Grassroots

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How carnivores could help farmers

SA's path to sustainable energy

CLIMATE CHANGE: *risk for plants and animals*

Symposium: *Ecosystem based fire management*

Advancing Rangeland Ecology and Pasture Management in Southern Africa

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FROM THE EDITOR

It gives me great pleasure to welcome you to the second issue of Grassroots for 2018.

Inside you will find several local news articles and a few relevant international news articles resembling the multi-disciplinary quality of the society, one feature article, and one opinion article.

More about this issue

The question is asked whether conservation strategies needs to be more compassionate; ecologists look at what they can learn from native knowledge; how carnivores could help farmers; response to planted-pasture species listed as potential invasive species; climate change risk in biodiversity hotspots; organic soil fertility; well-managed renosterveld during drought; superhero fly; sustainable energy; project rhino; save the giraffe from extinction; tracking Valchellia spp. in Kalahari Gemsbok National Park; vultures and water catchment; Lower Orange River Riparian Project; and a feature on the scrap value of farm land.

New editor

My two year term as Publications Editor for Grassroots has come to an end. Thank you for the great opportunity and thank you to all the readers and contributors.

It gives me great pleasure to welcome Janet Taylor as the new Publications Editor of Grassroots – good luck Janet.

Congress 53 Sponsors

Lastly, a special thanks goes out to our sponsors of Congress 53: Dow AgroSciences, Western Cape Government, ARC and UNISA.

Enjoy!

6 things to look forward to in this issue:

Do conservation strategies need to be more compassionate?

Some scientists and ethicists are criticizing traditional conservation strategies, which they say focus on saving valued species while discounting the lives of less charismatic animals. Will these advocates of "compassionate conservation" point the way to new approaches, or are they simply being naïve?

Brandon Keim

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At a moment of best-selling animal intelligence books and headlines about songbird language and grieving elephants, it's easy to forget that nonhuman minds were until recently considered — by most serious-minded scientists, anyway — to be quite simple.

Well into this millennium, animal consciousness was regularly dismissed as either nonexistent or profoundly dissimilar to our own. Animals were considered "conscious in the sense of being under stimulus control," as the famed psychologist B.F. Skinner opined so neatly in 1974, expressing a conventional wisdom that dated to the zoological musings of Aristotle. The notion of animals as thinking, feeling beings was relegated to the edges of serious discourse.

Those days are past, buried by an avalanche of scientific findings and history-of-science critiques. More people than ever worry about the welfare of farmed animals; pets are practically citizens; and wild animals too are increasingly regarded as beings with whom people share fundamental aspects of inner life. Yet in some places, that mind-denying legacy survives — including, say a small but vocal number of scientists, ethicists, and animal welfare activists, in conservation. In their eyes, the discipline devoted to protecting Earth's life has a certain blind spot to the animals themselves.

"Conservation essentially developed in an era in which animals were automatons," says Arian Wallach, an ecologist at the University of Technology Sydney in Australia. "There was a revolution in the recognition of sentience across the animal world," and "conservation is only now coming to grips with the fact that this happened."

Wallach identifies as a "compassionate conservationist," the name taken by those critics of conservation's tendency to focus on species and populations without much considering the well-being of individual animals and the ethical issues involved. "A compassionate conservation approach," Wallach and others write in a recent Conservation Biology essay, "aims to safeguard Earth's biological diversity while retaining a commitment to treating individuals with respect and concern for their well-being."

Figure 1: Illustration by Luisa Rivera/Yale E360

Central to the compassionate conservation movement is a deep dismay at the practice of killing some animals to help others.

The implication might raise some hackles — few conservationists would consider themselves uncompassionate. As a historical critique of conservation's framing, though, it rings true. "Conservation is engaged in the protection of the integrity and continuity of natural processes, not the welfare of individuals," wrote biologist Michael Soulé, who is generally credited with founding the scientific discipline of conservation biology, in his seminal 1985 essay "What is Conservation Biology?"

Soulé's way of thinking, says environmental philosopher J. Baird Callicott, was not unusual. It dovetailed with the hunting-focused wildlife management that formed conservation's foundations in the early 20th century. So long as populations thrived, individuals merited little formal recognition. Neither did Aldo Leopold's influential land ethic, with its call to view nature as "a community to which we belong," spare much thought for individual animals. They don't even appear in this decade's so-called "New Conservation" debates over weighing the value of protected areas and human economic well-being in making conservation decisions.

Individual animals have instead been the province of animal welfare and, more recently, the related academic field of human-animal studies. Conservation stayed, in Soulé's words, "conceptually distinct." But as Callicott notes, "Now

these two mutually exclusive lines of thinking about ethics beyond humans are converging in compassionate conservation. "It's new and uncharted territory."

The first rules of this territory: to do no harm, and to acknowledge the value of every individual's life. Central to the movement is a deep dismay at the practice of killing some animals to help others; it doesn't seem coincidental that many compassionate conservationists hail from Australia, a place where — along with nearby New Zealand and the region's small islands — killing historically non-native mammals plays an outsized role in conservation.

In Australia, where the government has pledged to kill 2 million feral cats, landscape-scale poisoning campaigns are a routine — and indiscriminate — part of efforts to protect native species. The same goes for New Zealand, where conservationists intend to protect native animals by exterminating all possums, rats, and weasels by 2050, and possum-killing fundraisers are held at elementary schools. While those programs are extreme in their scope and intensity, killing for the sake of conservation is certainly not limited to those nations.

To pick two recent examples, Scotland's natural resources agency recently approved a controversial plan to protect shorebirds by killing ravens, and the U.S. Fish and Wildlife Service moved this spring to permit the killing of up to 18,270 cormorants blamed for depredating Midwestern fisheries. Such actions might comprise a relatively small proportion of all conservation activity, but they are not uncommon, and the new thinking of compassionate conservation sees them as existentially problematic. "As a conservation community we have normalized the perpetration of significant, intentional, and often unnecessary harm against wildlife individuals," write Wallach and her colleagues in the new paper. Given what's now known about the "widespread sentience and sapience of many animals," they state, "practices that categorically prioritize collectives without due consideration for the well-being of individuals are ethically untenable."

In social media conversations about that paper, one biologist wondered if compassionate conservation even deserves to be called conservation. Another likened compassionate conservationists to vaccine denialists who wrongly claim that immunizations cause autism; just as doctors were pushed by that community to emphasize the importance of vaccines, this ecologist wrote, so might scientists be galvanized to "promote the reality of conservation needs and action."

Figure 2: Volunteers for New Zealand's Predator Free by 2050 campaign in front of predator traps, which are available for the public to borrow. NEW ZEALAND DEPARTMENT OF CONSERVATION

There are situations where some form of killing is necessary" to protect biodiversity, says biologist Michael Soulé.

Soulé is more diplomatic. Compassion is a virtue, he affirms, and "we must be as compassionate to individuals as possible" — but there are limits. "As people who believe that our ultimate goal is to protect biodiversity, then there are situations where some form of killing is necessary," he says. When native species are threatened by the descendants of species introduced by humans, "I think the survival of the native species that helps to maximize global diversity can trump the pain and suffering of some individuals."

Michael Nelson, an environmental ethicist at Oregon State University and co-author of the new Conservation Biology paper, notes that compassionate conservationists may diverge on this issue. Some, such as Wallach and ethologist Marc Bekoff, one of the movement's most prominent voices, consider killing to be unacceptable in any situation. Others, including Nelson, think it might be acceptable when there's no other solution — but it's at best a tragic, sorrowful last resort. Even that, though, would be an "amazing shift" from strategies that are quick to embrace lethality, Nelson says. Both factions agree that a readiness to kill can mask deeper issues. Chris Darimont, a conservation biologist at the University of Victoria and the Raincoast Conservation Foundation, pointed to wolf-killing programs intended to protect caribou harmed by mining and forestry. In Australia, more effort seems to be devoted to killing animals than protecting habitat: For all the attention given to alien species, it's been a decade since habitat there was last designated as critical for a threatened species, and that has happened just five times since Australia's Environment Protection and Biodiversity Conservation Act was enacted in 1999.

"Killing for conservation does allow people to avoid addressing root problems," Darimont says. Wallach recommends that conservationists look to ecology for solutions: her own specialty is dingoes, Australia's widely-persecuted apex predators, who may be far more effective than culling programs at regulating foxes and feral cats. The same may hold for coyotes in the United States.

Wallach and other ecologists also suggested in a 2015 Trends in Ecology and Evolution paper that rather than being killed, apex predators should be allowed to thrive so they can regulate "novel ecosystems" — mixes of native and non-native species that have no precedent in the earth's history, and which many conservationists consider impoverished. They worry that accepting ecological novelty is a big step down the slippery slope to a depauperate Earth dominated by a handful of weedy species.

Some scientists, however, argue that such judgements are tinted by a bias against non-native species. Many com-

passionate conservationists have taken up the cause: By refusing to accept non-natives as legitimate parts of nature, they say, people are blinded to their possibilities. Novel ecosystems might represent adaptations to a radically changed biosphere, with vital roles performed by unfairly-maligned species like wild donkeys or even feral pigs. Novel ecosystems, they say, might also be valued simply because every life matters; being open-minded toward them is itself an act of compassion.

"These critiques are captivating," says Matthew Herring, an ecologist who works with Australian rice farmers to manage their fields to provide habitat for endangered bitterns. "They challenge much of what I was taught." Though not a compassionate conservationist himself, Herring says he aspires to the principles, and their view of novel ecosystems resonates with his own observations. "Novel habitats now support globally endangered species," he says. "Some of the 'invasive' species, such as European carp, provide critical food resources" to the bitterns he is working to protect.

Herring's work, which he presented at the third International Compassionate Conservation Conference, held last November in Sydney, embodies a theme of coexistence that's less attention-grabbing than objections to lethality, but is just as important. That conference, and a similar one held two years ago in Vancouver, featured a bounty of new approaches: not only non-lethal solutions, like remote-controlled robots that defend desert tortoises from raven populations swelled by the abundance of human food waste, but strategies for helping people live alongside animals.

Compassion doesn't require avoiding all suffering, only unnecessary, human-caused harms, says ecologist Arian Wallach.

Some involve high-profile species with whom humans regularly come into conflict, such as keeping wolves away from livestock through a mixture of deterrents and management techniques or accommodating the movements of Asian elephants in human-dominated landscapes. Others involve common creatures, such as prairie dogs and suburban rattlesnakes, and animals considered pests.

To Melissa Amarello, co-founder of Advocates for Snake Preservation, it's a much-needed expansion of conservation's focus. Much of her advocacy involves teaching people not to fear the common, venomous snakes they encounter — and often kill — in their own neighbourhoods. This isn't an important issue "for traditional conservation, because it's not impacting a species of concern," says Amarello, but "it doesn't matter if they're common or rare. What matters is that they exist." That ethos applies to all the less-charismatic species who tend to go unappreciated, particularly in the current focus on urban nature, which has excited many conservationists hopeful that cities can become strongholds of biodiversity. Everyone enjoys a pretty migratory songbird, Amarello says, but compassion "helps open people's eyes to some of the other animals."

This focus on common animals might in some ways seem ill-suited to an era of mass extinction and extirpation. Can conservationists afford to devote their limited resources to helping people coexist with raccoons? Soulé fears that compassionate conservation could turn into an unworkable obligation to help every unwell animal or even interfere with natural processes, especially predation, that cause suffering.

Wallach counters that compassion doesn't require avoiding all suffering — which, were it even possible, would cause ecological catastrophe — but only unnecessary, human-caused harms. Here the movement collides with recreational hunting, and many compassionate conservationists are extremely critical of the North American model of wildlife conservation, which gives governmental agencies focused largely on hunting, fishing, and trapping a central role in public conservation.

These agencies, they say, ignore animal advocates and too often support activities that are ethically or ecologically suspect, such as wildlife killing contests or the hunting of large carnivores. Some traditional conservationists might feel uncomfortable with that critique: so-called consumptive users have played a historically important role in conservation, and Darimont notes that scientists tend to be uncomfortable with animal rights.

