



# GRASSLAND SOCIETY OF SOUTHERN AFRICA

*Advancing Rangeland Ecology and Pasture Management in Africa*



Jan Graf



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Wayne Twine



Tony Swemmer



Jan Graf

## **52<sup>nd</sup> Annual GSSA Congress**

**WITS RURAL FACILITY, NEAR HOEDSPRUIT,  
MPUMALANGA-LIMPOPO BORDER, SOUTH AFRICA**

**23 TO 28 JULY 2017**



Grassland Society of Southern Africa



Advancing Rangeland Ecology  
and Pasture Management in Southern Africa

## **52<sup>ND</sup> ANNUAL CONGRESS**

INCORPORATING THE

**EIGHTH RESEARCH SKILLS WORKSHOP**

AND A

**POLICY AND PRACTICE WORKSHOP**

**ADVANCING RANGELAND ECOLOGY AND PASTURE MANAGEMENT IN AFRICA**

***WITS RURAL FACILITY, NEAR HOEDSPRUIT,***

***MPUMALANGA-LIMPOPO BORDER, SOUTH AFRICA***

***23 TO 28 JULY 2017***

***PROGRAMME COMPILED BY JANKE VAN DER COLF***

***PROOFREADING AND EDITING BY RACHEL HOBSON***



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## GRASSLAND SOCIETY OF SOUTHERN AFRICA

52<sup>nd</sup> Annual Congress

Advancing Rangeland Ecology and Pasture Management

23 to 28 July 2017, Wits Rural Facility, near Hoedspruit, Mpumalanga-Limpopo Border, South Africa

Monday, 24 July 2017

08:00 –17:00	<b>Registration</b>
	<b>Opening of the 52nd Annual Congress of the Grassland Society of Southern Africa</b>
18:00 - 19:15	<b>Welcome:</b> Dr Mike Peel, Agricultural Research Council - Animal Production Institute <b>Presidential Address:</b> Dr Julius Tjelele, Agricultural Research Council - Animal Production Institute <b>Opening Address:</b> Dr John Job, Kruger-to-Canyons Biosphere - Grasslands, Bushes and a Biosphere
19:15	<b>MEET &amp; GREET</b>

Tuesday, 25 July 2017

07:30 - 08:30	Registration (continues)	
	<b>Opening Plenary Session</b>	
08:30 - 10:30	<b>Keynote address:</b> Heterogeneity as the basis for rangeland management	<i>Sam Fuhlendorf, Oklahoma State University</i>
	<b>Keynote address:</b> Biodiversity for society – a reflection on the diversity of direct local impacts of the Kruger National Park	<i>Louise Swemmer, SANParks - Kruger National Park</i>
10:30 - 11:30	<b>TEA AND STANDARD POSTER VIEWING</b>	
11:30 - 13:30	<b>Rangeland Ecology</b>	<b>Planted Pastures: Cultivar Adaptations and Management</b>
13:30 - 14:30	<b>LUNCH</b>	
14:30 - 16:50	<b>Rangeland Management</b>	<b>Planted Pastures: Fertilizer Applications for Maximum Production</b>
	<b>Keynote address:</b> Social and legal barriers and opportunities for using prescribed fire on private land in the Southern Great Plains, USA	
	<b>Keynote address:</b> Managing African rangelands using heterogeneity characteristics	Rina Grant, NMMU
17:00	<b>ANNUAL GENERAL MEETING OF THE GRASSLAND SOCIETY OF SOUTHERN AFRICA WITH REFRESHMENTS</b>	
19:00	<b>DINNER</b>	

Wednesday, 26 July 2017

07:00-08:00	Registration (continues)	
08:00-10:00	<b>Tree-Grass Interactions</b>	<b>Workshop: Social and legal barriers and opportunities for using prescribed fire on private land in the Southern Great Plains, USA</b>
10:00-11:00	<b>TEA AND STANDARD POSTER VIEWING</b>	
11:00-13:00	<b>Rangeland Assessment and Monitoring</b>	<b>Livestock Diet and Nutrition</b>
13:00-14:00	<b>LUNCH</b>	
14:00-15:40	<b>Rangeland Fire Ecology</b>	<b>Land Transformation and Restoration</b>
15:40-17:00	<b>TEA AND RESEARCH PROPOSAL POSTER VIEWING AND EVALUATION</b>	
18:00	<b>QUIZ EVENING AND DINNER</b>	

