous forests do not burn naturally, but once they are invaded by paraf-

Figure 2: The destruction of fire to a stand of wattle in Harrismith

Figure 3: Coppice of wattle after a fire (Bergville)

Figure 4: Chromolaena invading the edge of a coastal forest in KZN

Figure 5: Regrowth of Pompom weed, a month after a fire

Figure 6: Pompom weed is a big invader of South Africa's inland grasslands

Figure 7: Regrowth of Bramble in Karkloof, after an annual burn

fin weed, dry season fires can be carried into the forest when the weed ignites. Under the right conditions fires can be used to control the plant in veld areas because it is semi-woody with a shallow fibrous root system. However, it should never be used to control the weed in indigenous forests.

Indigenous forests take decades to recover after a wildfire and are susceptible to invasion by many other species that are harder to kill than paraffin weed. Biocontrol against this weed is recommended in indigenous forests.

Pompom weed

Pompom weed (*Campuloclinium macrocephalum*) is a grassland invader and is most troublesome on the Highveld. It is a perennial herb that produces annual stems from an underground rootstock. Unlike paraffin weed, it does not pose a direct fire threat but rather an ecological one.

The plant is dormant in soil during winter, so wildfires pass harmlessly overhead. However, the heat stimulates the rootstock to resprout before grass can regrow and the shoots form a thick, leafy canopy that smothers emerging grasses (Figure 5 and 6).

Fire significantly increases the density of pompom weed on the Highveld. However, it has also been found to destroy seeds on the soil surface and kill germinating seeds in the topsoil, which means that it can be used to control the weed as part of a holistic treatment plan.

Controlled burning can be combined with herbicides to kill regrowth, attacking both seeds and plants in quick succession. Regrettably, fires are seldom followed by spraying, so the problem continues to worsen despite access to cost-effective control options.

American bramble (*Rubus cuneifolius*) also produces stems from rootstock underground. Like pompom weed, infestations are worst in veld that burns regularly (Figure 7).

Wildfires

Uncontrolled fires not only destroy the habitat of fauna and flora, but the loss of topsoil and changes to soil structure also permanently influence which plants grow at the site.

Other knock-on effects include loss of biodiversity, carrying capacity and productivity.

In contrast, controlled fires are a powerful tool in the holistic management of fire-prone vegetation, but the risks are significant and the line between success and disaster is fine.

Wildfires can cause major damage and farmers need to carefully evaluate their fire prevention strategies to prevent their farms from becoming tinderboxes. –Jeremy Goodall, ARC Plant Health and Protection

For more information, contact the author on 033 355 9413 or send an email to goodallj@arc.agric.za.

Move over silage, here is stylish way to store feeds

Reprinted From: http://bit.ly/38ydHNX

Richard Maosi

Some 16km from Nakuru Town along the Nakuru-Nairobi highway sits the Moi Forces Barracks, Lanet. The military facility is one of the government installations in the area, the other being the Kenya Agricultural and Livestock Research Organisation (Kalro).

At Kalro, we meet Dr Naftali Ondabu checking on *brachiaria grass* on the institution's fodder farm. Dr Ondabu, a livestock specialist, is seeking to ensure cattle farmers do not lack feeds to offer their animals come rain or shine.

"Feeds consist of up to 60 per cent of the total cost on livestock farms. These costs have risen due to climate change, especially for farmers in arid areas," he says.

Dr Ondabu is teaching farmers how to make nutritious feed blocks from various fodder grasses, in particular *brachiaria*, which are then stored and fed to animals especially during the dry period. *Seeds of Gold* finds him and his team preparing to harvest *brachiaria* grass.

"This looks like napier grass but it is not. Napier grass no longer thrives in different parts of the country because of pests and diseases. *Brachiaria*, which grows well in most regions, is more nutritious."

The grass only takes two months to mature and harvesting can continue for up to 10 years.

"From *brachiaria*, a farmer can harvest some 18 tonnes of grass per acre but when dried and turned into hay, it produces about 10 tonnes due to loss of moisture."

Besides *brachiaria*, one can also use Boma Rhodes and lucerne grass to make feed blocks.

To make the feed blocks, one puts two litres of molasses mixed with one litre of warm water into a basin, then adds 2 kg of dry *brachiaria* grass or any other kind of fodder grass.

Figure 1: Miriam Wangare, a farmer in Wanyororo A in Lanet feeds her dairy cattle with the feed blocks. They are used to help livestock farmers take care of the changing climate pattern. (Photo: Richard Maosi – Nation Media Group)

Highly nutritious feeds

Well-dried fodder mixes easily with molasses and minimises the risk of rotting later. The mixture, placed in a normal basin, makes between 2-3 feed blocks.

"In the mixture add two handfuls of dolichos beans powder for protein, two tea spoonfuls of table salt for taste and lemon rinds that act as a preservative, then you stir the mixture thoroughly until no fluid leaks out.

Then put the mixture in the machine used in brickmaking or a similar gadget that can be made easily on the farm to attain a rectangular or square shaped feed blocks" he says, noting besides dolichos, one can use dried and ground desmodium or lucerne leaves.

The blocks are then put under the shade for about three to four days. The highly nutritious feeds are ready to be given to the animals thereafter.

"One can also put the feed blocks inside a greenhouse for drying. In fact, this is the best place because temperatures are usually higher inside, which speeds up the process of hardening the feed blocks."

Small-scale livestock farmer can, however, store the feed blocks in a well-ventilated room without any moisture.

"Moisture is avoided to curb the emergence of moulds, which are associated with dump environment and are poisonous," he notes.
The blocks are high quality feeds that are readily available all year round, says Dr Ondabu, adding that they are cost-effective and easy to make and store.

"Feed blocks' shelf-life depends on how you preserve them because their purpose is to be used during the dry season when other feeds are not available," he says, adding that they can last up to three years without losing nutrients.

The feed blocks, according to him, comprise of all nutrients that an animal needs. "It is advisable to give livestock water after feeding them."

Good replacement

He notes that if one intends to make feed blocks from napier grass, it must be dried thoroughly unlike *brachiaria* which can be used while raw.

Moreover, *brachiaria* has fine particles and crude protein that are easier to digest compared to napier.

"Maize stalks cannot make good feed blocks because they are concentrated with much starch and sugars, unless you choose the protein source from *desmodium* or lucerne grass."

He says Kalro introduced the blocks to improve the yields of production in dairy animals, especially in arid areas of Samburu, Garissa, Marsabit and Kajiado but they can be made and used by all farmers.

"The feed blocks are to help farmers take care of the changing climate pattern. They are part of climate-smart feeds," he notes, adding the blocks can be supplemented with other feeds. Rose Nelima, a livestock breeding specialist, at Kalro, Lanet, says the feed blocks are a good replacement to normal grass and napier grass that don't thrive when the weather conditions are bad.

"Poor quality grass cannot sustain the body requirement of the cattle. They come with negative impacts such as loss of body mass, but not when one is utilising the feed blocks."

Miriam Wangare, a farmer in Wanyororo A in Lanet, is among those who are using the feed blocks.