Nelson worries that debates about compassionate conservation might yield even deeper divisions between these camps — a fate hinted at by two recent online postings, one decrying "animal liberation dressed up as conservation science," and the other calling traditional conservation "a pathological disorder." Yet compassion might also bring new supporters into the fold, according to Nelson. For instance, "it could motivate people who are interested in animal welfare," he says, and even teach them to think about traditional conservation values — healthy habitats, intact ecosystems — in terms of helping individual animals flourish.

Embracing animal ethics also gives conservationists permission to talk about animals in ways that tend to be omitted from conservation discourse but may resonate far more with people for whom biodiversity or ecosystem services are abstract terms.

"When I talk to people about prairie dogs, I always start off with the ecological aspect. I tell them that prairie dogs are disappearing rapidly, and soon we might not have any. Their eyes glaze over," says Con Slobodchikoff, a conservation biologist at Northern Arizona University. "Then I tell people that prairie dogs have language and can talk to each other. Their eyes light up. They start to empathize."

Herring echoed his point. "Thinking big, about populations, evolution and so forth, is useful," he says, "but because of its abstract nature it disconnects us from the animals we love, the animals we're trying to protect."

Figure 3: Signs opposing New Zealand's use of landscape-scale poisoning campaigns to eradicate non-native predators, such as rats and weasels. ELI DUKE/FLICKR

Figure 4: Research shows that prairie dogs have language and can talk to each other, which "compassionate conservationists" argue is a reason to put more value on the well-being of individual animals. LINDSAY WILSON/FLICKR

Native Knowledge: What ecologists are learning from indigenous people

From Alaska to Australia, scientists are turning to the knowledge of traditional people for a deeper understanding of the natural world. What they are learning is helping them discover more about everything from melting Arctic ice, to protecting fish stocks, to controlling wildfires.

Jim Robbins

Current Address: Helena, Montana, USA
Reprinted From: https://bit.ly/2HtUCnw

While he was interviewing Inuit elders in Alaska to find out more about their knowledge of beluga whales and how the mammals might respond to the changing Arctic, researcher Henry Huntington lost track of the conversation as the hunters suddenly switched from the subject of belugas to beavers.

It turned out though, that the hunters were still really talking about whales. There had been an increase in beaver populations, they explained, which had reduced spawning habitat for salmon and other fish, which meant less prey for the belugas and so fewer whales.

"It was a more holistic view of the ecosystem," said Huntington. And an important tip for whale researchers. "It would be pretty rare for someone studying belugas to be thinking about freshwater ecology."

Around the globe, researchers are turning to what is known as Traditional Ecological Knowledge (TEK) to fill out an understanding of the natural world. TEK is deep knowledge of a place that has been painstakingly discovered by those who have adapted to it over thousands of years. "People have relied on this detailed knowledge for their survival," Huntington and a colleague wrote in an article on the subject. "They have literally staked their lives on its accuracy and repeatability."

Tapping into this traditional wisdom is playing an outsized role in the Arctic, where change is happening rapidly.

Figure 1: Illustration by Luisa Rivera / Yale E

This realm has long been studied by disciplines under headings such as ethnobiology, ethno-ornithology, and biocultural diversity. But it has gotten more attention from mainstream scientists lately because of efforts to better understand the world in the face of climate change and the accelerating loss of biodiversity.

Anthropologist Wade Davis, now at the University of British Columbia, refers to the constellation of the world's cultures as the "ethnosphere," or "the sum total of all thoughts and dreams, myths, ideas, inspirations, intuitions, brought into being by human imagination since the dawn of consciousness. It's a symbol of all that we are, and all that we can be, as an astonishingly inquisitive species."

One estimate says that while native peoples only comprise some 4 or 5 percent of the world's population, they use almost a quarter of the world's land surface and manage 11 percent of its forests. "In doing so, they maintain 80 percent of the planet's biodiversity in, or adjacent to, 85 percent of the world's protected areas," writes Gleb Raygorodetsky, a researcher with the POLIS Project on Ecological Governance at the University of Victoria and the author of *The Archipelago of Hope: Wisdom and Resilience from the Edge of Climate Change.*

Tapping into this wisdom is playing an outsized role in sparsely settled places such as the Arctic, where change is happening rapidly – warming is occurring twice as fast as other parts of the world. Tero Mustonen, a Finnish researcher and chief of his village of Selkie, is pioneering the blending of TEK and mainstream science as the director of a project called the Snowchange Cooperative. "Remote sensing can detect changes," he says. "But what happens as a result, what does

Figure 2: The Skolt Sami people of Finland have documented a local decline in Atlantic salmon and are collaborating with scientists on a project to restore them. Credit: Gleb Raygorodetsky

it mean?" That's where traditional knowledge can come into play as native people who make a living on the landscape as hunters and fishers note the dramatic changes taking place in remote locales – everything from thawing permafrost to change in reindeer migration and other types of biodiversity redistribution.

The Skolt Sami people of Finland, for example, participated in a study that was published in the journal Science last year, which adopted indicators of environmental changes based on TEK. The Sami have seen and documented a decline in salmon in the Näätämö River, for instance. Now, based on their knowledge, they are adapting – reducing the number of seine nets they use to catch fish, restoring spawning sites, and also taking more pike, which prey on young salmon, as part of their catch. The project is part of a co-management process between the Sami and the government of Finland.

The project has also gathered information from the Sami about insects, which are temperature dependent and provide an important indicator of a changing Arctic. The Sami have witnessed dramatic changes in the range of insects that are making their way north. The scarbaeid beetle, for example, was documented by Sami people as the invader arrived in the forests of Finland and Norway, far north of its customary range. It has also become part of the Sami oral history.

It's not only in the Arctic. Around the world there are efforts to make use of traditional wisdom to gain a better and deeper understanding of the planet – and there is sometimes a lot at stake.

Record brush fires burned across Australia in 2009, killing 173 people and injuring more than 400. The day the number of fires peaked – February 7 – is known as Black Saturday. It led to a great deal of soul searching in Australia, especially as climate warming has exacerbated fire seasons there.

Land managers in Australia have adopted many of the fire-control practices of the aborigines and have partnered with native people.

Bill Gammage is an academic historian and fellow at the Humanities Research Center of the Australian National University, and his book, *The Biggest Estate on Earth: How the Aborigines Made Australia*, looks at the complex and adept way that aborigines, prior to colonization in 1789, managed the landscape with "fire and no fire" – something called "fire stick farming."

They used "cool" fires to control everything from biodiversity to water supply to the abundance of wildlife and edible plants. Gammage noted five stages of the indigenous use of fire – first was to control wildfire fuel; second, to maintain diversity; third, to balance species; fourth, to ensure abundance; and five, to locate resources conveniently and predictably. The current regime, he says, is still struggling with number one.

"Controlled fire averted uncontrolled fire," Gammage says, "and fire or no-fire distributed plants with the precision of a flame edge. In turn, this attracted or deterred grazing animals and located them in habitats each preferred, making them abundant, convenient, and predictable. All was where fire or no-fire put it. Australia was not natural in 1788, but made."

While the skill of aborigines with fire had been noted before the giant brushfires – early settlers remarked on the "park-like" nature of the landscape – and studied before, it's taken on new urgency. That's why Australian land managers have adopted many of the ideas and partnered with native people as co-managers. The fire practices of the aborigines are also being taught and used in other countries.

Scientists have looked to Australian natives for other insights into the natural world. A team of researchers collaborated with natives based on their observations of kites and falcons that fly with flaming branches from a forest fire to start other fires. It's well known that birds will hunt mice and lizards as they flee the flames of a wildfire. But stories among indigenous people in northern Australia held that some birds actually started fires by dropping a burning branch in unburned places. Based on this TEK, researchers watched and documented this behavior.

"It's a feeding frenzy, because out of these grasslands comes small birds, lizards, insects, everything fleeing in front of the fire," said Bob Gosford, an indigenous rights lawyer and ornithologist, who worked on the research, in an interview with the Australian Broadcasting Corporation in 2016.

Another recent study down under found that an ancient practice of using fire to clear land to improve hunting also creates a more diverse mosaic of re-growth that increases the number of the primate prey species: monitor lizards and kangaroos.

"Westerners have done little but isolate ourselves from nature," said Mark Bonta, an assistant professor at Penn State Altoona who was on a co-author on the paper on fire and raptors. "Yet those who make a point of connecting with our earth in some form have enormous knowledge because they interact with

a species. When you get into conservation, [that knowledge] is even more important." Aboriginal people "don't see themselves as superior to or separated from animals. They are walking storehouses of knowledge," he said.

The Maya people of Mesoamerica have much to teach us about farming, experts say. Researchers have found that they preserve an astonishing amount of biodiversity in their forest gardens, in harmony with the surrounding forest. "The active gardens found around Maya forest villagers' houses shows that it's the most diverse domestic system in the world," integrated into the forest ecosystem, writes Anabel Ford, who is head of the MesoAmerican Research Center at the University of California at Santa Barbara. "These forest gardeners are heroes, yet their skill and sophistication have too long been set aside and devalued."

Valuing these life ways is an important part of the process. For the Skolt Sami, writes Mustonen, "seeing their language and culture valued led to an increase in self-esteem and power over their resources."

It may not just be facts about the natural world that are important in these exchanges, but different ways of being and perceiving. In fact, there are researchers looking into the relationship between some indigenous people and the very different ways they see the world.

Some native people have the ability to adopt the "perspective of many creatures and objects – rocks, water, clouds," a researcher says.

Felice Wyndham is an ecological anthropologist and ethnobiologist who has noted that people she has worked with can intimately sense the world beyond their body. "It's a form of enhanced mindfulness," she says. "It's quite common, you see it in most hunter-gatherer groups. It's an extremely developed skill base of cognitive agility, of being able to put yourself into a viewpoint and perspective of many creatures or objects – rocks, water, clouds.

"We, as humans, have a remarkable sensitivity, imagination, and ability to be cognitively agile," Wyndham says. "If we are open to it and train ourselves to learn how to drop all of the distractions to our sensory capacity, we're able to do so much more biologically than we use in contemporary industrial society."

Among the most important messages from traditional people is their equanimity and optimism. There "is no sense of doom and gloom," says Raygorodetsky. "Despite dire circumstances, they maintain hope for the future."

Figure 3: Aboriginal Australians were the first to observe that kites hunt their prey by dropping burning branches to start new brush fires. Bob Gosford

From foe to friend: How carnivores could help farmers

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Across the globe, the numbers of carnivore species such as leopards, dingoes, and spectacled bears are rapidly declining. The areas they occupy are also getting smaller each year. This is a problem, because carnivores are incredibly important to ecosystems as they may provide services such as biodiversity enhancement, disease regulation, and improving carbon storage. And that, in turn, is important to human wellbeing.

But convincing people to conserve wildlife based on these indirect benefits can be challenging – particularly in the case of farmers. After all, carnivores such as leopards can pose a threat to livestock, livelihoods, and sometimes even lives. So interactions between farmers and carnivores have typically been framed as a conflict.

Farmers often overestimate these threats. For many, the response is to kill carnivores – even those that are not eating livestock. This is one of the main reasons why carnivores are in crisis.

This could change if people were aware of the more tangible benefits that carnivores could provide. Our new study showed that far from causing problems for farmers, carnivores could actually be beneficial by controlling rodent pests.

Rodents and carnivores

There's a desperate need for farmers to control rodents because they destroy 15% of the crops growing in African fields. The most common solution is to use poison. But this can be expensive and can kill many other species. On top of this, rodents eventually become resistant.

We set out to find out whether carnivores that eat rodents were found naturally on smallholder farms. We set camera traps on land used for cropping in South Africa, areas used to graze cattle (which was less disturbed than cropland), and among houses in village settlements.

Figure 1: Species like the large spotted genet were commonly found in cropping areas. Credit: Shutterstock

We found nine species of carnivores in the camera trap pictures. Rodents are an important part of the diet of seven of the nine, including the striped polecat, honey badger, and African civet. To our surprise, we found that the highest number of carnivore species were often found in the cropping area, which included species such as the large spotted genet and slender mongoose.