Thursday, 27 July 2017

07:00-08:00	Registration (continues)	
08:00-09:30	<b>Biodiversity Initiatives and Conservation Planning</b>	<b>Communal Livestock Farming Systems</b>
09:30-10:00	<b>TEA AND STANDARD POSTER VIEWING</b>	
10:00-12:30	<b>Workshop: Grasses as Invasive Aliens (with further discussion session after lunch)</b>	
13:00-18:00	<b>Mid-Congress Tours with PACKED LUNCH:</b>	
	<ul style="list-style-type: none"> <li>The challenges of managing protected areas in the Lowveld Savannas: perspectives from national parks, provincial parks and private reserves</li> <li>Herding 4 Health: rangeland management in an FMD area</li> <li>Invasive alien plant control and biomonitoring: ecosystem restoration from grasslands to rivers</li> <li>WITS Rural Facility: Savanna ecology field experiments</li> </ul>	
19:00	<b>GALA DINNER</b>	



**TUESDAY, 25 JULY 2017**

<b>08:30-10:30</b>	<b>Opening Plenary Session</b>			
<b>08:30</b>	Welcome and introductions			<i>Mike Peel</i>
<b>08:40</b>	<b>Keynote address:</b> Heterogeneity as the basis for rangeland management			<i>Sam Fuhlendorf</i>
<b>09:20</b>	<b>Keynote address:</b> Biodiversity for society – a reflection on the diversity of direct local impacts of the Kruger National Park			<i>Louise Swemmer</i>
<b>10:00</b>	Discussion led by session chair			<i>Mike Peel</i>
<b>10:30-11:30</b>	<b>TEA and STANDARD POSTER VIEWING SESSION</b>			
	<b>Rangeland Ecology</b>		<b>Planted Pastures: Cultivar Adaptations and Management</b>	
	Effect of rest and distance from water on the vegetation in the Gamka Karoo, South Africa	<i>Nelmarie Saayman</i>	Evaluation of forage yield of pigeon pea ( <i>Cajanus cajan</i> (L.) Millspaugh) varieties in Eastern Cape, South Africa	<i>Asiphe Mhlembana</i>
	Big trees and elephant in the Associated Private Nature Reserves	<i>Mike Peel</i>	The characterisation of an <i>Opuntia ficus-indica</i> (cactus pear) collection conserved by the ARC-National Forage Genebank	<i>Letty Masemola</i>
	Do grazing response groups explain the relative defoliation tolerance of mesic grassland species?	<i>Naledi Zama</i>	<b>Planted Pastures: Production Systems and Management</b>	
	The effect of land-use on herbaceous production and grazing capacity in the Molopo district of the North West province	<i>Franci Jordaan</i>	Seasonal effect on quality, yield and botanical composition of cultivated beef pasture	<i>Josef van Wyngaard</i>
	The influence of rainfall zone, catenal position, and distance from village on composition and structure of herbaceous vegetation in a communal rangeland	<i>Wayne Twine</i>	Intake of grass hay by Jersey cows as affected by supplementation with essential oils and its effect on milk yield and composition	<i>Portia Moshidi</i>
	<b>Rangeland Management</b>		<b>Planted Pastures: Fertilizer Applications for Maximum Production</b>	
	Current range condition in relation to land ownership types in Gauteng province, South Africa	<i>Lucas Letsoalo</i>	The effect of phosphorus application and Rhizobium inoculation on growth performance and biomass production of <i>Lablab purpureus</i> in Alice, South Africa	<i>Sanele Mpongwana</i>
	The effects of holistic planned grazing, continuous grazing and 4-camp rotational grazing systems on tick loads and worm counts on grazing animals	<i>Monde Rapiya</i>		