She has been using them for the last two years after switching from napier grass. "Unlike silage which consists of molasses and starch only, feed blocks are more nutritious."

She made her last blocks in November last year from *brachiaria* grass which she grows and she supplements them with napier grass.

***Brachiaria* grass**

Brachiaria is a tropical grass species that originated in Kenya, and was improved and embraced by dairy and beef farmers in Brazil, Colombia and Australia. It is commonly known as the Maasai, Tanzania or Mombasa grass.

The beauty of *brachiaria* grass is that it allows farmers to boost meat and milk production while reducing methane emissions that contribute to global warming.

Differences in forage and feed quality are a key reason cattle in parts of Sub-Saharan Africa contribute relatively more methane per kilo of meat or milk produced. Boosting dairy production is critical in fighting poverty among farmers.

In summary

- Feed blocks not only extends the shelf-life of fodder grasses like *brachiaria* but also improves their quality and palatability.
- To make the feed blocks, one puts two litres of molasses mixed with one litre of warm water into a basin, then adds 2kg of dry *brachiaria* grass or any other kind of fodder grass.
- Well-dried fodder mixes easily with molasses and minimises the risk of rotting later. The mixture, placed in a normal basin, makes between 2-3 feed blocks.
- The blocks are high quality feeds that are readily available all year round, says Dr Ondabu, adding that they are cost-effective and easy to make and store.

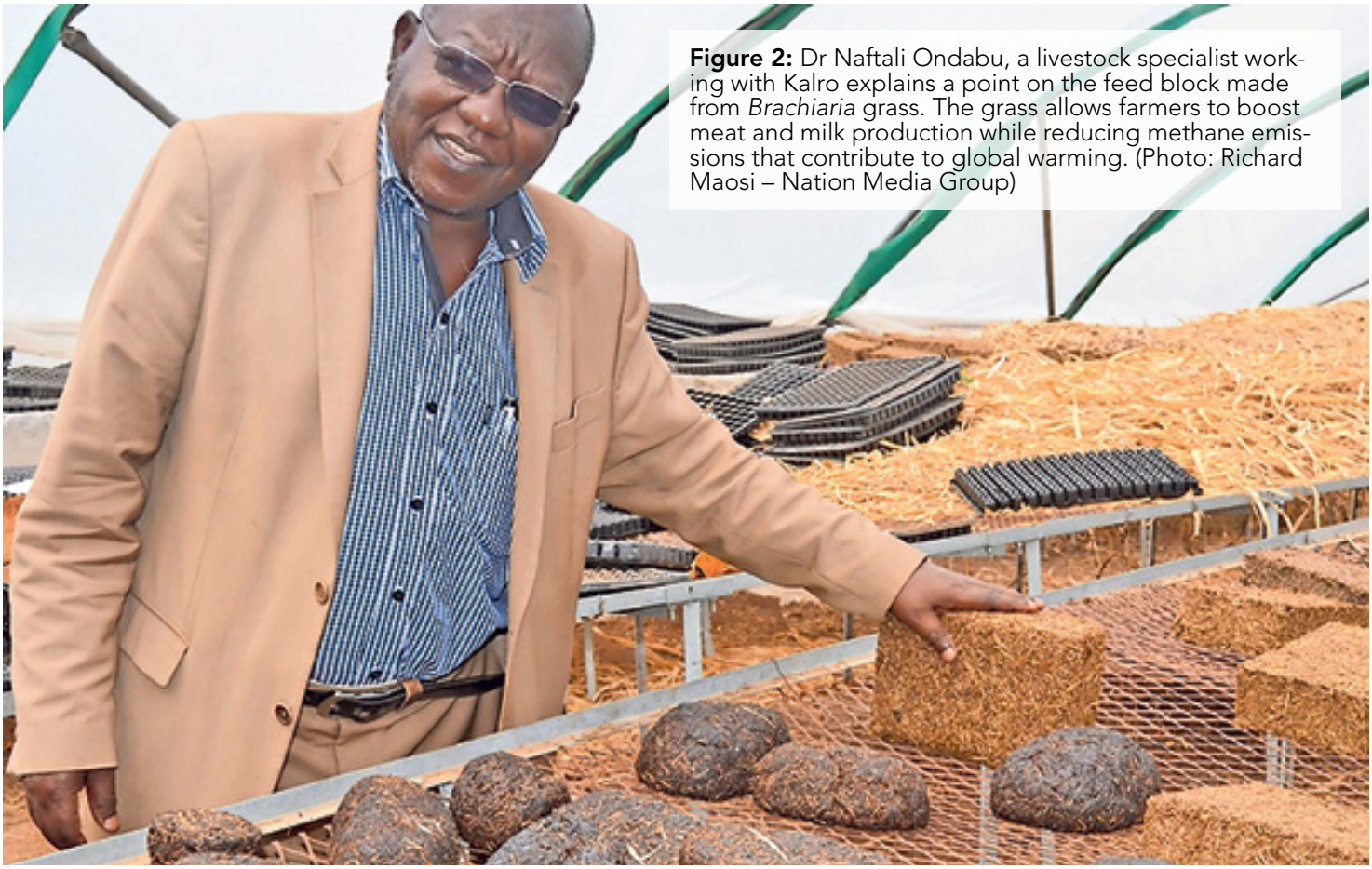

Figure 2: Dr Naftali Ondabu, a livestock specialist working with Kalro explains a point on the feed block made from *Brachiaria* grass. The grass allows farmers to boost meat and milk production while reducing methane emissions that contribute to global warming. (Photo: Richard Maosi – Nation Media Group)

Spekboom Challenge warning

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

Aimee Pace

Capetonians and South Africans at large have taken up the Spekboom Challenge to make a change through planting the wonder plant and reducing carbon emissions with its powerful air cleansing benefits, but while the Spekboom Challenging is doing a lot of good there are also negatives to be aware of.

Recently residents and those with knowledge about Cape fynbos and the sensitive ecosystems they form have been taking to social media to warn people about planting Spekboom in areas where they do not belong.

Local botanist Elzanne Singels posted a picture of a spekboom cutting she had found planted in a lowland fynbos area where it would certainly do more harm than good.

"Pictured is a spekboom cutting, that was planted by a well-intentioned Capetonian in one of the last remaining intact lowland fynbos habitats in Cape Town (lying on the critically endangered Diastella proteoides). This is exactly what I had feared when the Spekboom challenge started being a thing that seems to have captivated the minds of so many South Africans. To be very clear: Spekboom is not indigenous to Cape Flats Sand Fynbos, it will colonize and become invasive in this habitat and threaten the already extremely threatened habitat and the endangered species that grow there," said Singels in a Facebook post.

While the wonders of the spekboom cannot be overlooked it is very important that planters are aware of where they are planting it. The spekboom is originally found in a rocky area in the Eastern Cape and it is best to either plant them in your garden or in pots around your home.

Those who have joined the Spekboom Challenge are being urged to never plant it in natural or wild veld areas where it could do more harm than good.

"Plant spekboom in your garden by all means! Cook with it, propagate it and share among friends to grow in their gardens and homes, but spekboom should never be planted in natural veld without consulting a rehabilitation or restoration specialist," adds Singels.