So not only are carnivores present on farmers' fields, but it's likely that they are also controlling rodents that would otherwise damage crops. But more research is needed to confirm this.

We set about establishing whether people were aware of the potential connection between the presence of carnivores on their farms and rodent control. During a series of interviews it quickly became clear that even though some people believed that carnivores ate rodents, they still had negative perceptions and often killed them.

Big potential

The idea to use natural predation to control rodents is not new. But to use mammalian predators to assist in biological control of rodent pests has often been neglected in conservation circles. As such there is great potential for carnivores to help farmers, but for this to work, farmers would need to stop killing them.

Changing these perceptions would take a lot of work. But efforts to change African perceptions about predatory birds, particularly barn owls, have been successful in some South African townships. Successful approaches to change community attitudes has often relied on education programmes through local schools. Bringing owls, snakes and other predators to primary schools can help raise awareness among children, who

then go home and educate their parents, ultimately breaking down widely held superstitions.

If education campaigns could convince farmers to kill fewer carnivores, carnivores might just repay the favour by doing a better job of controlling rodents in crop fields. This could lead to less reliance on poisons, avoiding unnecessary killings and costs.

If successful, this could help farmers to save money, while working in a much more environmentally friendly way. This really could be a win-win situation for both people and wildlife, and it shows that interactions between people and carnivores on farmland can be much more nuanced and positive than the traditional image of conflict.

Finding new ways in which people and wildlife can coexist will be essential to lessen the impact of the growing human population on the ecosystems on which humans depend.

Figure 2: A cape fox (*Vulpes chama*) on a maize farm feeding on *Gerbilliscus*, a common rodent pest in South Africa's grain areas. Credit: Lourens Swanepoel, CC BY

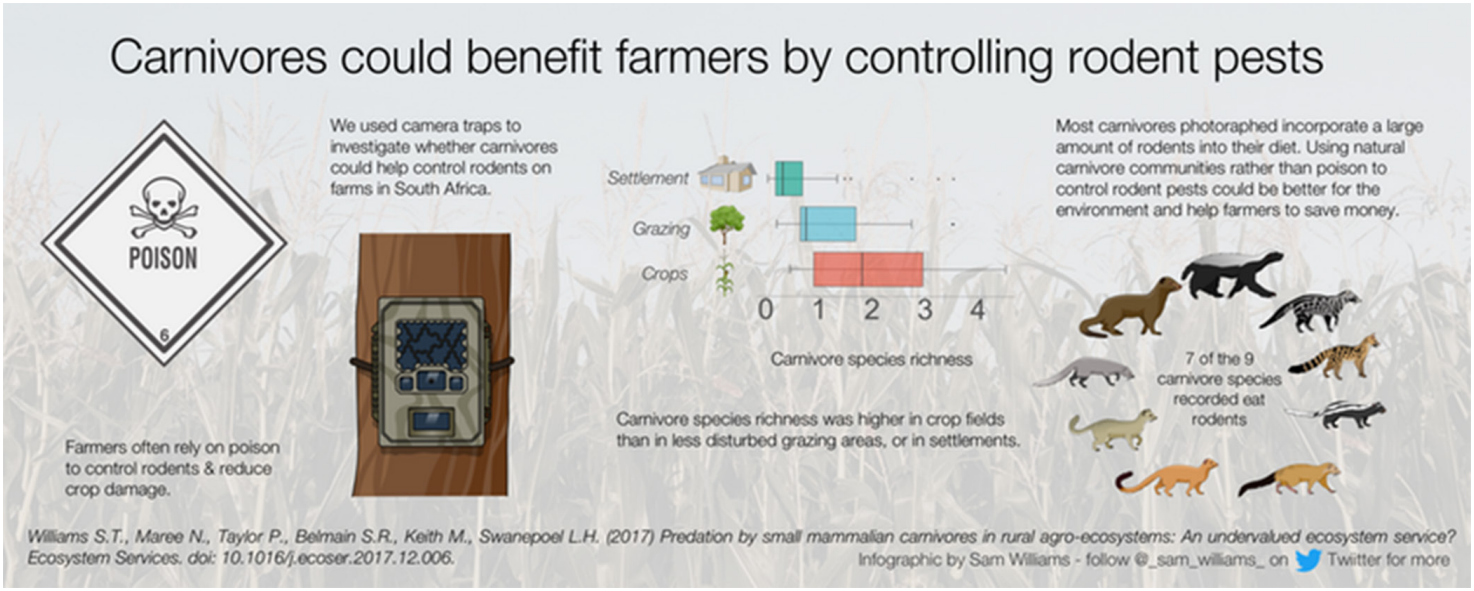

Figure 3: Infographic summarising the findings of the study of rodent control by carnivores on South African farms. Credit: Sam Williams

The species *Lolium perenne*, *L. multiflorum* and *Cynodon dactylon* listed in the draft Alien and Invasive Species regulations

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Recently two observant GSSA members alerted the GSSA council of the three pasture species Lolium perenne, L. multiflorum and Cynodon dactylon being included in the proposed list of the draft Alien and Invasive Species regulations in terms of section 97(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) proposed as category 2 invaders.

This was considered with some concern as the two Lolium species are the two main pasture species used in dairy production systems in South Africa and for that matter in many parts of the world. They are important commercial species with many bred varieties available.

In the case of Cynodon dactylon it is considered indigenous and is an important grazing resource in drier areas and in addition prevents soil erosion due to its rhizomatous and stoloniferous nature.

In the case of Lolium perenne it is a pasture species that is only suited to well irrigated and highly fertilized pasture systems due to its shallow root system and lack of adaptation to high temperatures. The importance of the species in dairy systems is due to its herbage productivity and high forage quality required for milk production. The main concern however is that many of the main role players in the dairy pasture industry and pasture research were not aware of this proposed listing or of the risk assessments associated with these species which could have led to the proposed listing.

The GSSA requested that these risk assessments are made available to allow for a better understanding of the matter before the species are listed.

Tracking *Valchellia erioloba* dynamics over nearly four decades in the Kalahari Gemsbok National Park

Dr Helga van der Merwe (SAEON) and Dr Hugo Bezuidenhout (SANParks)

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

A long-term study over nearly four decades tracks two populations in different landscapes of a large conservation area and offers valuable data on this species under different environmental conditions (interior sandy dune field versus clayey Nossob Riverbed).

In the southern Kalahari, *Vachellia erioloba* is regarded as an important species as it provides food, shelter, perches, nests and roost sites to many types of animals, and harbours a distinct assemblage of plant species below its canopy.

In South Africa, *V. erioloba* is protected by legislation. It is long-lived and not easily affected by short-term climatic variations, possibly because individuals of this species have some of the deepest roots of any known species (the maximum recorded was 68 m), allowing them access to deep groundwater sources.

Figure 1: Prof. Gretel van Rooyen (UP, SAEON Research Associate), Tshililo Ramaswiela (SAEON), Dr Charlene Bissett (SANParks) and Dr Noel van Rooyen (previously from UP, SAEON Research Associate) measure *Vachellia erioloba* trees in the Nossob Riverbed (Photo: Marco Pauw)

There is a growing concern that this species is declining in the southern Kalahari due to factors such as an increase in fire frequency, increasing groundwater abstraction, alien invasive species as well as harvesting.

Long-term study continued

Quantitative information on growth rates and lifespan of the species is however, still lacking. In 1978, surveys were initiated in the Kalahari Gemsbok National Park to gather information on the growth rate, life span and population dynamics of *V. erioloba* in the interior dune field and in the Nossob River habitats.

The key questions in current study were to (a) determine the mean annual increase in stem diameter and tree height of 18 permanently marked *V. erioloba* trees; and (b) to determine the mean age of these trees when they died in the interior dune field of the park; additionally (c) to follow the changes in the size class distribution of a *V. erioloba* population in the Nossob Riverbed.

Mortality and coppicing were recorded for the 18 trees marked in the interior dune field. Stem circumference measurements enabled the calculation of growth rates for these trees. Results from the population in the Nossob Riverbed indicated that over the 38-year period, this population has progressed from a young and growing to a mature-to-old population with limited recruitment.

The valuable collaboration between the University of Pretoria (UP), SANParks and SAEON has enabled the continuation of a 38-year-old dataset, thereby greatly improving our understanding of this long-lived tree species.

Figure 2: *Vachellia erioloba*, a keystone tree species in the southern Kalahari (Photo: Helga van der Merwe)

Climate change risk for half of plant and animal species in biodiversity hotspots

Current Address: University of East Anglia, Norwich, England
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Up to half of plant and animal species in the world's most naturally rich areas, such as the Amazon and the Galapagos, could face local extinction by the turn of the century due to climate change if carbon emissions continue to rise unchecked.

Even if the Paris Climate Agreement 2°C target is met, these places could lose 25% of their species according to a landmark new study by the University of East Anglia (UK), the James Cook University (Australia), and WWF.

Published today in the journal Climatic Change and just ahead of Earth Hour, the world's largest environmental event, researchers examined the impact of climate change on nearly 80,000 plant and animal species in 35 of the world's most diverse and naturally wildlife-rich areas.

It explores a number of different climate change futures - from a no-emissions-cuts case in which global mean temperatures rise by 4.5°C , to a 2°C rise, the upper limit for temperature in the Paris Agreement . Each area was chosen for its uniqueness and the variety of plants and animals found there.

The report finds that the Miombo Woodlands, home to African wild dogs, south-west Australia and the Amazon-Guianas are projected to be some the most affected areas. If there was a 4.5°C global mean temperature rise, the climates in these areas are projected to become unsuitable for many the plants and animals that currently live there meaning:

- Up to 90% of amphibians, 86% of birds and 80% of mammals could potentially become locally extinct in the Miombo Woodlands, Southern Africa
- The Amazon could lose 69% of its plant species
- In south-west Australia 89% of amphibians could become locally extinct
- 60% of all species are at risk of localised extinction in Madagascar
- The Fynbos in the Western Cape Region of South Africa, which is experiencing a drought that has led to water shortages in Cape Town, could face localised extinctions of a third of its species, many of which are unique to that region.

As well as this, increased average temperatures and more erratic rainfall could become be the "new normal" according to the report - with significantly less rainfall in the Mediterranean, Madagascar and the Cerrado-Pantanal in Argentina. Potential effects include;

- Pressure on the water supplies of African elephants - who need to drink 150-300 litres of water a day
- 96% of the breeding grounds of Sundarbans tigers could become submerged by sea-level rise
- Comparatively fewer male marine turtles due to temperature-induced sex assignment of eggs.

If species can move freely to new locations then the risk of local extinction decreases from around 25% to 20% with a 2°C global mean temperature rise. If species cannot they may not be able to survive. Most plants, amphibians and reptiles, such as orchids, frogs and lizards cannot move quickly enough keep up with these climatic changes.

Lead researcher Prof Rachel Warren from the Tyndall Centre for Climate Change Research at UEA said: "Our research quantifies the benefits of limiting global warming to 2°C for species in 35 of the world's most wildlife-rich areas. We studied 80,000 species of plants, mammals, birds, reptiles and amphibians and found that 50% of species could be lost from these areas without climate policy. However, if global warming is limited to 2°C above pre-industrial levels, this could be reduced to 25%. Limiting warming to within 1.5°C was not explored, but would be expected to protect even more wildlife."

Overall the research shows that the best way to protect against species loss is to keep global temperature rise as low as possible.

The Paris Agreement pledges to reduce the expected level of global warming from 4.5°C to around 3°C, which reduces the impacts, but we see even greater improvements at 2°C; and it is likely that limiting temperature rise to 1.5°C would

Figure 1: Verreaux's sifaka in Madagascar. Credit: WWF

protect more wildlife.

This is why on 24 March millions of people across the world will come together for Earth Hour, to show their commitment to reducing global emissions and protecting people and wildlife from the impacts of climate change. The event also sends a clear message to business and government that there is a global will to change this trajectory.