**TUESDAY, 25 JULY 2017**

**Parallel Sessions: 11:30 - 13:30**

	<b>Rangeland Ecology</b>		<b>Planted Pastures: Cultivar Adaptations and</b>	
<b>11:30</b>	Patterns of grass productivity in communal rangelands and protected areas in semi-arid Mopaneveld, and implications for rehabilitation	<i>Tony Swemmer</i>	The production potential and botanical composition of kikuyu over-sown with temperate grass-legume mixtures using different establishment methods	<i>Janke van der Colf</i>
<b>11:50</b>	The impact of livestock grazing on inselberg vegetation along a grazing gradient in three biomes in South Africa	<i>Laetitia Piers</i>	Effect of cutting on dry matter and total non-structural carbohydrate percentages of ten selected Italian ryegrass cultivars	<i>Khutso Mohubedu</i>
<b>12:10</b>	What are the long-term effects of high density, short duration stocking on the soils and vegetation of mesic grassland in South Africa?	<i>Kevin Kirkman</i>	Morphological differences between chicory varieties and the potential of using plant height as a measure of dry matter yield	<i>Sigrun Ammann</i>
<b>12:30</b>	Effect of bush control on species composition, tiller and leaf production of grasses	<i>Mthunzi Mndela</i>	Effects of salinity on germination performance of selected <i>Lolium</i> and <i>Eragrostis</i> grass species	<i>Mziwanda Mangwane</i>
<b>12:50</b>	The importance of ecosystem state factors to the hydrologic responses of woodlands to land management activities	<i>Jason West</i>	Effect of cutting stages on re-growth dry matter production and nutritional value of the five winter cereal cultivars in Moloto district Gauteng and Nooigedacht, Mpumalanga province	<i>Patrick Rakau</i>
<b>13:10</b>	Browsing effects on species composition, structural diversity and biomass production under pastoral and commercial ranching in semi-arid savanna, northern Kenya	<i>Staline Kibet</i> Did not present	Biomass production of perennial ryegrass ( <i>Lolium perenne</i> (L)), cocksfoot ( <i>Dactylis glomerata</i> (L)) and tall fescue ( <i>Festuca arundinacea</i> (Schreb)) varieties grown under	<i>Sizwe Tikwayo</i>
<b>13:30</b>	<b>LUNCH</b>			

**Parallel Sessions: 14:30 - 16:50**

	<b>Rangeland Management</b>	<b>14:30 - 16:50</b>	<b>Planted Pastures: Fertilizer Applications for Maximum Production</b>	<b>14:30 - 15:10</b>
<b>14:30</b>	<b>Keynote address:</b> Social and legal barriers and opportunities for using prescribed fire on private land in the Southern Great Plains, USA	<i>Urs Kreuter</i>	The effect of nitrogen fertilisation on dry matter production and botanical composition of grass-legume pastures in the southern Cape	<i>Bernhard Jordaan</i>
<b>14:50</b>			The effect of nitrogen fertilisation on the yield and botanical composition of kikuyu-based pastures	<i>Charne Viljoen</i>
<b>15:10</b>	<b>Keynote address:</b> Managing African rangelands using heterogeneity characteristics	<i>Rina Grant</i>	<b>Planted Pastures: Production Systems and Management</b>	
<b>15:30</b>			Designing diverse forage crop mixes for weed suppression	<i>Chloe MacLaren</i>
<b>15:50</b>	Consolidation of the wildlife estate: management challenges at differing spatial scales with special reference to drought	<i>Mike Peel</i>	Influence of social dynamics on intensification of fodders innovations in communal areas of Limpopo province	<i>Ntuwiseni Mmbi</i>
<b>16:10</b>	Comparison of holistic, conventional rotational and communal grazing management practices in the Eastern Cape grassland biome of South Africa: impacts on grass and soil properties	<i>Solomon Tefera</i> Did not present	Yield and chemical composition of native pastures in six semi-arid communal grazing lands located in three soil types: effect of disturbance and season	<i>Ayanda Kwaza</i>
<b>16:30</b>	Holistic Planned Grazing™ fails to beef up farm production: an ox's-eye view	<i>Zander Venter</i>	Discussion led by session chair	

**ANNUAL GENERAL MEETING OF THE GRASSLAND SOCIETY OF SOUTHERN AFRICA WITH REFRESHMENTS**

**19:00 DINNER**



**WEDNESDAY, 26 JULY 2017**

**Parallel Sessions: 08:00 - 10:00**

<b>Tree-Grazing Interactions</b>		<b>Workshop: Social and legal barriers and opportunities for using prescribed fire on private land in the Southern Great Plains, USA</b>
08:00	Coppice dynamics of two common savannas trees species under different post-harvest treatments <i>Wayne Twine</i>	
08:20	Comparing the effects of canopy cover increase on grass biomass between <i>Dichrostachys cinerea</i> and <i>Terminalia sericea</i> <i>Tilly Randle</i>	
08:40	The effects of environmental factors on <i>Seriphium plumosum</i> L. encroachment susceptibility <i>Gilbert Pule</i>	
09:00	Woody plant densities, cover, height class distribution and their uses in six semi-arid communal grazing lands located in three soil types <i>Ayanda Kwaza</i>	
09:20	Effects of <i>Pteronia incana</i> (blue bush) invasion on grass biomass production, species distribution and soil chemical characteristics under systematic control methods <i>Thando Ntutha</i>	
09:40	The effect of fire, frost and simulated grazing on the survival of <i>Vachellia sieberiana</i> (formerly <i>Acacia sieberiana</i> ) seedlings along an altitudinal gradient <i>Jennifer Russell</i>	