Figure 1: The Spekboom Challenge aims to tackle climate change but should never be planted in natural veld without consulting a specialist (Photo: Elzanne Singels)

Further perspectives and results on high density rotational grazing

Reprinted From: RPO Newsletter: November 2019 http://bit.ly/2SZDWIB

Heinz H. Meissner

I have been informed that the results and debate on this topic have been keenly followed! Thus, as a follow up to last month's contribution, titled: *The grazing management model debate continues!* **I have done a further literature study of comparatively new findings and overviews (see below), and to give my own perspective on the topic.**

In the study by Venter and co-workers they surveyed 48 farms country-wide which were under consistent management for about 15 years, to test the hypothesis that rotational grazing sustains higher animal numbers while increasing grass cover and reducing bare ground and woody plant cover. In a subset of the data they compared 23 fence lines between farm neighbours or camps with similar fire programs, but with grazing management varying from continuous to ultra-high density grazing. They also did comparisons with satellite-assisted remotely-sensed vegetation indices.

The results from the 48 farms revealed that stocking rates on average were about 59% higher than the recommended rates and that adherence to high density rotational grazing management did not affect this. In the fence-line comparisons, the results yielded about a 85% relative difference in grazing densities but revealed no significant differences in vegetation indices, bare ground, and grass and woody plant cover. The absolute magnitude of fence-line differences in stocking rate of 30% and grazer percentage of 55% also had no consistent effect on vegetation cover. Thus, this analysis of the 48 farms country-wide corroborates findings from many experimental studies on rotational grazing and adds weight to it by including a diversity of rotational grazing intensities. The evidence in the study was not compatible with commonly observed negative effects of high stocking rates on vegetation cover, implying that the relatively high stocking rates were within the carrying capacity of the farms studied. Further, the previously untested hypothesis that rotational grazing alters woody plant cover was not supported in this study. **The authors concluded that, based on these and the findings of others, continued advocacy for extreme forms of rotational grazing management such as ultra-high density stocking rate is unfounded.**

The next study addressed the question if heavy grazing and land degradation have a negative effect on plant diversity and richness (abundance). The study by Rutherford and Powrie was undertaken to determine the effects of heavy grazing on richness of plant species across the arid and semi-arid rangeland biomes of South Africa. These were the Succulent Karoo, Nama-Karoo, Thicket, Grassland, Kalahari dune savanna and Mopane savanna. The related parameters of species diversity, evenness and turnover were also examined.

The impact of heavy grazing on plant species richness were found to vary from negligible or slightly positive to distinctly negative. The sharp reductions in richness may have been partly associated with variables other than grazing which can occur in arid areas. Species diversity did not always correlate well with species richness and was often dominated by species evenness patterns. Moderate to substantial turnover of species occurred, even with negligible change in species richness. Species turnover was largely associated with replacement of species. Heavy grazing altered species composition at all study sites, usually with reduced grazing quality and favouring annual plants. Surprisingly, however, few of the replacement species on most of the study areas were alien or exotic. **The results showed that the question of whether plant species richness and diversity is negatively influenced by heavy grazing depends on area and biome type.**

Finally, in a review by Teague and Barnes from results obtained mainly in the US, they concluded that what they referred to as 'adaptive multi-paddock (camp) grazing management', leading conservation farmers have achieved superior results with this approach in ecosystem improvement, productivity, soil carbon and fertility, water-holding capacity and profitability. The method is based on multiple camps per herd with short grazing periods, long recovery periods, and adaptively changing recovery periods, residual biomass (left-over material), animal numbers and other management elements as conditions change.

So, then what is my perspective and recommendations? Experimental results and farmer reports to date show both positive and negative effects with high density rotational grazing, and also sometimes no differences in comparison with other grazing management systems. These effects are in terms of biomass, species diversity, ecosystem protection, carbon footprint, use of fire, animal productivity, bush encroachment, animal species, marketing system and profitability. I do not find this surprising as biomes differ as the results above show, and even districts and farms. There are simply too many variables to extrapolate from one area to the next. Grazing management is a farm and farmer issue, meaning that a farmer should do his/her own on-farm trials within his/her production system and approach to establish what works with him/her. High density rotational grazing can be effective, but so can other systems; the common denominator is comparatively long resting periods. I agree with the Teague and Barnes recommendation of adaptive multi-camp grazing management; the farmer adapts his/her number of animals according to veld biomass (and other feed sources available) and shifts the animals accordingly, based on experience and analyses by pasture scientists where applicable.

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Could Abandoned Agricultural Lands Help Save the Planet?

Agriculture's global footprint is decreasing — more land globally is now being abandoned by farming than converted to it. This, some researchers contend, presents an opportunity for ecological restoration that could help fight climate change and stem the loss of biodiversity.

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

Richard Conniff

People have lived in Castro Laboreiro, where northern Portugal borders Spain, long enough to have built megaliths in the mountainous countryside and a pre-Romanesque church, from 1,100 years ago, in the village itself. But the old rural population has dwindled away, leaving behind mostly elders yearning for their vanishing culture.

Roughly half the area once grazed by sheep, goats, and cattle is now unused and reverting to nature, meaning that wolves, bears, wild boars, and other species have rebounded in their old habit. Iberian ibex and griffon vultures thrive where they were extinct, or nearly so, as recently as the 1990s. So what feels like loss to some village residents, looks to others like a great recovery.

Places like Castro Laboreiro are of course everywhere. Abandonment of rural lands has become one of the most dramatic planet-wide changes of our time, affecting millions of square miles of land.

Partly it's a product of rural flight, and the economic, social, and educational appeal of cities. Partly it's about larger forces like climate change and globalization of the food supply chain.

But the result, according to a new study in *Nature Ecology and Evolution*, is that the global footprint of agriculture has "started decreasing in size during the past two decades, with more land now being abandoned from agriculture than converted to it, especially in Western Europe and North America." (This change doesn't appear to have affected global food supply, at least not yet, because the land lost was marginal to start with, and farming elsewhere has become more productive.)

The study, led by researchers from the University of Minnesota, found that abandoned lands can take decades or even centuries to recover their original biodiversity and productivity.

But it termed land abandonment "an unprecedented opportunity for ecological restoration efforts to help to mitigate a sixth mass extinction and its consequences for human wellbeing." Indeed, by some accounts, a more aggressive - and evidence-based - approach to restoring abandoned lands could bring about major progress in both the climate and extinction emergencies.

The biggest caveat is that current governmental initiatives on degraded lands lack even rudimentary planning.