Tanya Steele, CEO of WWF commented: "Within our children's lifetime, places like the Amazon and Galapagos Islands could become unrecognisable, with half the species that live there wiped out by human-caused climate change. Around the world, beautiful iconic animals like Amur tigers or Javan rhinos are at risk of disappearing, as well as tens of thousands plants and smaller creatures that are the foundation of all life on earth. That is why this Earth Hour we are asking everyone to make a promise for the planet and make the everyday changes to protect our planet."

The models used in this research come from the Wallace Initiative, a near decade long partnership between the Tyndall Centre at UEA, eResearch at James Cook University, the Global Biodiversity Information Facility and WWF.

Dr Jeff Price, coordinator of the Wallace Initiative and also from UEA, said: "This research provides a view on the differing spatial impacts of climate change on biodiversity. It shows the benefits of combining citizen science with the research and resources of highly-ranked universities to assist an NGO with their conservation activities."

'The implications of the United Nations Paris Agreement on climate change for globally significant biodiversity areas' is published in the journal Climatic Change on March 14, 2018.

Figure 2: East Africa elephants. Credit: WWF

Figure 3: A giant panda from the Yangtze River area. Credit: WWF

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The link between soil fertility and on farm sustainable profits has been proven throughout history. You cannot produce good yields and quality crops from depleted soils, no matter the quantities of expensive fertilizer and growth promoters thrown at it. The only way to achieve sustainable production is to "farm the soil" by investing your efforts and money for compounded returns through improved soil fertility. Consumer awareness and growing demand for nourishing foods by health conscious consumers, has resulted in the incredible growth of organically farmed and crafted produce of 20% per year worldwide, and South African farmers are sure to benefit from this fast establishing business while maintaining productivity on a sustainable basis.

What are the basic principles of organics?

- To build up a healthy living ecosystem in the soil where beneficial micro-organisms such as bacteria and fungi thrive to protect plants from diseases.
- Increase carbon content of soil through composting, green manure and using plant residues as mulch.
- Improving the soil Biology, Chemistry and Physical structure to deliver quality plants, animal and human life though quality food.
- Inputs like poisons, synthetic fertilizers and herbicides that can damage the environment, pollute soil and water sources, kill soil life, or cause toxicity in food, are strictly forbidden in organic farming methods.

When a product, food or process is certified organic, the consumer is assured that a stringent inspection and control system, governed by worldwide standards through IFOAM (International Federation of Organic Agriculture Movements), is applied.

How do organic fertilisers compare with synthetic fertilizers in terms of efficiency and cost?

In the past organic farming was viewed as low cost inputs (i.e. when animal manures or composts were used as the only source of nutrients) yielding low productivity so organic farming was often not seen as commercially viable. Produce was often stunted, diseased and nutritionally deficient when grown in naturally poor soils using only manures and

Figure 1: Maize and lusern planted alternately to improve soil fertility in an organic and cost-effective way.
Credit: Agri-kultuur

compost. Now there are organic fertilizers available in SA which can outperform synthetic fertilisers which makes sustainable and organic farming viable. They are scientifically formulated into familiar fertiliser blends like 2:3:2, 5:1:5, 3:1:5. These supply high levels (Group 1) of complete sustained release Nitrogen (N), Phosphate (P) and Potassium (K), with minor and trace nutrients for optimum crop health.

The lack of focus on soil fertility means that synthetic fertilizers have to be added in straights or blends to supply one, two or three nutrients only, with no minor or trace nutrients (e.g. LAN, Superphosphate or synthetic 2:3:2). This required regular small applications of fertilizer to crops to ensure sufficient nutrients during their growing and fruiting phases. Then costly top-ups of foliar trace nutrients are applied to prevent deficiencies. These repeated applications increase labour, fuel and machinery costs.

Prevention is easier and less costly than cure

Most synthetic fertilizers are water soluble, for immediate nutrient uptake by the plant. This increases the potential loss of nutrient through leaching of up to 50% in sandy soils, so these costs are seldom factored in.

The bulk of synthetic fertilizers are fillers like lime, gypsum, granite chips, or salt based carriers, so often plant nutrients only make up 10 to 35% of actual weight purchased.

When using natural nutrients from plant, animal and naturally mined sources, organic fertilizer nutrients are bound in complex forms which are not water soluble so nutrients are released by microbial action in the soil (fungi, bacteria, algae, plant exudes and soil life) which gives a sustained feed to the crop. No fillers are added. Organic fertilizer should be viewed as an investment as the soil fertility builds up, savings on inputs and therefore costs are reduced.

Many additional factors like sustainability, impact indirectly on eventual cost per ton of fertilizer.

South African farmers are being pressured by lifeless unproductive soils, pollution of rivers and escalating costs of pest and disease control, associated with years of overuse of synthetic fertilizers, herbicides and poisons. So many farmers are rethinking and refining commercial practises which could be detrimental to the farms natural production potential and profitability, in tandem with international food safety standards and legislation which is now benchmarked as "no-residue".

Can insect pests be controlled as effectively with organic products as with synthetic insecticides?

The organic farmer will be guided by the saying: "Prevention is easier and less costly than cure."

They strive to grow strong and healthy plants, which resist pests and disease with natural immunity. High pest attack is nature's quality control system removing the weak plant to prevent propagation of a poor specimen.

In preference to using poisons, which kill the good with the bad, while potentially adding poison residues to food, the organic farmer uses products that disrupt the pest's life cycles, comfort, feeding habits, or acts as a repellent. This allows for the preservation of predators and beneficial insects to flourish and contain pest outbreaks naturally. Only as a last resort are natural poisons like Pyrethrum used to regain control of pest attacks.

Natural poisons breakdown rapidly, so does not build-up residues in the environment.

Figure 2: Maize cobs produced from organic fertilised soil. Credit: Agri-kultuur

Figure 3: Insect pests on fruit and vegetables can be effectively controlled by organic products. Credit: Agri-kultuur

International consortium to boost powers of "superhero fly"

University Stellenbosch AgriSciences

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University Stellenbosch: AgriSciences Newsletter 89 of April 2018

With a growing world population comes two major challenges (1) Food security, how do we create more food to ensure that no one goes hungry without exhausting our natural resources? And (2) Waste accumulation, more people means more activity and more activity means more waste is being produced. Surprisingly, a humble insect might be the answer to these challenges. The black soldier fly (BSF), is a cosmopolitan species, is consider a non-pest, and is not known to be a vector of disease, yet this small animal has two remarkable characteristics that make them very useful indeed.

The larvae are remarkably efficient at digesting organic waste (including food processing-, and other agricultural waste) and as such they are excellent bio remedial agents. Not only can the larvae degrade this waste, but the larvae themselves then convert this into usable animal protein and oils that is comparable to fishmeal; the major protein and oil source for animal feed that is then used for human consumption (e.g. meat- and dairy products, fish, and eggs). The declining world fisheries means that a sustainable alternative for animal protein is needed and by using BSF we can create a self-sustaining source.

Recognising the value of BSF, a group of international scientists have formed a consortium to study and improve the BSF for biotechnological application. The first meeting and symposium was hosted by Dr Christine Pichard (Department of Biology, Indiana University – Purdue University, Indianapolis, Indiana, USA) facilitated by a grant from the IUPUI Office of the Vice Chancellor for Research. Although genomics stand at the core of the research paradigm, the team is multidisciplinary, consisting of geneticists, entomologists, and food and nutrition scientists. The consortium has identified key research focus areas in basic science with applied relevance, including:

1. Evolutionary- & Molecular Ecology, to elucidate the origins and diversity of the BSF populations worldwide;
2. Genetics of Complex Traits, to assess the correlations between genetic and phenotypic variation;
3. Meta-Genomics & Microbiome Interaction, to understand microbial community associated with BSF;
4. Functional 'Omics: to analyse the functional biological aspects of BSF using a systems approach.

It is hoped that investigating these aspects, as it relates to the BSF, will help improve production performance and sustainability, product development, and food safety and nutrition.

As one of the first researchers to study the genetics of BSF, Dr Clint Rhode, from the Department of Genetics, Stellenbosch University represented South Africa on this international forum. He presented some of his preliminary research findings showing the genetic impact of mass commercial rearing on the BSF populations and the implications thereof for sustainable BSF production. Dr Rhode works in close collaboration with local BSF producer, AgriProtein, and has recently also received a National Research Foundation (NRF) grant to continue his research on this topic, the grant will support the studies of a number of postgraduate students on doctoral-, masters- and honours level.

Figure 1: From left to right: Dr Yongping Huang (Institute for Biological Sciences, SIBS, Shanghai, China); Dr Clint Rhode (Department of Genetics, Stellenbosch University, Stellenbosch, South Africa); Dr Sherah van Learhoven (Department of Biology, University of Windsor, Windsor, Canada); Dr Jonathan Cammack (Department of Entomology, Texas A&M University, College Station, TX, USA); Dr Christoph Sandrock (Department of Livestock Sciences, Research Institute of Organic Agriculture, Frick, Switzerland); Mr Devon Brits (Entomology Department, Louisiana State University, Baton Rouge, LA, USA); Dr Jennifer Pechal (Department of Entomology, Michigan State University, USA); Dr Jeffery Tomberlin (Department of Entomology, Texas A&M University, College Station, TX, USA); Dr Andrea Liceaga (Department of Food Science, Purdue University, West Lafayette, IN, USA); Dr Christine Picard (Host) (Department of Biology, IUPUI, Indianapolis, IN, USA)

Project Rhino 2018

First Quarter Newsletter - Summary

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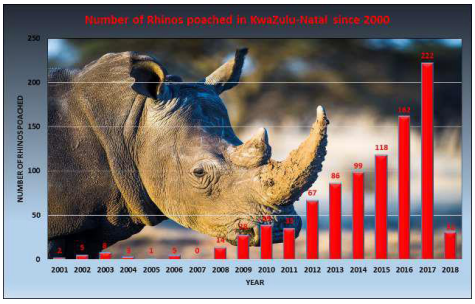
"When you tug at a single thing in nature, you find that it is attached to the rest of the world" - John Muir

The first quarter of 2018 has been jam-packed and exciting as Project Rhino works together with its member organisations to support our member reserves in anti-poaching and the protection of our wildlife. Project Rhino in conjunction with the Game Rangers Association of Africa (GRAA) and the Southern African Wildlife College already conducted 4 training courses, which trained 42 managers and field rangers in various essential skills.



The Project Rhino K9 Unit has developed a strategy out of the pilot period that we have been running the detection dog service for the Zululand reserves. The K9 Unit Strategy has further been informed by attending two workshops, one hosted by Ezemvelo Wildlife and the Endangered Wildlife Trust and the other hosted by the USA Fish and Wildlife as well as Save the Rhino and Elephant Foundation and was organized and run by Michalea Butorova and Kirsty Brebner.

We have officially launched our Horse anti-poaching unit, which is based in Hluhluwe iMfolozi Game Reserve.The unit consists of 7 horses and 5 rangers who patrol up to 30 km per day. The horses were donated by Lauren Louwrens of Kokstad. Lauren also trained the groom (Shokhwakhe Gumede of the Somkhele mine area) and acts as a consultant in the Equine department of the unit. All rangers have Cyber trackers and their movements and distances can be monitored each day.

Project Rhino believes that there is a lot of value in meeting with the rhino reserves and Project Rhino members. In this first quarter Project Rhino facilitated the Zululand reserves meeting, Midlands Wildlife Security Initiative (MWSI), Community meeting to map out current, planned and needed community work and have had our member organization meeting. We have also visited the Zululand and Midlands Reserves which keeps us informed of the needs on the ground and how we need to respond with agility. Our Rhino Art team has been very active in keeping the awareness and education going by visiting many schools in KZN and the Eastern Cape. We have also met with some of our key supporters, Mr Price Sport, Tandem Tyres and the American Consulate.

Project RHINO
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BLACK RHINO RANGE EXPANSION PROJECT

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SA's path to sustainable energy for all

'Sustainable energy for all' can seem like a fanciful bumper sticker. Is it even possible? How does one begin to address it?

National Science and Technology Forum (NSTF)

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Climate change consequences have forced decision making and driven society to take on global goals to ensure the survival of earth's inhabitants. And the goals are intertwined with one impacting on the other.