**10:00-11:00 TEA and STANDARD POSTER VIEWING SESSION**

<b>Tree-Grazing Interactions</b>		<b>Livestock Diet and Nutrition</b>	
The effect of temperature and growth medium on germination potential of unpalatable <i>Seriphium plumosum</i> L. seeds in growth chamber <i>Khwezi Myeki</i>		Assessing diet selection, preferences and grazing parameters of herded sheep in the Succulent Karoo biome in South Africa <i>Amy Schroeder</i>	
Efficacy of different control methods on <i>Seriphium plumosum</i> on degraded rangeland of Mpumalanga province <i>Thabile Mokgakane</i>		Bioactive compounds and rumen potency of leaf extracts of selected Savanna Mixed Bushveld trees <i>Claude Muya</i>	
Invasion of <i>Prosopis</i> species along riparian areas of the Molopo River, North West province, South Africa <i>Simanga Nkosi</i>		Seasonal variation in nutritive value of four indigenous browse species used for livestock supplementation in the Eastern Cape <i>Siza Mthi</i>	
<b>Rangeland Assessment and Monitoring</b>		The efficacy of acetone leaf extracts of <i>Chicorium intybus</i> L. and <i>Lespedeza cuneata</i> on egg hatching of <i>Heamonchus contortus</i> : <i>in vitro</i> studies <i>Peter Oosthuizen</i>	
Scientific grazing capacity norms for the North West province <i>Franci Jordaan</i>		<b>Land Transformation and Restoration</b>	
Ecological monitoring to inform management of semi-arid African savannas: an assessment of techniques across the wildlife-livestock interface and the evaluation of a long term data set <i>Graeme Wolfaard</i>		An investigation into the control of the invasive <i>Phymaspermum acerosum</i> (Curry's Post weed) in the KwaZulu-Natal Midlands Mistbelt Grassland <i>Michelle Keith</i>	
A comparison of the belt transect and adapted point-centred quarter sampling approaches to assessing woody savanna vegetation <i>Cobus Botha</i>		Influences of land-use types on soil organic carbon, total nitrogen and related soil properties in semi-arid area, Pretoria <i>Abubeker Hassen</i>	
<b>Rangeland Fire Ecology</b>		Effects of bush clearing on soil respiration in north-central Namibia: Cheetah Conservation Fund (CCF) and Erichsfelde <i>Wilhelmina Nuule</i>	
Effects of fire history on ground dwelling arthropods' abundance, species richness & diversity in an arid woodland savanna, Waterberg Plateau Park, central Namibia <i>Nekulilo Uunona</i>		Germination and seedling establishment of indigenous legume species: assessing the potential for rehabilitation of mine soils <i>Zanele Ndhrazi</i>	
Impacts of heavy grazing and fire on aboveground net primary productivity in a Highveld grassland <i>Alekzandra Szewczuk</i>			



## WEDNESDAY, 26 JULY 2017

### Parallel Sessions: 11:00 - 13:00

	Rangeland Assessment and Monitoring		Livestock Diet and Nutrition	
11:00	Savanna Long-Term Research Initiative in the Southern Great Plains	<i>John Walker</i>	Retrogression in rumen and body metabolism of starving cattle on communal area grazing lands: case study of smallholder dairy cattle in Vhembe district, South Africa	<i>Florence Nherera-Chokuda</i>
11:20	An assessment of woody biomass as a sustainable energy source in a bush thickened area of northern Namibia	<i>Nico Smit</i>	Comparing production of Zulu and Merino sheep on veld and grazing maize—preliminary report	<i>Peter Oosthuizen</i>
11:40	Assessment of grass species composition and nutritive value as influenced by soil characteristics in two different grazing areas under North West province, South Africa	<i>Sesupho Manyedi</i>	Anti-nutrients and <i>in vitro</i> digestibility of <i>Lablab purpureus</i> and <i>Vigna unguiculata</i> forage legumes	<i>Soul Washaya</i>
12:00	Competition and defoliation tolerance of <i>Themeda triandra</i> and <i>Eragrostis curvula</i>	<i>Naledi Zama</i>	A systematic study of <i>Themeda triandra</i> Forssk.: anatomy, genetics and cytology	<i>Sinethemba Ntshangase</i>
12:20	Development of a robust, easy-to-use biodiversity index for mesic grasslands	<i>Lize van der Merwe</i>	Discussion led by session chair	
12:40	<b>TAKING OF CONGRESS 52 DELEGATE GROUP PHOTO</b>			
13:00	<b>LUNCH</b>			