A study earlier this year in Science calculated the potential tree cover on "degraded" lands worldwide and found, according to senior author Thomas Crowther of ETH Zurich, that a massive program to plant trees and grow them to maturity "could cut carbon dioxide

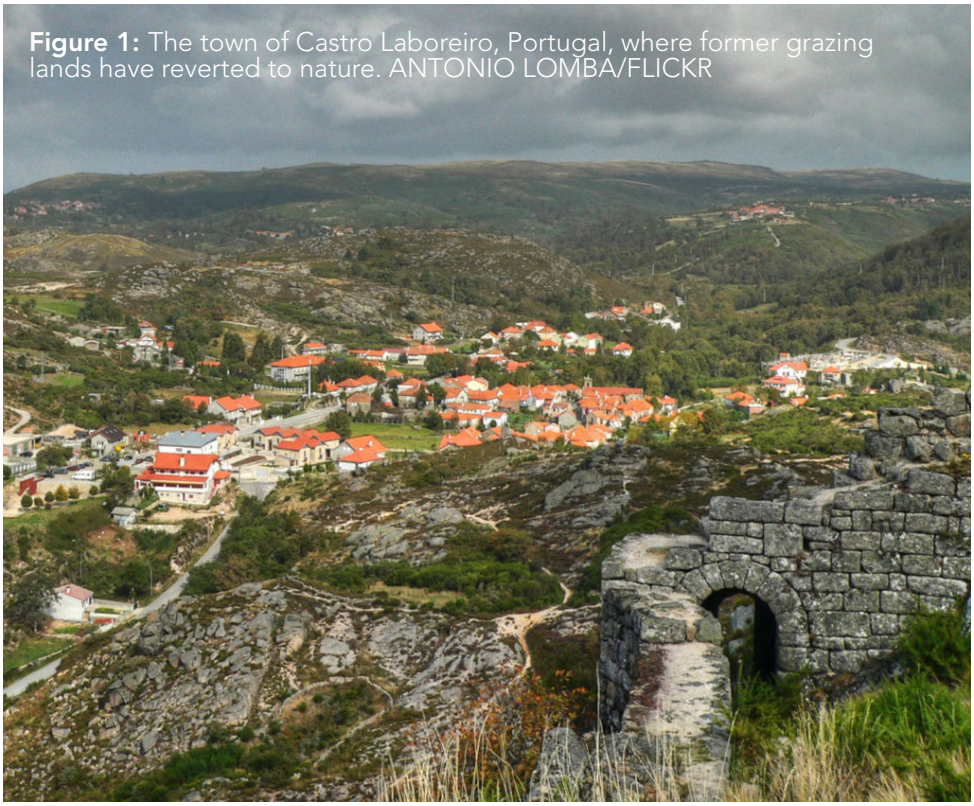


Figure 1: The town of Castro Laboreiro, Portugal, where former grazing lands have reverted to nature. ANTONIO LOMBA/FLICKR

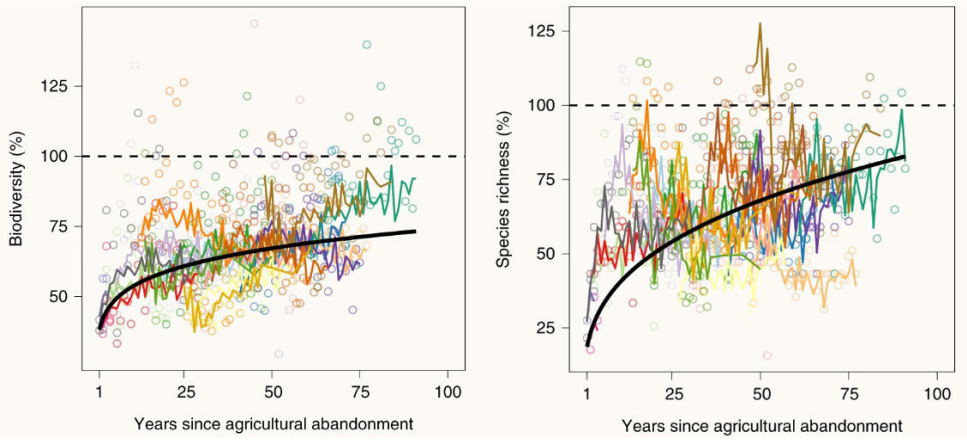


Figure 2: Biodiversity and species richness continue to increase for years after farmland has been abandoned. ISBELL ET AL, *NATURE* 2019

in the atmosphere … to levels last seen almost a century ago."

That study, which elicited sharp criticism from other researchers, called for planting at least 6.6 million square miles of degraded land not currently used for urban or agricultural purposes. More than half the planting would take place in six countries that are, conveniently, also major contributors to climate change: Russia, the United States, Canada, Australia, Brazil, and China.

Crowther calls it "the best climate change solution available today," with the potential to remove 25 percent of the carbon dioxide emissions humans have added to the atmosphere. But critics have characterized the proposal as a distraction from the immediate priority of reducing greenhouse gas emissions. They also questioned the suitability of land in the study for reforestation.

"These plans have been developed by scientists who do a lot of remote sensing and don't understand the social context of why these lands are in transition, or if they are in transition," says Mark Ashton, a forest ecologist at the Yale School of Forestry & Environmental Studies. "This is much more complex than looking at a map and thinking you can plant trees, without understanding the human context around that land."

The study came with major caveats of its own: The authors could not determine whether the available land is publicly or privately owned. Moreover, some lands that are now suitable for regeneration could become much less so as climate change advances.

The biggest caveat, though, is that current government initiatives on degraded lands typically lack even rudimentary planning. For instance, of the 48 nations that have committed to restore forests under the Bonn Challenge — an international reforestation initiative — about 10 percent have committed to restore more forest than they have land to grow forests on. Many other countries have committed to restore an area that's less than half the abandoned land they have available.

This haphazard approach persists even though the estimated scale of land abandonment is massive. China has reported losing about 7,700 square miles of agricultural land each year. The United States has lost almost 98,000 square miles of farmland just from 1997 through 2018. And according to one recent estimate, the European Union could have up to 82,000 square miles of abandoned farm land by 2040, or roughly 11 percent of the area that was being farmed at the start of the century.

Worldwide, a 2011 study in the journal *Climatic Change* put the current area of "recovering secondary vegetation," including old fields, pastures, and recovering forests, at 11.2 million square miles of land — roughly triple the entire land area of the United States — and rising. But that number included lands used and abandoned at any point over the past 600 years. It was also based on computer models.

Measurements of actual landscapes are still surprisingly difficult to make, according to Robin Chazdon, a tropical forest ecologist now retired from the University of Connecticut. Satellites and other remote monitoring technologies cannot readily distinguish, for instance, between a naturally regenerating forest and a tree plantation.

The current chaotic approach to abandoned lands often pushes land managers in directions that do nothing for either wildlife or climate change, says Chazdon. For instance, many tropical nations, such as Costa Rica, Peru, and the Philippines, have well-intended laws that strictly ban harvesting of native trees, including the trees that regenerate naturally on abandoned fields. "But if you document that you planted the trees, they become yours," she says. "This has created a perverse incentive to prevent farmers from turning their land back into natural forest, and to plant tree plantations instead."

Under certain circumstances, grasslands and rangelands can prove more resilient than forests for carbon storage, one study found.

Elsewhere, climate and biodiversity initiatives often compete instead of supporting each other, says Frans Schepers, managing director of Rewilding Europe, a nonprofit group working to re-establish native landscapes across Europe. "The mainstream response to abandoned lands is, 'We have to put windmills and solar out there, or we need to use biomass and burn materials from our forests.'"