'Affordable and clean energy' is number 7 of the United Nations (UN) Sustainable Development Goals (SDGs). It's the UN's 'International Decade of Sustainable Energy for All' currently. There is also 'Sustainable Energy for All' (SEforALL), a global non-profit organisation launched by former UN Secretary-General Ban Ki-moon.

Need for ongoing national discussion forum

The topic and the goal are immense – whether one considers it on a global or national level. It's transdisciplinary and cuts across industries.

There is also an emphasis on developing partnerships to tackle the challenge. At the same time, science, engineering and technology (SET) are positioned as key to finding solutions.

Consequently, the National Science and Technology Forum (NSTF) held a Discussion Forum on 'Sustainable Energy for All in South Africa'. It ran from 16-17 April 2018 in Gauteng.

The NSTF provides neutral collaborative platforms where issues and sectors meet

- One of the National Science and Technology Forum (NSTF) functions is to hold discussion forums, bringing the private and public sector together to address important issues and engage with government policy.
- Feedback from these discussion forums is given to stakeholders.
- Recommendations are put forward to government as part of the SET community's lobbying efforts.

NDP's low-carbon economy

As part of the National Development Plan's (NDP) aims to eliminate poverty and reduce inequality by 2030, a low carbon future is positioned as the only realistic option. While the NDP presents an integrated energy sector with adequate investment in infrastructure, it recognises that trade-offs must come into play.

The integrated and diversified energy sector must support economic growth through job creation, export, and R&D for competitive advantage. The focus is on environmental sustainability and climate change mitigation but this is balanced with supply security, safety, affordability, and access. These remain relevant in today's context. While historically policies have focused on minerals and energy, renewable energy is now an integral part of SA's energy mix.

Policy context

South Africa is a signatory to the Paris (COP21) Agreement 2016 – which aims to reduce global warming through each country's actions – explains Dr Rebecca Maserumule, Chief Director: Hydrogen and Energy at the National Department of Science and Technology (DST). In her presentation, she notes that South Africa's guiding frameworks include:

- The NDP with its focus on investments in energy infrastructure, affordable tariffs for needy households, and diversifying energy resources and supply options.
- The National Climate Change Response Strategy for long-term mitigation scenarios.
- The Industrial Policy Action Plan (IPAP) with its focus on re-industrialisation, support for local beneficiation, and local manufacturing.
- The National Energy Act and universal access to modern forms of energy services, energy security through guaranteed supply, optimal use of economically-viable energy resources, and addressing constraints on the renewable industry. This includes the Integrated Energy Plan (IEP) and the Integrated Resource Plan (IRP). The latter aims for 42% of electricity generation from renewable energy sources by 2030.

Research focus areas include clean coal technologies, nuclear energy, renewable energy (eg solar, biofuels, and wind), energy efficiency and energy demand management, and hydrogen and fuel cells research. In most cases, says Dr Maserumule, the research has been in place for over a decade through partnerships with key research institutions.

Systems around sustainable energy

One of the ways to understand sustainable energy is to look at its impacts in various areas. Prof Sanette Marx, DST/National Research Foundation Research (NRF) Chair in Biofuels at North West University, considers three areas: environmental impact, economic impact, and social impact. We can consider something sustainable when it's equitable, viable, and socially and environmentally acceptable.

Broader definition of energy poverty

Prof Roula Inglesi-Lotz, Associate Professor from the University of Pretoria, ques-

tions whether energy poverty is only lack of access? Energy poverty impacts not only on lighting – consider heating, cooking, and communications. Access to the latter has a knock-on effect because it affects knowledge transfer such as with internet access.

She presents the following definition: "…the absence of sufficient choice in accessing adequate, affordable, reliable, high-quality, safe and environmentally benign energy services to support economic and human development" (Reddy, 2000). She notes that the definition acknowledges the absence of choice and the role of affordable and adequate technology.

Renewable energy in waste

SA continues to innovate in the renewable energy space. Take the work done by IDEAS – the Institute for the Development of Energy for African Sustainability – at UNISA.

Using a transdisciplinary approach, the research focuses on environmentally-responsible chemical conversion technologies, with particular emphasis on sustainable and flexible small-scale solutions and using surplus and underused resources (such as municipal waste and sewerage). This is waste as a resource, not a health hazard.

Clean energy in organic waste
Consider a rural family who cooks on a two-plate stove for 2 hours a day (at simmer) and heats up 40 litres/day water to 50 °C. One cow, with the family's human waste, could supply this energy.

Prof Diane Hildebrandt, Director of IDEAS, explains that they have developed small-scale anaerobic biodigesters. These are basically large double-walled bags where you feed in organic waste and slurry comes out on the other end. The slurry overflow has no smell and can be used as a fertiliser. The biodigesters produce biogas while removing pathogens from waste (with consequent reduced health risks). IDEAS is developing a business case to show employment benefits, as well as cost reduction for immediate users and the municipality.

Developing clean coal technologies

Coal is not environmentally acceptable as such, but we can make it so through clean coal technologies, says Prof Sanette Marx. One of her research areas is hydrothermal liquefaction – a method to produce biochar for creating cleaner coal. The first patent and pilot plant occurred in 2016/17.

Prof Rosemary Falcon, currently a Director of the Fossil Fuel Foundation, was the SARChI (South African Research) Chair in Clean Coal Technology at Wits University until she retired last year. She and Dr Samson Bada are part of the DST-NRF SARChI Clean Coal Technology Research group. Part of this is the High Efficiency and Low Emissions (HELE) Programme. It looks at options for environmentally-responsible use of coal.

About coal

- SA is the 7th largest producer of coal in the world and the 7th largest exporter.
- Coal accounts for the highest foreign exchange earnings in SA since 2011.
- It's the largest mining income earner, beating gold, platinum and diamonds.
- There are over 255 000 direct employees in coal-related industries. It also supports most major towns in Mpumalanga, Limpopo and some in KZN.

(DST-NRF SARChI Clean Coal Technology Research group)

What about shale gas?

Over the past few years, there has been a lot of debate around drilling for shale gas and its environmental impact. Research from the DST-NRF Centre of Excellence in Integrated Mineral and Energy Resource Analysis (CIMERA), University of Johannesburg, looks at 'Questioning the existence of an economic producible shale gas resource in the southern Main Karoo Basin based on results of the CIMERA-Karin drilling project'.

One of the aims was to establish the maturity and shale gas potential by direct measurements of gas content. Prof Nicolas Beukes explains that nothing like this had been done before. Everything previously had been speculation including shale gas estimates.

After the CIMERA-KARIN Drilling Project with the first true gas measurements, very little to no gas was detected. The conclusion is that shale gas potential looks to be much lower than initially estimated. There are some provisos, such as the project not specifically targeting 'sweet spots'.

Prof Beukes explains that we need to do the science first. We need to answer the question of whether South Africa actually has an economically viable shale gas resource. This will avoid unnecessary environmental concerns and legal battles.

Models for SA's energy mix?

The CSIR Energy Centre has been developing models for SA's energy mix. Currently, energy is coal dominated with end use being 25% transport, 25% electricity and 50% heating and cooling.

CSIR's Mr Jarrad Wright explains that globally there have been significant cost reductions in renewable energy. Solar PV technology and wind technology, for example, have now become cost competitive. Focusing on electricity, Wright showed that – whether there is a high or low demand forecast for South Africa – there is a gap. This needs to be filled in the least-cost manner and with a reliable and flexible energy supply.

Three scenarios were presented:

- The Draft IRP 2016 Base Case sees the energy mix as $^1/_3$ coal, $^1/_3$ nuclear, and $^1/_3$ renewable energy.
- The Draft IRP 2016 Carbon Budget Case sees nuclear energy take a 40% share by 2050.
- The Least Cost Case is largely based on wind and solar PV complemented by flexibility (including existing coal, new gas, hydro and concentrated solar power). This case deploys considerable solar PV and wind – and flexibility – with no new investments in coal or nuclear capacity. The scenario includes a managed system of energy supply.

Speakers that addressed the forum can be contacted through the spokesperson, Ms Jansie Niehaus.

Video clips with the full presentations and discussion can be found on the NSTF web site.

Western Cape drought: How well-managed renosterveld can help farmers

Heather D'Alton

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During a drought, healthy natural grazing could provide a lifeline to many livestock farmers.

In the Western Cape in particular, taking care of renosterveld fragments during the good years can provide that essential grazing when times are tough, says Keir Lynch of the Overberg Renosterveld Conservation Trust.

Culling of sheep herds

The drought in the province has already cost the agricultural sector nearly R6-billion, according to the Western Cape government. Nearly a quarter of sheep herds in the province, and 5% of other livestock have been slaughtered because of grazing and feed shortages, says the Agri Western Cape.

"Best practice management of renosterveld fragments therefore need to be part of a farm management plan," says Lynch. "That in turn will secure healthy natural landscapes for a farmer from a biodiversity standpoint – including the fauna and flora on the farm, and valuable grazing for his or her livestock."

How controlled burns can help

Ecological burns are a crucial part of a management plan. If undertaken properly, renosterveld species such as the favourable Rooigras (*Themeda*), Blougras (*Ehrharta*) and palatable shrubs and vygies will grow post-fire.

Figure 1: The start of a controlled burn on renosterveld. Credit: Agri-kultuur

"Controlled burns should be used for ecological reasons, and should include an assessment of the veld, and a five-year controlled burn strategy coupled with a grazing plan," he says.

For example, burning too frequently will destroy key renosterveld species. The ORCT recommends burning every 10 to 15 years, based on the condition of the veld.
Lynch says the aim is to create a mosaic of veld ages on the property – which in turn gives refuge to the animal life that depends on renosterveld.

Don't burn in winter

He also says the ideal time to burn is late summer to early autumn. Burning in April is acceptable in some cases – especially when the veld is very old. But he warns that burning during late autumn could destroy bulbs just as they push out their leaves. Ecological burns should never take place in winter or spring.

After a burn, the veld should be left for a minimum of two years before grazing is allowed. If grazed too early, it will prevent the regrowth of those palatable species, which can't compete with less-favourable species like Renosterbos. "If you manage your veld well, it promotes more favourable species, so that in the long term, your grazing quality is higher."

Prioritising alien vegetation for clearing

Because burns generally take place during fire season, the ORCT helps landowners to ensure firebreaks are in place – to reduce the risks of wildfire. The ORCT has partnered with the Greater Overberg Fire Protection Association and the Overberg District Municipality to ensure safe ecological burns which best conserve critically endangered ecosystems, including renosterveld.

One such ecological burn was recently undertaken at the Kinko Conservation Area in the Breede River Cluster, where 30-year old veld was burned. The burned area has been fenced off, to prevent grazing, and alien vegetation that may grow will be prioritised for clearing.

Lynch says, "This is part of the service the ORCT provides, and we include these components in the integrated management plans we develop with the farmers we work with."

The ORCT Watercourse Restoration Project is funded by WWF Nedbank Green Trust.

Figure 2: A progressed controlled burn on renosterveld in late-summer. Credit: Agri-kultuur

Groundbreaking research to help save the giraffe from extinction

Leni Martin describes the scene as some novel research on giraffes gets under way – with De Beers Group playing a key role.

Leni Martin

Reprinted From: Diamond Route Newsletter - April 2018

Burly arms thrust upwards against the giraffe's neck, giving the animal impetus to scramble to its feet. The 30 or so people standing back to give it space applaud briefly as it canters away, but there's no time to reflect on success. The chopper pilot is already reporting another giraffe nearby and lands quickly to pick up the vet who will dart it.

The remaining people sprint to the vehicles that are soon dashing across the veld towards their next subject. Less than 40 minutes after darting the first giraffe, the capture team in the leading pickup race to guide the second giraffe as it falls on to its side. They restrain its legs, raise its neck on a wedge-shape platform to help its breathing, and cover its eyes and close its ears with cotton wool to minimise stress.

More than a dozen people are scurrying around, taking the animal's temperature and measuring its hooves, testes, scrotum and ossicones (the giraffe horns). A figure with a clipboard records the measurements. Others are collecting ectoparasites, hoof clippings, blood samples, hair, faeces, and finally the big one: semen. It's the first time ever that semen has been collected from a giraffe in the wild.