Even tree planting can become "a technological solution, a numbers game, planting the wrong species, in a straight line, and in areas where they wouldn't actually grow back on their own," resulting in "a huge waste of money." It makes more sense, he says, to regenerate natural forests as functioning ecosystems, including large herbivores to reduce fuel accumulation on the forest floor and prevent wildfires.

Likewise, says Schepers, converting abandoned pastures to forests based on the simplistic notion that this will automatically improve carbon storage can end up harming species and climate alike. Not only do many plant and wildlife species require open habitat, but under certain circumstances, grasslands and rangelands can prove more resilient than forests for carbon storage, according to a 2018 study from the University of California at Davis.

That's because they store carbon largely underground, where it is less vulnerable in drought- and wildfire-prone

areas than the above-ground carbon stored in trees.

The bottom line is that putting abandoned lands to work again for a livable planet will require considerable nuance. For instance, instead of simply paying rural people to do the things that made sense in the past — graze livestock on marginal lands — those subsidies may need to be targeted to address different concerns in different places.

It might make sense to pay subsidies, as the European Union now does, to preserve the traditional way of life in areas with a rich cultural heritage, like Castro Laboreiro, says Emma van der Zanden of VU University Amsterdam. But it could also make sense to stimulate abandonment, for instance, by subsidizing green projects in other areas where environmental values predominate.

In Australia, many marginal and abandoned areas could become more productive if converted to forests for carbon storage, paid for by fossil fuel-intensive industries, says David Lindenmayer, a landscape ecologist at Australian National University, Canberra. Farm income could come partly from grazing, partly from cropping, and partly from regeneration, which would incidentally improve water retention in those areas. "If you want people to stay on that land you have to pay them for the asset, and the asset clearly has to be carbon storage," he says. "But our government refuses to create a mechanism for paying farmers to store carbon."

As he speaks, Lindenmayer looks out his window at the evidence of Australia's latest prolonged drought, combined with a deadly heatwave, and massive wildfires that have darkened skies across much of the country. Australia, he warns, is merely "at the leading edge of the kind of challenges that are going to arise" for other nations as warmer and less predictable climate conditions become more common. Abandoned lands could help minimize or even prevent the likely damage. But that will only happen if scientists and policymakers come together quickly on the smartest ways to put those lands back to work.

Figure 3: Critics note that flawed strategies have encouraged tree farms, such as this oil palm plantation in Costa Rica. SHUTTERSTOCK

New 'South African' pasture crop for Aussie farmers

Reprinted From: http://bit.ly/2PptY0P

Stellenbosch University

Farmers in the sandy areas of Western Australia will soon be able to plant a brand new perennial pasture crop that originated from South Africa.

Some ten years ago, researchers from the Murdoch University in Western Australia went on a mission to find a new leguminous pasture crop for their farmers. The research group, led by Prof John Howieson, went through most of the Mediterranean regions and their search was finally completed in South Africa. *Lebeckia ambigua*, an upright growing green plant with beautiful bright yellow flowers, was the plant that caught their attention.

During their search for a pasture crop, seed from the Lebeckia plant was collected in the sandy regions of the Northern and Western Cape of South Africa. The surrounding areas, where the plant was found, compared well to typical conditions in Western Australia. According to the Australian research group, this plant grew in low rainfall areas (200 – 450 mm) in deep, infertile sandy soils.

Howieson and his team took some seeds back to Murdoch University and years of research led to the introduction of a brand new leguminous pasture crop for the low rainfall, sandy regions of Australia. During the recent launch of the pasture crop in Australia, Howieson mentioned that this specific crop would turn 3 million hectares of marginal soils into areas with productive summer pastures. The crop will survive summer months and farmers will be able to increase the carrying capacity of their pastures. Economic analyses also showed that Australian famers could possibly make 400 Australian dollars more per hectare compared to other available pastures in the same climatic conditions.

During the years the research group spent commercializing Lebeckia, two new rhizobium species (*Burkholderia dilwothii* and *Burkholderia sprentiae*), were associated with the plant. Inoculation with the rhizobium species will allow the Lebeckia plant to fixate nitrogen in low pH, sandy soils.

No nitrogen fertilisation would thus be necessary on the pastures, however, additional superphosphates and potassium are recommended in a 3:1 ratio.

The first seed will be commercially available to Australian farmers next year. This seed will be sold as the first cultivar of Lebeckia, Isanti. The cultivar name was given by a Stellenbosch University student, Karen Truter.

During a recent visit to Murdoch University in Australia, Howieson asked for suggestions for a cultivar name for Lebeckia. It was decided to use a word from an African language that is easy to pronounce in English. Karen decided on Isanti as it means "sand" in Xhosa. It originally grows in the Sandveld region of the Western Cape and therefore the name can directly relate to the original derivation.

The Isanti-cultivar will probably also be available to South African farmers in the near future. Meanwhile, researchers of the Western Cape Department of Agriculture have received 100 grams of Isanti seed from Howieson.

They are aiming to establish a few plants in Hopefield and Lambertsbaai to see if the crop will provide adequate pastures in sandy soils during late summer months and autumn.

If the trial succeeds, Murdoch University will be requested to make the seed and rhizobium species available to South African farmers.

Karen Truter is a second year MSc student in the Department of Agronomy. She works under supervision of Dr Pieter Swanepoel of the Department and Dr Johann Strauss from the Western Cape Department of Agriculture. Her research focusses on conservation agriculture systems and the type of seed-drill to use for crop establishment.

Editor's Note

Karen has now completed her MSc and is graduating in March 2020.

Figure 1: The seed for a new pasture crop will soon be available.

National Biodiversity Assessment 2018: The status of South Africa's ecosystems and biodiversity

Current Address: SANBI
Reprinted From: http://bit.ly/2SWrVDG

Shahieda Davids, Dr Andrew Skowno and Carol Poole

The National Biodiversity Assessment (NBA) was released on 3 October 2019 in Pretoria by the Minister of Environment, Forestry and Fisheries, Ms Barbara Creecy.

The NBA is the primary tool for reporting on the state of biodiversity in South Africa. It is used to inform policies, strategies and activities for managing and conserving biodiversity more effectively.

During the NBA launch Minister Creecy said, "The assessment allows the government to evaluate progress and shortcomings in conservation and ecosystem management on both land and sea."

The NBA was led by the South African National Biodiversity Institute (SANBI) as part of their mandate to monitor the status of South Africa's biodiversity and was undertaken between 2015 and 2019. It involved extensive collaboration from over 470 individuals representing about 90 institutions.

Key partners

The Council for Scientific and Industrial Research (CSIR) and Nelson Mandela University (NMU) were key partners to SANBI on the NBA – the CSIR led the freshwater and estuarine components and NMU led the coast component.

SAEON also played a fundamental role in contributing towards the NBA, as ten SAEON staff members were involved in the technical reports as authors and contributors. Contributors from SAEON included: Charles von der Meden, Grant van der Heever, Hannah Raven, Jasper Slingsby, Lara Atkinson, Sue van Rensburg and Thomas Bornman.

Dr Nicky Allsopp from SAEON's Fynbos Node was a reviewer on the overall NBA synthesis report and commented, "A huge amount of material has been effectively synthesised in accessible and easily understood figures and tables."

Megadiversity threatened with ecological collapse

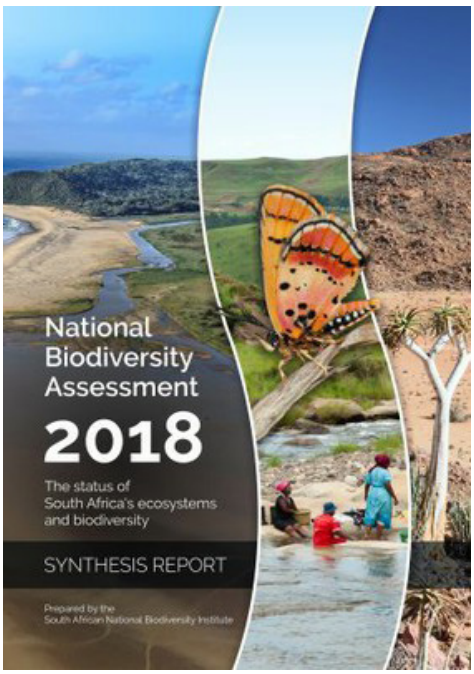


Figure 1: The National Biodiversity Assessment is used to inform policies, strategies and activities for managing and conserving biodiversity in South Africa more effectively.

South Africa is ranked in the top three countries globally when it comes to plant and marine species endemism (species found nowhere else on Earth).

The diversity and uniqueness of South Africa's species and ecosystems makes us one of the world's 17 megadiverse nations – countries that, together, contain more than two-thirds of the world's biodiversity.

The NBA revealed that almost half of all South Africa's 1 021 ecosystem types are threatened with ecological collapse and one in seven of the 23 312 indigenous species that were assessed is considered threatened with extinction.

Nonetheless, efforts to protect our biodiversity are showing promising outcomes, as over two-thirds of ecosystem types and 63% of species assessed are represented in protected areas.

These four headline indicators of threat status and protection level for ecosystems and species are summarised in the graphs below.

The study found that major pressures on South Africa's biodiversity are habitat loss, changes to freshwater flow, overuse of some species, pollution, climate change and invasive alien species.

Protected areas have expanded in the ocean and on land and are a source of pride for South Africans.

Continued expansion will help to ensure biodiversity conservation, ecological sustainability and even more social

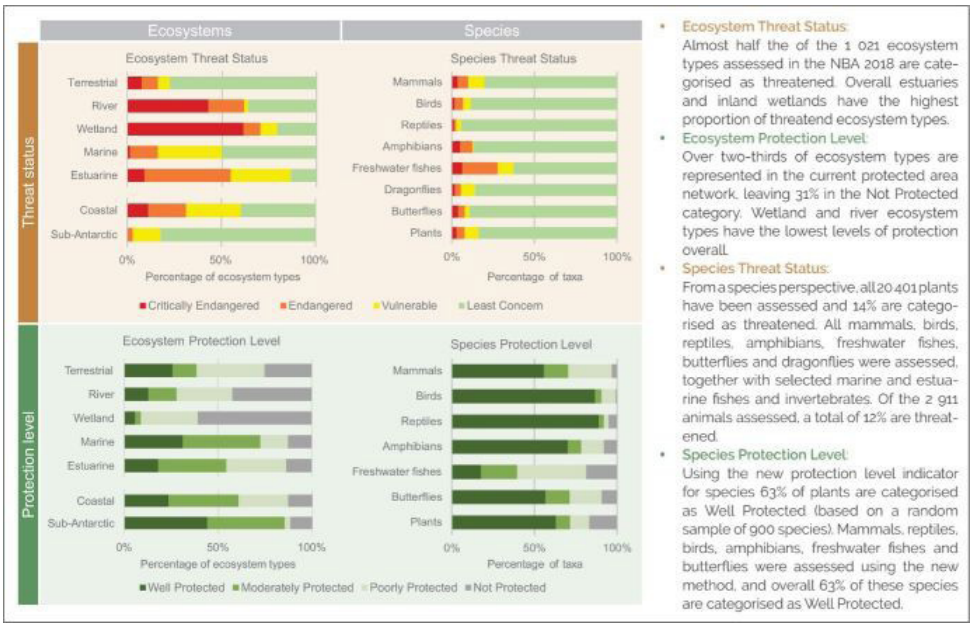


Figure 2: Indicators of threat statues and protection level for ecosystems and species

and economic benefits from biodiversity to society.

Protected areas now cover nearly 9% of South Africa's mainland area and 75% of terrestrial ecosystem types have some form of representation.

Socio-economic benefits

South Africa's biodiversity wealth gives people benefits like food, water, medicine and materials; it supports agricultural and fisheries production and helps protect us from natural hazards like floods and droughts; and it provides the basis of a vibrant tourism industry while offering natural spaces for recreational and cultural activities.

South Africa's economy is highly dependent on its biodiversity – for example: biodiversity-related employment is estimated at 418 000 jobs; biodiversity tourism generates a direct spend of R31 billion annually; and our approximately 2 000 medicinal plant species contribute to the African Traditional Medicine sector worth ~R18billion a year.

Minister Creecy commented that with this wealth of biodiversity comes the responsibility of ensuring it is both protected and used sustainably.

She said, "Biodiversity is central to South Africa's national objectives of addressing poverty, inequality and unemployment, and supports increased economic growth and improved service delivery for all its citizens.

Every decision taken, whether by governments or individuals, affects the future of biodiversity".

The full set of NBA products, which include a synthesis report, seven technical reports, datasets, maps, supplementary materials and popular products, is accessible via http://nba.sanbi.org.za/

Figure 3: The National Biodiversity Assessment was launched on 3 October 2019 in Pretoria

Learning to use remote sensing to establish woody plant encroachment in the savanna biome

Current Address: PhD Hydrology Student,
SAEON Grasslands-Forests-Wetlands Node and University of KwaZulu-Natal
Reprinted From: http://bit.ly/38ZlCVB

Tiffany Aldworth

The two main types of satellite data used in remote sensing to produce images of the earth's surface include optical and radar.

Optical satellites use visible and infrared sensors to detect the solar radiation reflected from targets on the ground, whereas radar satellites emit microwaves and calculate the time they take to return to the sensor after reflecting from targets.

Optical remote sensing is more commonly used but radar remote sensing is more continuous, has an inherently higher information content and a higher resolution. Its biggest advantage is that it is not affected by lighting or weather conditions, allowing radar satellites to operate at night and during cloudy conditions.

Figure 1: Tiffany's PhD research focuses on understanding the impacts of woody plant encroachment on freshwater resources in South Africa's savanna biome

First EMSAfrica Summer School

From 23 to 26 September, I attended the first EMSAfrica Summer School on the basics and applications of synthetic aperture radar (SAR) remote sensing for environmental monitoring.

The summer school took place at the Wits Rural Facility in Acornhoek, Mpumalanga. It consisted of a four-day hands-on training course which featured a mixture of theory lessons and corresponding practical tutorials using Sentinel-1 data.