All the while, a crew is filming the whole event for a documentary. Above the scene, their drone is making its own recording. An observer could be forgiven for thinking that this large team had done this many times before; few would believe this was only the second giraffe they were collaring.

At the giraffe's head, team leader Dr Francois Deacon monitors its breathing, watching for signs of distress, liaising with the wildlife veterinarians, calling for water to keep the animal cool, and instructing bushes to be sawn down to clear a path for the giraffe's getaway.

Figure 1: The view from a drone above, as samples are taken from a giraffe. Credit: The Diamond Route Newsletter

The three-person collaring team puts the finishing touches to fitting the halter-like GPS collar snugly but not tightly between the giraffe's ossicones. Weighing only 600g, the collar is less than one per cent of the giraffe's body weight.

After only 15 minutes, the veld is cleared

Figure 2: The team chases a darted giraffe. Credit: The Diamond Route Newsletter

of all paraphernalia and the data collection team moves back towards the vehicles. And the second giraffe rises, unsteady as a calf taking its first steps, before cantering away.

It happened nine more times before nightfall, and again and again on the days following, until the collars were used up and there were no more hours in the helicopter's fuel tank.

The giraffe-collaring exercise took place on De Beers' Rooipoort Nature Reserve in South Africa's Northern Cape Province on a scale never seen before. The company is playing a pivotal role in saving giraffe from extinction.

Under the aegis of the University of the Free State's (UFS) Faculty of Natural and Agricultural Sciences and Dr Deacon's leadership, the specialists had come together to find answers to basic questions about giraffe biology – and to more complex ones about conservation programmes and the management of giraffes.

It was an ambitious effort. When the team's tents had gone up in a large circle and flags had been distributed to mark the nationalities of their occupants – German, Dutch, British, American and, of course, South African – Dr Deacon had worried that there would be too many people and they'd get in one another's way.

In fact, each member – biologist, grassland scientist, GPS/GIS specialist, acoustic specialist, zoologist, wildlife veterinarians, reproductive physiologist, endocrinologist, soil scientist, animal behaviourist, geneticist, biochemist, animal welfare advocates and bioengineers – had a role to play.

Almost unnoticed, Africa's wild giraffe population has dropped by roughly 40 per cent in the past 30 years, so the kind of exercise undertaken by the UFS-led team has a certain urgency, and particularly in view of the multitude of gaps in current knowledge about the species.

There are, for example, many questions about reproduction. Postdoctoral fellow Tanja Wolf from Germany will study the faecal samples collected to get a better handle on females' oestrous cycles and when males reach reproductive age, as well as DNA to establish which males are siring the calves and whether dominance is a factor. She will stay on the reserve for a full year to continue her research, as will PhD student Ciska Scheijen from the Netherlands, studying levels of stress experienced by giraffes.

Biochemist Professor Gary Osthoff of UFS will compare milk taken from pregnant females with milk taken from nursing cows to establish any changes in quality and composition, while master's students Amaria Janse van Rensburg and Jamie Paulse will look at the giraffes' parasite loads and body condition, along with preferred habitats and their vegetation quality.

Animal behaviourist Fred Bercovitch, among others, will study what the all-important GPS collars reveal about the movements and home range use of both males and females, with Professor Nico Smit examining the habitat qualities and Hennie Butler focusing on the behaviour and thermoregulation.

And then there's that groundbreaking collection of semen samples by reproductive physiologist Ilse Luther. The prospects are exhilarating, and it wasn't long before Ilse was sharing her excitement with the entire team back at camp, where a trailer had been set up as a mobile lab.

Valuable research has already been done on giraffes. Dr Deacon has previously captured some 40 of them successfully and collected important data. But most of the avenues being explored as a result of this exercise are novel and will contribute a vast amount to the body of knowledge about giraffes.

And with that knowledge will come not

Figure 3: The giraffe is eased down to the ground. Credit: The Diamond Route Newsletter

only insights into how populations can be managed (especially in South Africa where they live in fenced, fragmented reserves), but also a more precise understanding of the factors that regulate giraffe demography and reproduction.

Importantly too, with each capture, techniques are improved and the risk to the giraffe is lessened. On this exercise, every giraffe got to its feet none the worse for the experience, and all the cows were reunited with their calves.

Figure 4: Samples are taken and figures are recorded. Credit: The Diamond Route Newsletter

Figure 5: The team prepares for the next capture. Credit: The Diamond Route Newsletter

Find out more at:
www.ufs.ac.za/templates/archive.aspx?news=10285&cat=1

Flight to Vulture's Retreat serves dual research purpose in South Africa's most critical water catchment

Kent Lawrence and Paul Gordijn, SAEON Grasslands-Forests-Wetlands Node

Reprinted From: https://bit.ly/2uJ7Xz4

On 16 May 2018, the technical team from the Grasslands-Forests-Wetlands Node, Paul Gordijn, Siphiwe Mfeka and Kent Lawrence, found themselves hovering above the endangered Cape Vultures of the uKhahlamba Drakensberg as the helicopter pilot carefully maneuvered them to their most remote field research site.

At this research site known as Vulture's Retreat, located on a small inselberg (free-standing peak) near the Drakensberg escarpment, at an altitude of 3068 m.a.s.l., the highest long-term weather station in South Africa was established in August 2015.

Only one visit to the station since then, in November 2015, was undertaken to boost the communication ability of the station - now the weather conditions at the site can be viewed live here: https://bit.ly/2gBtlf9. This recent visit was to upgrade and repair instrumentation on the station, which takes some preparation (programming behind a computer back in the office and then testing instruments), but the opportunity was also taken to initiate some long-term vegetation monitoring.

The high altitude of this site is associated with occasional winter snowfalls and temperature regularly drops below zero. These chilly conditions with snow and ice have resulted in the weather station's automatic rain gauge being blocked, which may affect the accuracy of the gauge.

To overcome this problem, a special snow gauge was installed on this visit. The snow gauge has a heater which melts snow and ice. By comparing precipitation from the conventional rain gauge and the snow gauge at the site, the technical team will get an idea of how snow contributes to the water balance.

They will also be able to track long-term changes in these different precipitation forms with a fancy new barometric sensor for air pressure that adds to the unique value of the highest long-term weather station in South Africa. This all feeds into the socio-economic value that SAEON is adding by contributing important weather data to the public and the research community.

Long-term vegetation monitoring
The isolated nature of the Vulture's Retreat inselberg provides a unique opportunity to assess vegetation dynamics away from the impacts of large herbivores. These inselbergs contain some unique species which have differentiated from their relatives over time, speciation driven by their isolation.

Given that this trip was out of the flowering season, species could not be easily identified. Therefore, the team set up some long-term photo monitoring sites whereby dynamics between the temperate fynbos shrubs and grassy elements can be monitored into the future and climate change signals evaluated. This represents the first long-term monitoring effort of vegetation on Drakensberg inselbergs.

"We look forward to continued research at this unique long-term monitoring site and specifically anticipate appreciation of this weather and vegetation monitoring data at the 'top' of a site known as the "water tower" of southern Africa, which is also an important biodiversity hotspot," says Sue Van Rensburg, Coordinator of SAEON's Grasslands-Forests-Wetlands Node.

Watch video clips of the landing and take-off.

Figure 1: The Grasslands-Forests-Wetlands Node's most remote field research site, Vulture's Retreat, is located on a small inselberg (free-standing peak) near the Drakensberg escarpment

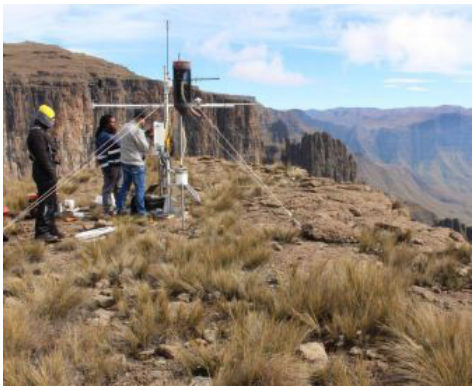

Figure 2: Established in August 2015, Vulture's Retreat is the highest long-term weather station in South Africa at an altitude of 3068 m.a.s.l.

Figure 3: The technical team from the Grasslands-Forests-Wetlands Node, Paul Gordijn, Siphiwe Mfeka and Kent Lawrence, repair instrumentation

Figure 4: The isolated nature of the Vulture's Retreat inselberg provides a unique opportunity to assess vegetation dynamics away from the impacts of large herbivores

Introducing the Lower Orange River Riparian Project

Marco Pauw, Field Technician, SAEON Arid Lands Node

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

Reclining on the banks of the lower Orange River at Augrabies, with the sun setting over this rocky desert landscape, one cannot help but be amazed at how the river's water has flowed for about 2 200 km from the highlands of Lesotho, through a diversity of landscapes, to eventually spill over the Augrabies Falls.

From here the water flows through the most arid part of South Africa to its final destination - the Atlantic Ocean.

As far back as primary school we learned about the life-sustaining and economic importance of this, the largest river system in South Africa. It continues to capture the imagination of those lucky enough to visit the lower reaches of the river, where the lush green riparian vegetation is in stark contrast with the surrounding desert landscape. The lower Orange River is truly magnificent.

Naturally, the river's flow has varied with time from apocalyptic-like floods to (believe it or not!) running completely dry. Humans have captured and tamed the river as best they could. It started off with a few reservoirs and weirs too small to stop floods or prevent drought, such as the Boegoeberg Dam (20.7 million m3) that was completed in 1933.

Tipping point

A tipping point in human development along the Orange came with the completion of the Gariep Dam in 1971 - the largest reservoir in South Africa at 5 348 million m3. The hydrological regime downstream would forever be changed.

Today, there is a complex system of reservoirs, transfer schemes and irrigation canals. This includes the Vanderkloof Dam, also constructed during the Orange River Project in the 1970s, the Katse and Mohale dams, constructed as part of the Lesotho Highlands Water Project (1990s to present) and the Vaal Dam (originally constructed in the 1930s, but raised twice since), controlling the Orange River's main tributary, the Vaal River.

Figure 1: The Arid Land Node's trusty boat (seen here packed with equipment and supplies for a week) allows the team to access remote sites

As a result, the seasonal nature of flow in the lower Orange River has been all but eliminated and small floods are captured by reservoirs so that they no longer wet the floodplain as frequently as before. This, along with the development taking place along its banks, is why most of the lower Orange River riparian zone has been declared a threatened ecosystem.

SAEON study

But what exactly are the effects of the altered hydrological regime on the riparian zone? This is what the SAEON Arid Lands Node, in collaboration with SANParks and the University of the Witwatersrand (Wits), set out to discover in the Lower Orange River Riparian Project (funded by SAEON and the Botanical Education Trust).

Making use of flow records and aerial photographs, principal investigator Marco Pauw (SAEON Arid Lands Node field technician and PhD candidate at Wits) aims to determine how the riparian vegetation between Augrabies Falls and Richtersveld changed in response to the altered hydrology. Several other factors, such as Prosopis invasion and land use, are also taken into account. This desktop component is complemented by in-situ data collection.

In October and November 2017, Marco, with Tshililo Ramaswiela (fellow field technician) and Stefan Goets (intern), collected data on the riparian vegetation in Augrabies Falls National Park and along the banks of Blouputs1 and Riemvasmaak2 as well as at Raap-en-Skraap farm. This represents the first attempt to collect data on and describe the riparian vegetation communities along the lower Orange River on this scale, mainly due to logistical difficulties. Some areas are only accessible by boat.

The Arid Lands Node team will continue to brave extreme temperatures, head-

winds, dense and thorny vegetation, and biting insects in 2018. They will visit more places with exotic names such as Onseepkans, Pella and Vioolsdrift, and eventually the iconic Richtersveld.

Hopefully, they will gain better insight into the ecology and long-term changes in the riparian zone along the lower Orange River, which sustains biodiversity and provides important ecosystem services in a truly harsh environment.

[1] Blouputs is a settlement consisting of several grape and citrus farms on the south bank just downstream of Augrabies Falls.

[2] Riemvasmaak is a large communal area that borders the Orange River north of Augrabies Falls National Park and Blouputs.

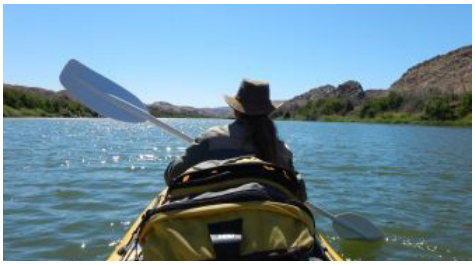

Figure 2: Rowing to the next camp site looks peaceful but ask Stefan Goets: it's hard work if you're up against a headwind.

Figure 3: Marco in his happy place, trying every possible means to find a way into the dense riparian woodland.

Figure 4: Life is tough in the lower Orange River valley, but this 4x4 trail on the farm Raap-en-Skraap conveniently passes through the riparian woodland and allows easy access to a research site

Figure 5: Due to the diversity of life supported by the Orange River, the team had many special sightings during their trip, including birds such as fish eagle, giant heron and even rosy-faced lovebird. This rock monitor was found raiding bird nests on rocky outcrops in the river

Figure 6: Field technician Tshililo Ramaswiela contemplates the dramatic contrast of a landscape where the lush green riparian vegetation is in stark contrast with the surrounding desert

Does farm land have a scrap value?

Dr Philip Theunissen

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

In 1995 an American agricultural economist, Prof. Arnold W. Oltmans, published an article entitled "Why Farmland Cannot, Will Not and Should Not Pay for Itself". The argument he advances in this article is that the big difference between the production value of land, which is calculated on repayment capacity, and the considerably higher market value of land, which is the actual price farmers pay, should be ascribed not to the overvaluing of farm prices but rather to an erroneous form of land purchase financing.

The "error" that financial institutions are making, according to Oltmans, is that they want to finance the purchase of a farm like a form of hire-purchase. While hire-purchase is the instrument of choice for financing an item like a tractor, which depreciates in value, it is the wrong instrument for financing an item which appreciates in value.

A tractor that is depreciating eventually reaches the end of its life and is left to rust under a gum tree with an empty coffee tin over its exhaust, waiting to be cannibalised for parts. Land, in contrast, never wears out and its value never reaches scrap value. It should therefore be financed on the assumption that no final payment should ever be made, because then the production value and the market value would be the same. But is the professor correct in assuming that land could never reach the stage where it becomes an abandoned object under a gum tree with a coffee tin over the exhaust pipe?

Title deed

Land as fixed property is described in a title deed as a flat surface area. Consequently ownership does not vest in the land itself but instead attaches to a document which assigns certain rights to the holder of the document in respect of an immovable, specified flat surface. Financial institutions like documents of this kind, through which they can acquire certain rights that would enable them to finance the purchase of the land at an amortisable amount. The American professor may well have a strong argument when he speaks of the wrong form of financing in respect of land as fixed property.

But land as a natural resource is not a flat surface area which can be described in a title deed. In this capacity it is a cube which is not confined to a flat surface. Its dimensions extend some way into the air and include rainfall and temperatures. They also reach beneath the surface and include the different soil profiles with the organisms that live on and in them. The condition of land as a natural resource could well change considerably whereas land as fixed property will always remain a flat, specified area on a title deed. Contrary to the professor's argument, the value of farm land might well degenerate to scrap level, depending on the context in which it is measured.

Erosion

In its natural state land is continually exposed to erosion. The erosion of arable land involves the accelerated weathering of the topsoil through the physical forces of wind and water, possibly hastened by cultural practices. This artificial erosion arises when the energy that builds up in rainfall or wind is transmitted to the soil. Raindrops that fall on bare soil launch small particles of dust into the air while the heavier particles that remain behind become compacted. When the lighter particles descend to the compacted surface, they easily tend to flow away or be blown away, especially on slightly sloping surfaces. But living or dead plant matter on the soil absorbs the raindrops or wind energy and prevents the dust particles from being launched into the air or the heavier particles from becoming compacted.

In contrast, soil formation is a far slower process than soil degradation and soil losses can therefore be regarded as irreversible. Continual erosion therefore causes permanent damage to the topsoil which impairs its ecological production and hydrological function. The best way to counteract the continual degradation of soil is therefore to provide a permanent vegetal cover.

Losses

The international soil erosion model, known as the Universal Soil Loss Equation (USLE), was used by Dr Jay le Roux and his colleagues at the University of the Free State to measure rainfall erosion for South Africa. In quantitative terms the model estimates that South Africa's average loss of soil as a result of rainfall run-off alone amounts to 12.6 tons/ha/year.

This is naturally considerably more than the average natural soil formation of 5 tons/ha/year and means that South Africa is losing soil at a net rate of 6 tons/ha/year, simply as a result of water erosion. In comparison with a country like Australia (4.1 tons/ha/year), South Africa is losing three times as much soil per year.

Dr le Roux ascribes this big discrepancy to the aggressive cultural practices applied on South Africa's arable land. As mentioned previously, soil loses its ecological production capacity and hydrological functions if the topsoil is lost. This secondary effect, determined on the basis of American research, is shown in Table 1.

Table 1: Secondary effect of soil losses due to water and wind erosion

Factors	Quantities lost Loss/ha (1 year)	Yield Loss	Quantities lost Loss/ ha (10 year)
Loss/ha (10 year)	75 mm	7%	750 mm
Nitrogen (N)	15 kg		150 kg
Phosphorus (P)	0.6 kg	2.4%	6 kg
Potassium (K)	123 kg		1230 kg
Soil depth	1.4 cm	0.3%	14 cm
Organic matter	2 ton	0.2%	20 ton
Water holding capacity	0.1 mm	0.1%	1 mm
Soil biota	-	0.1%	0.0
TOTAL	-	10.1%	6 ton
FINANCIAL LOSS	0.6 ton/ha/year	R 1 212	R 12 120

* Based on 17 tons/ha/year
** 10 tons of water erosion and 7 tons of wind erosion
*** Based on a maize yield of 6 tons/ha and a maize price of R2 000/ton

According to Table 1, a soil loss of 17 tons/ha/year means an accompanying loss of 75 mm of rainwater, 1.4 cm of soil depth and 2 tons of organic matter. The loss of N, P and K means a consequent crop loss of 2.4%. Along with the other losses, the soil loss ultimately results in a crop reduction of 10.1%. At an average maize yield of 6 tons/ha, this would amount to 0.6 tons and based on a maize price of R2 000/ton it would mean an annual financial loss of R1 212/ha. In retrospect a crop farmer could cumulatively lose one full harvest out of every ten as a result of water and wind erosion. A further consequence is that the country could forfeit a full year's grain supplies every decade if farmers continue to apply tillage practices that promote water and wind erosion.

Conservation

The potential for protecting agricultural land by means of conservation practices has been demonstrated many a time in scientific reports. Even the simple expedient of creating an organic cover on the surface reduces water and wind erosion of the topsoil. At the same time strong permanent subterranean root systems also contribute to the protection of the rest of the soil profile against erosion and leaching. Table 2 contains information on soil losses resulting from different tillage practices measured at Cedara in Kwazulu-Natal in 1983 after ten years of continuous maize production.

Table 2: Average annual soil loss and maize yield for different tillage practices

Treatment	Organic cover	Maize yield	Organic material	Average soil loss
	%	Ton/ha	%	Ton/ha/year
No till	70%	5.7	5.8%	0.5
Chisel	30%	6.6	4.6%	1.6
Mouldboard (Spring)	0%	6.7	5.2%	7.1
Mouldboard (Autumn)	0%	6.1	3.9%	9.9
Control (Rotavated)	0%	-	3.8%	61.9

* Cedara water runoff trials in 1983 after 10 years of continuous maize production

After ten years of the same tillage methods, the maize yield produced by no till was 5.7 tons/ha as against the 6.7 tons/ha with spring ploughing. However, the loss of topsoil in the same year as a result of no till was only 0.5 tons/ha as against the 7.1 tons/ha that resulted from ploughing. Although the yield was higher, over 1 ton of topsoil was lost for every 1 ton of maize produced. With chisel ploughing a yield of 6.6 tons/ha was obtained while the soil loss was restricted to 1.6 tons/ha. But there was only 4.6% organic material present in the soil whereas there was 5.8% present in the case of no till.

Compatibility

South African farmers have been associated with farming and the land but at the same time there have always been anomalies surrounding the general view of their role in respect of conservation practices. Farmers are generally characterised in terms of their close ties with nature, their marked awareness of weather patterns and their stewardship of the earth. At the same time conventional farming practices are held accountable globally for the alarming degradation of the land as a natural resource.

For many farmers economic targets and the aims of conservation farming cannot always be reconciled. The lines are largely blurred by the continual sharp increase in the prices of land as a fixed

asset, for the very reason that it is not seen as having a scrap value. On the other hand, the simultaneous degradation of the land as a natural resource is mainly invisible and in practice the financial implications are never really dealt with. Just as the farmer needs to understand the economic forces that determine land prices, he should also show an understanding of the natural forces that could destroy the sustainable value of his land.

Land as a natural resource is not an inexhaustible pantry for humankind and rainfall alone is often insufficient to solve all the financial problems. The land on which we are farming today has belonged to many people before us who are long dead and it will belong to many people who have yet to be born, and who will have to make a living from it. Something that will have to last for so long cannot simply be covered with a coffee tin and must be protected against degradation at all costs, so that its condition never degenerates to the point where it has no more than scrap value.

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NELSON MANDELA UNIVERSITY

The School of Natural Resource Management of the Nelson Mandela University (NMU) invites you to the 12th Fire Management Symposium:

"From commitments to action: Ecosystems based fire management for effective disaster risk reduction"

Date: 3 - 5 October 2018
Venue: George, NMU (George Campus), Southern Cape, South Africa

Background and purpose

Globally, effective wildfire management is impeded by a lack of integration between research results, technological development and efforts by fire managers to prevent, suppress and protect the environment, human wellbeing and assets against wildfire. This event aims to streamline the efforts of natural resource managers, engineers and scientists through an integrated approach to ensure better management throughout the wildfire community by making the different role-players aware of each other's realities. You are invited to join fire managers and authorities from different disciplines and land uses (Nature Conservation, Agriculture, Disaster Management, Forestry, Local Authorities, etc.) for a range of informative presentations, and exciting networking opportunities.

Focus

Following the worst fire that we experienced in the history of South Africa in the Southern Cape on 7 June 2017 as well as numerous other urban interface fires in SA, we decided to dedicate our biannual wildfire symposium to the topic of Ecosystems based fire management risk.

Programme

The 2018 Fire Management Symposium promises to be a special event. Not only because of the unique setting of the venue in the heart of the Garden Route, but because of the conglomeration of top rated fire management specialists whom will share their expertise in a very practical and applied manner. Internationally renowned fire scientist Prof Dave Neal will deliver the key note address and will be supported by local fire specialists such as Prof Winston Trollope, Richard Cowling and others. We will also proudly host other international fire specialists from the USA as well as specialists from leading forestry companies in South Africa. The 2nd day of the event will provide the opportunity to visit the Knysna area that was devastated in the June 2017 fires. The Southern Cape Fire Protection Association (SCFPA) will host this day. A range of service providers and equipment manufacturers will have stalls at the event

In General

This event present opportunities to people from different entities and parts of South Africa to network. In addition, the world of scientists who are engaged in research will meet that of the hard core fire manager who gets the smoke of wildfires in his/her eyes. Due to the capacity of the venue only 200 delegates can be accepted for a specific day of the event. Final cost of the event has not been finalised but as in the past, will be very reasonable in order to provide the opportunity for everybody to afford attendance. The event dinner will take on the form of a spit braai with live music.

For more information contact tiaan.pool@mandela.ac.za 044-8015024/ or sonia.roets@mandela.ac.za 0448015091.