The coordinating institution was the Department for Earth Observation, Friedrich-Schiller University in Jena, Germany, through the SPACES projects, EMSAfrica (Ecosystem Management Support for Climate Change in southern Africa) and SALDi (South African Land Degradation Monitor).

The summer school was funded by the German Federal Ministry of Education and Research (BMBF). Thirteen students, researchers and technicians from several southern African countries, including South Africa, Swaziland and Botswana, attended.

My PhD research focuses on understanding the impacts of woody plant encroachment on freshwater resources in South Africa's savanna biome. The research, which is being conducted in a private game reserve in Phalaborwa in the Limpopo province, is primarily field based but I also plan to use remote sensing to establish the extent and rate of woody plant encroachment in the area and to extract information to compare with field observations and upscale them to catchment and national scales.

The summer school equipped me with skills which will certainly benefit my research. Overall it was a great experience, where I learnt a lot and made many new connections. Many thanks to the course organiser, Dr Christian Berger from the Friedrich-Schiller University, his team and the BMBF.

The course was also attended by SAEON MSc students Keletso Moilwe and Lungile Khuzwayo, whose projects focused on mapping invasive alien trees in grasslands and fynbos respectively. SAEON's Dr Gregor Feig and Dr Jasper Slingsby are collaborators on the EMSAfrica project.

Figure 2: Tiffany's PhD research focuses on understanding the impacts of woody plant encroachment on freshwater resources in South Africa's savanna biome

Figure 3: The four-day training course featured theory lessons and corresponding practical tutorials using Sentinel-1 data

A new book has taken wings and is flying off the bookshelves!

Current Address: Ezemvelo KZN Wildlife School of Animal,
Plant and Environmental Sciences, University of the Witwatersrand
E-mail Address: Debbie.Jewitt@kznwildlife.com
Reprinted From: http://bit.ly/2PptY0P

Dr Debbie Jewitt

Drone Professional 1 is a newly released book that has rapidly become a number one best seller on Amazon (USA) in the commercial aviation and aviation piloting and flight instruction sections. Edited by Louise Jupp and Andrew Priestley, the book has contributions from 16 drone professionals from around the world, giving their perspectives on contemporary drone issues. These include drones, professional drone pilots, software and technology, civil aviation, commercial aviation, drone science and drone education – a broad range of topics ensuring a valuable resource for drone operators and enthusiasts. The book combines both technical and personal anecdotal feedback from frontline experts.

Drone technology is rapidly evolving and the full extent of the services they can provide society is still to be realised. Unfortunately, the negative news and media coverage of drones often overshadow the positive advancements being made in the industry. This book aims to illustrate the enormous potential benefits of the drone industry across a broad range of professional applications. We hope this book encourages you to join the drone community!

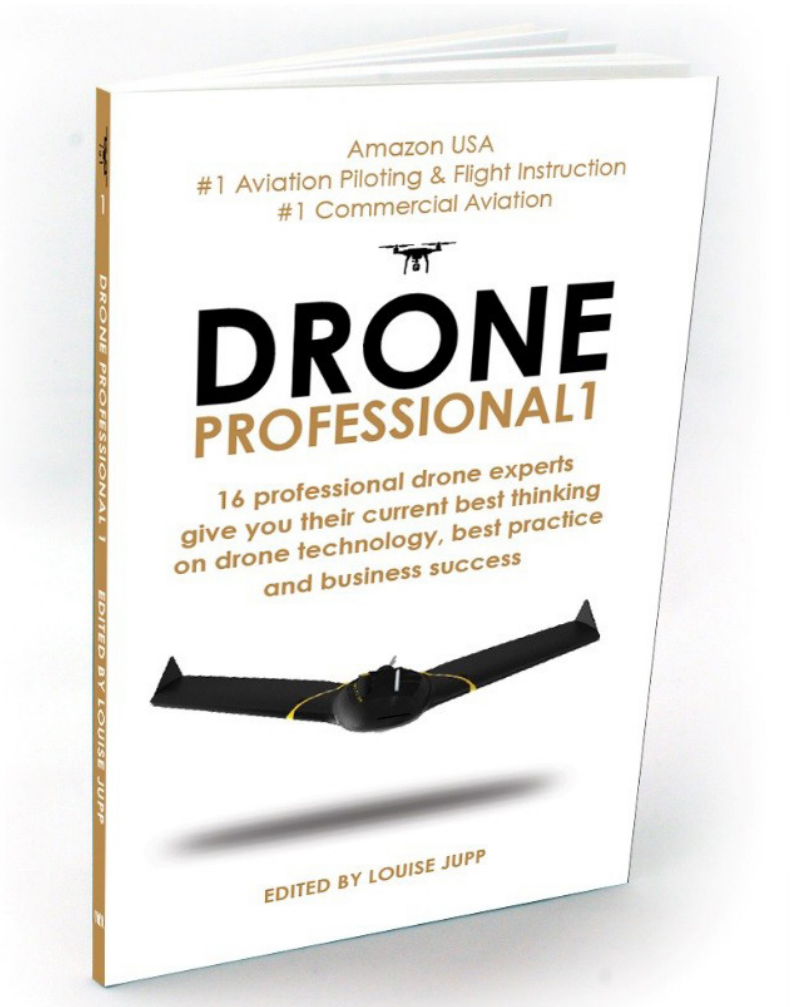
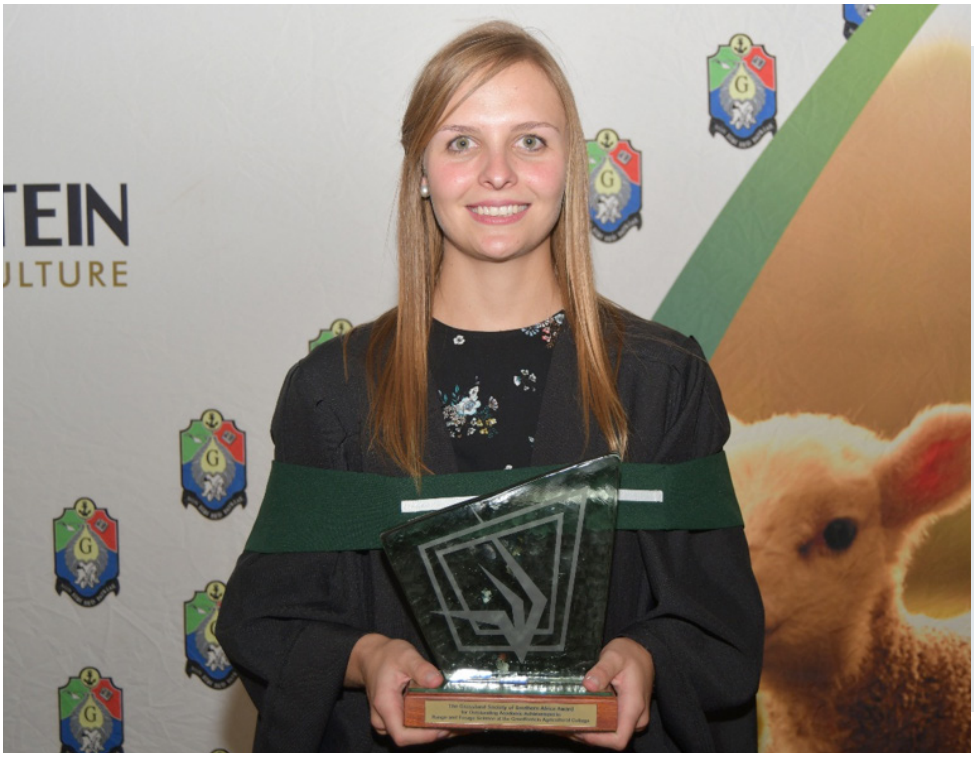


Figure 1: Drone 1 is a newly released book highlighting perspectives on drone issues from around the world.

Figure 2: This book has contributions from 16 drone professionals from around the world. Dr Debbie Jewitt, the current GSSA president is one of the contributors.

Grootfontein College of Agriculture Student Awards

Minette van Lingen



The GSSA trophy, together with a certificate, is awarded to a deserving third year Grootfontein student. This award is made to a final year student who achieved the highest marks for rangeland, pasture and environmental management modules, with an average of at least 70% for all modules. In 2018, this prestigious award was presented to Nienke Scholtz during the diploma ceremony at Grootfontein. She has a passion for agriculture and this was evident in her commitment throughout her studies. She has enrolled for the B. Agric course at the University of the Free State.

Figure 1: Carla du Plessis receiving the GSSA student award (2019). Photo: Niel Schoeman

Cattle in the KwaZulu-Natal Midlands

Financial support through the Trust of the Grassland Society of Southern Africa

Background
The Trust of the Grassland Society of Southern Africa offers financial support to members of the Society for a range of activities.

What can be covered?
Any application must be of relevance to the interests of the Grassland Society of Southern Africa, for example:

- Attendance of GSSA Congress
- Attendance of local conferences
- Attendance of international conferences
- Small research grants
- Attendance of short educational courses (including online)
- Attendance of field educational courses

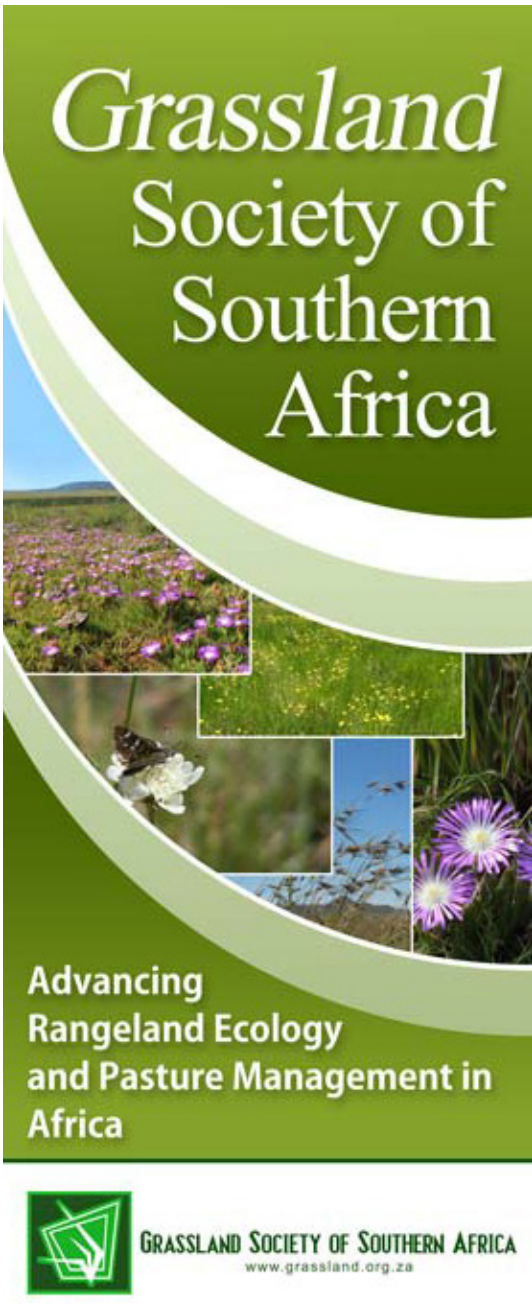
Who can apply?
- Members of the Grassland Society of Southern Africa
- Non-members if special motivation is made but they are encouraged to first join
- Students and early career professionals will be given priority

How much can be requested?
Applications up to R30,000 will be considered, but allocation may be less at the discretion of the Trustees.

When must applications be in?
Applications must be in by the last day of April 2020 for this call

How can I apply?
Applications are done via http://bit.ly/2pVfYT2

Nota bene
The decision of the Trustees of the Grassland Society of Southern Africa's Trust is final.



Upcoming events

13-15 May 2020

National Symposium on Biological Invasions at the
Future Africa Conference Venue at the University of Pretoria, Tshwane.
Visit https://www.ru.ac.za/centreforbiologicalcontrol/nationalsymposiumonbiologicalinvasions/
or please contact Kim Weaver for any further information:
K.weaver@ru.ac.za or 046 603 7702/046 603 8763

29 June - 2 July 2020

55th Annual Congress of the Grassland Society of Southern Africa.
Watch this space as venue in the Eastern Cape of
South Africa will be confirmed!
For enquiries contact info@grassland.org.za.

6 - 9 July 2020

54th Conference of the SA Society for Agricultural Extension.
Ashanti Estate, Sonstraal Road, Paarl, Western Cape.
Theme conference is "Facilitation for Development in
Agricultural Extension". Abstracts due 16 Dec 2019.
For more info contact the SASAE Secretary on 051 401 2781
or email on secretariat@sasae.co.za or Dr. J A van Niekerk at
083 231 7380 or email vNiekerkJA@ufs.ac.za

SOUTH AFRICAN SOCIETY FOR AGRICULTURAL EXTENSION

2 - 7 August 2020

Ecological Society of America meeting in Salt Lake City, USA.
This year's theme is "Harnessing the ecological data revolution".
Abstracts for presentations are due by 20 February 2020. Visit the
website https://www.esa.org/saltlake/ for more details

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

Upcoming events

6 - 11 September 2020

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)

7 - 11 September 2020

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.

25 - 30 October 2020

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

1 - 6 November 2020

2nd African Bioacoustics Community Conference, Stellenbosch, South Africa. Abstract submission deadline is 15 June 2020.
See https://africanbioacoustic.wixsite.com/abcommunity
for more details

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

REGISTRATION IS OPEN

Register and submit your abstract

https://2020gsa.dryfta.com/index.php

The 55th Annual Congress

of the Grassland Society of Southern Africa

Held from **29 June - 2 July 2020**
at **Mentorskraal**, Jeffreys Bay, Eastern Cape Province, South Africa

Congress Themes

- Next generation / 4th Industrial Revolution advances in Rangeland Management
- Water production Landscapes and Rangeland Management
- Communal Rangeland Dynamics, Governance and Restoration
- Dairy, Nutrition and cultivated pastures
- Drought-stressed Rangelands - reflection & the future
- Rangeland Management for Game Farming, Nature coservation and tourism