PROGRAMME: 12TH FIRE MANAGEMENT SYMPOSIUM 3 OCTOBER 2018				
Time	**Speaker**	**Topic**	**Tel**	**E-mail**
07:30 - 08:20	Coffee & registration			
SESSION 1: PROF JOS LOUW NMU				
08:30 - 08:45	**Tiaan Pool** NMU George Campus Prog. Coordinator Forestry & Veldfire	Welcome and formalities	044 801 5024 / 072 374 2347	tiaan.pool@mandela.ac.za
08:45 - 09:20	**Minister/Mr Michael Mlangane** Director General DAFF	Official opening		
09:20 - 10:00	**Dr Dave Neal** Director disaster management programme OSU	**Key note:** Risk and risk tradition		dave.neal@okstate.edu
10:00 - 10:15	**Questions & Answers – Panel Discussion**			
10:15 - 10:45	**Tea/Coffee**			
10:45 - 11:10	**Paul Buchholz** Project Manager: Garden Route Rebuild Initiative	Overview of the 2017 Knysna fire.	072 785 2742 079 881 4447	managerfpa@gmail.com p.buchholz@outlook.com
11:10 - 11:35	**Mr Malcolm Procter** Dep-Dir.: Regulation and oversight (DAFF)	Land use and risk management planning	051 400 3503 / 076 498 3383	MalcolmP@daff.gov.za
11:35 – 12:00	**Leo Long** Senior Practitioner: Training & Skills Development - SAFCOL	Community involvement/ challenges in veldfire risk management efforts	013 754 2700 082 907 9304	Leo@safcol.co.za
12:00 - 12:25	**Axel Jooste** Projects Manager SAPPI	Risk assessment: a case of factory blindness	033 347 6671 / 083 229 2851	Axel.Jooste@sappi.com
12:25 - 13:00	**Questions & Answers – Panel Discussion**			
13:00 -13:45	**Lunch**			
SESSION 2: MR KAGISO MONNAHELA; FORESTRY REGULATION & OVERSIGHT (DAFF)				
13:45 -14:10	**Jon-Jon Emary** Volunteer Wildfire Services	The need and contributions of volunteer fire fighters to reduce veldfire risk in SA	082 787 3524	chair@vws.org.za
14:10 - 14:35	**Ed Kirtley** Asst. Dean College of Engineering, Architecture, and Technology (Oklahoma State University)	Social engagement and wildfire risk.	405 744 3384 082 805 7123	ed.kirtley@okstate.edu
14:35 - 15:00	**Roger Godsmark** Operations Director - Forestry South Africa	The impact of new land-ownership on fire risk in the South African Forestry sector	033 346 0344	roger@forestrysouthafrica.co.za
15:00- 15:25	**Dr Jaap Steenkamp** Director: Forestry and allied manufacturing	Modernising our fire risk management efforts	083 2777998	jaap@forestservices.co.za
15:25 - 15:50	**Dr Christo Marais** Chief Dir. Department of Environmental Affairs	Integrated wildland fire management and its implications for ecosystems based adaptation to climate change and disaster risk reduction	021 441 2702 / 00 082 551 8316	cmarais@environment.gov.za
15:50 - 16:05	**Questions & Answers – Panel Discussion**			
16:05 – 16:20	**Tiaan Pool** NMMU George Campus Prog. Coordinator Forestry & Veldfire	Summary	044 801 5024 / 072 374 2347	Tiaan.Pool@nmmu.ac.za

4 OCTOBER 2018	Field excursion to Knysna area to observe aftermath of disastrous fire in 2017 (Facilitated by the Southern Cape Fire Protection Association) • Group breakaway sessions • Exhibitions by service providers & manufacturers • Evening Dinner

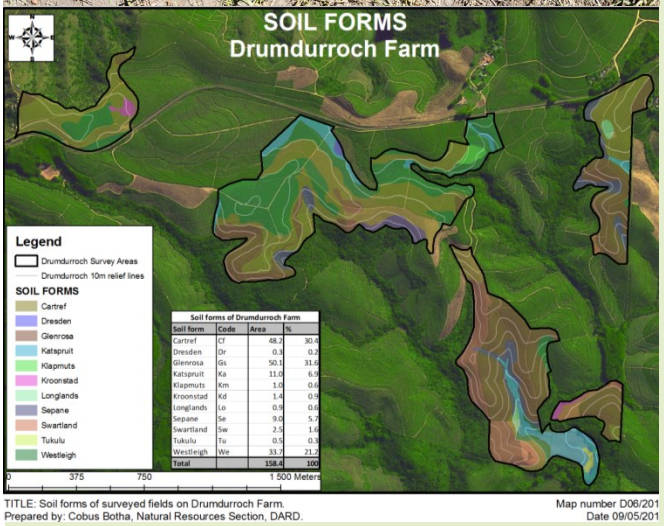
5 OCTOBER 2018				
Time	**Speaker**	**Topic**	**Tel**	**E-mail**
07:30 - 08:20	Coffee & registration			
SESSION 1: MR DECHLAN PILAY (DIRECTOR: SOUTH AFRICAN NATIONAL DISASTER MANAGEMENT CENTRE)				
08:30 - 09:10	**DR Mmaphaka Tau** Deputy Director-General (Head): National Disaster Management Centre	**Key Note**: Fire, Ecosystems and disaster reduction: A sustainability nexus towards a resilient future	082 884 5541 / 012 848 4602	mmaphakat@ndmc.gov.za
09:10 - 09:35	**Mr Len du Plessis** Conservation Standards & Compliance. Frontier Region, SANparks	Evacuation of residents from the Knysna high fire risk environment during the 2017 fire	082 809 1955	len.duplessis@sanparks.org
09:35 - 10:00	**Etienne du Toit** Deputy Director Fire & Rescue Services Western Cape Department of Local Government	Wildfire Risk in the Urban Interface	073 995 1609 021 937 6357	Etienne.dutoit@westerncape.gov.za
10:00 - 10:15	**Questions & Answers – Panel Discussion**			
10:15 - 10:45	**Tea/Coffee**			
10:45 - 11:00	**Dr Ronald Heath** Research Director - Forestry South Africa	The status and needs for Wildfire research in South Africa	011 268 1104 083 611 6946	ronald@forestrysouthafrica.co.za
11:00 - 11:25	**Marchy Snell-Jordaan** Planning Forester – PG Bison	The risk impact of fast changing weather on veldfires in the Forestry industry	045 933 8100 079 829 2191	msnell-jordaan@pgbison.co.za
11:25 - 11:50	**Dean da Costa** Head Technical Department Mondi South Africa	The Effect of modernisation / mechanisation on fire risk	083 635 5350 033 329 5330	Dean.daCosta@mondigroup.co.za
11:50 - 12:15	**Dr Tineke Kraaij** NMU School of Natural Resource Management	Differences in flammability and fire severity among select vegetation types	044 801 5018 084 586 5288	Tineke.Kraaij@mandela.ac.za
12:15 - 12:50	**Questions & Answers – Panel Discussion**			
12:50 -13:45	**Lunch**			
SESSION 2: DR ANTON SCHMIDT				
13:45 - 14:10	**Prof Winston Trollope** Research associate - NMU	Veldfire risk Management: A lifelong engagement	083 469 5357	winfire@procomp.co.za
14:10 - 14:35	**Dr Sarah McCaffrey** Research Social Scientist USDA Forest Service	Social aspects of fire risk management		smccaffrey@fs.fed.us
14:35 - 15:00	**Prof Richard Cowling** Distinguished Professor Botany Department NMU	Fire management in fynbos-thicket mosaics - problems with managing risks of fire hazard and biodiversity loss.		rmc@kingsley.co.za
15:00 - 15:25	**Mr Heini Muller** Area manager PG Bison Forestry	Veldfire Risk: Dealing with disaster	083 632 2740	hemuller@pgbison.co.za
15:25 - 16:50	**MR Hannes van Zyl** NMU - Lecturer	Summary	044 801 5140 072 273 3169	Hannes.vanZyl@mandela.ac.za
15:50 - 16:05	**Tiaan Pool** NMMU George Campus Prog. Coordinator Forestry & Veldfire	Closing	044 801 5024 / 072 374 2347	Tiaan.Pool@nmmu.ac.za

53rd Annual GSSA Congress: Mi

Thursday, 26 July 2018, 14:30, ARC Training Centre, Roodeplaat, Pre

Soil Assessment and Analysis

Presented by Cobus Botha (KwaZulu-Natal Department of Agriculture and Rural Development)



TITLE: Soil forms of surveyed fields on Drumdurroch Farm.
Prepared by: Cobus Botha, Natural Resources Section, DARD.

Map number D06/201
Date 09/05/201

Soil is the natural habitat that regulates our environment and responds to the pressures imposed upon it. Although overlooked by many of us, it carries out a number of key tasks that are essential to our well-being including: acting as a medium that enables us to grow food, natural fibre, timber and support wildlife habitats; functioning as a natural filter and regulator of water and biochemical cycles, and; a repository for carbon and other nutrients. Understanding the importance of soil in vegetation dynamics and its influence on the responses to management treatments are well-documented for rangeland science and cannot be overstated. The accurate identification of soil physical properties, the classification of soils according to soil type (or at least soil functional group), the collection of soil samples for laboratory analysis and the interpretation of soil data for land use, are practical skills required by all field scientists and practitioners. This practical session will attempt to familiarise or reacquaint participants with some of these basic skills and provide relevance in the rangeland science context. Equipment and reference material such as soil auger, beta sampling auger, blue book (Taxonomic Classification of South African Soils) and Munsel Colour Chart, Abney Level, GPS data dictionaries and field forms will be demonstrated. Interested delegates are welcome to bring their own equipment if available to them.

Tree Measurements: VOLCALC Workshop

Presented by Leslie Brown (UNISA)

Studies on plant phenology and browse capacity require effective methods to rapidly quantify plant dimensions such as tree height, height of maximum canopy diameter, height of first leaves, maximum canopy diameter, and diameter of trunk(s) at height of first leaves. The VolCalc programme is used to measure the various tree dimensions and calculate canopy volume using a measuring staff (for calibration), a digital camera and our VolCalc software. The workshop will be a brief overview of the programme where after a practical session will be done where participants will get hands-on training on the use of the programme. **Participants must have their own laptop so that the software could be loaded.**

d-Congress Practical Sessions

toria, Gauteng, South Africa

Grass and herbaceous species identification

Presented By: Caroline Mashau (SANBI)

The practical course will discuss some of the following aspects:

- How to collect and press grasses. This will include how to collect the whole grass plant; plant layout in the plant press; taking notes of locality and habitat details of the specimens.
- Grass terminology for identification. This will include terms such as spikelets; ligules and the shape of the inflorescence.
- An Introduction to keys for grass identification.

Veld Condition Assessment

Presented By: Dr Tony Swemmer (SAEON Ndlovu Node)

Many researchers and extension officers are required to conduct assessments of veld condition, and often with little formal training on the theory of monitoring or the various methods used. In many cases, those conducting veld conditions have taught themselves, with little or no practical training. Often a particular method is selected and retained without considering all the various methods available. Data analysis is often neglected or takes far too much time, due to a lack of application of widely-available data management tools.

The aim of this session is to provide practical training on all aspects of veld condition assessment, from planning to data collection to data analysis. A brief lecture will be provided on planning, including an introduction to monitoring, the purpose of veld condition assessment, selection of relevant variables and the various methods available. This will followed by a practical session, during which delegates will conduct veld condition assessments under the guidance of experienced practitioners, on an area of natural grassland close to the conference venue. Data will then be captured and a tutorial will be provided on data management and analysis, in MS Excel and R.

This session is intended for those who are new to veld condition assessments, particularly post-graduate students and newly appointed extension officers and researchers. Some aspects of the session may also be valuable to those who have experience with veld condition assessment but are interested in new methods or new ways of managing and analysing their data.

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3 KEEP YOUR LAND SUSTAINABLE

You want to take care of your land and your waterways to keep your farm productive for a long time, while doing your part to preserve the environment in your local community. We can help you manage resistant weeds, insect pests and plant diseases. Helping you deploy innovative management practices and support the health of your soil.

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