### Parallel Sessions: 14:00-15:40

	Rangeland Fire Ecology		Land Transformation and Restoration	
14:00	Hercules and the Hydra revisited: combining traditional management efforts with fire to control resprouting woody plant encroachment and restore savanna ecosystems	<i>Bill Rogers</i>	Containing desertification in arid northern Kunene region, Namibia	<i>Axel Rothauge</i>
14:20	Fire ecology and management of wildfires in Indonesian rain forests growing on peat beds and its potential relevance to ground fires in southern African wetlands	<i>Trevor Wilson</i>	Targeted livestock grazing to improve and restore rangelands	<i>John Walker</i>
14:40	The native, C3 grass <i>Festuca costata</i> alters grassland fuels and fire spread in the Drakensberg	<i>Devan McGranahan</i>	Challenges to measuring carbon fluxes in the Albany Thicket	<i>Tony Palmer</i> <span style="color: red;">Did not present</span>
15:00	Does fire facilitate biodiversity or forage productivity in renosterveld rangelands in the Kamiesberg Uplands?	<i>Megan Simons</i>	Soil nutrient content and forage quality on old lands in the Umzimvubu Catchment	<i>Ntomboxolo Mamayo</i>
15:20	Application of fire in savanna conservation areas	<i>Bruce Brockett</i>	Discussion led by session chair	





## WEDNESDAY, 26 JULY 2017

15:40– 17:00

## TEA and RESEARCH PROPOSAL POSTER VIEWING and EVALUATION

The effect of arbuscular mycorrhizal fungi, <i>Rhizobium inoculum</i> and phosphorus fertiliser on soil properties, biomass yield and nutrient content of three herbaceous legumes in Alice, South Africa	<i>Sanele Mpongwana</i>
The effect of applying different phosphorous fertiliser levels on four leguminous pastures planted at Dohne and Bathurst nurseries in the Eastern Cape province, South Africa	<i>Nobulungisa Mgujulwa</i>
Determining rainwater use efficiency, dry matter production and soil nutrient replenishing potential of dryland pastures produced in the old arable lands of Krwakrwa communal rangelands, Eastern Cape, South Africa	<i>Unathi Gulwa</i>
Assessing rainwater use efficiency of different grass species, biomass production and basal cover in two veld types of Krwakrwa communal rangelands in Alice, Eastern Cape	<i>Tanki Thubela</i>
Impact of drought and elevated CO <sub>2</sub> level on species diversity, productivity and water use efficiency of key forage species in semi-arid grassland in Gauteng province	<i>Thabo Magandana</i>
Transpiration rate of <i>Senegalia mellifera</i> in relation to diurnal pattern, seasonal pattern, rainfall, size of the tree, tree density and environmental factors in a semi-arid Namibian Thornbush Savanna	<i>Nelago Iiyambo</i>
Assessing parasitism of small ruminants in arid communal rangelands of South Africa	<i>Saloshni Govender</i>
Assessing the relationship between genetic diversity and diet selection in a semi-arid communal livestock farming system	<i>Amy Schroeder</i>
Assessing the relationship between landscape functionality and small mammal assemblages in the arid communal drylands of Steinkopf, Northern Cape	<i>Laetitia Piers</i>
Assessment of bush clearing on grass production, woody structure and plant diversity in a semi-arid savanna, central Namibia	<i>Visto Amputu</i>
Investigating active veld restoration by means of alternative fertilisation practices in the North West province	<i>Yvette Brits</i>
Control of bush encroachment on <i>Lopholaena corrifolia</i> shrub and soil properties around mixed bushveld region of Thembelele Hani, Mpumalanga province	<i>Oupa Keromecwe</i>
The impacts of alien infestations on veld grazing capacity	<i>Ayanda Mnikathi</i>
The role of biodiversity in providing ecosystem goods and services in agricultural landscapes	<i>Sizwe Tikwayo</i>
Analysing competition strategies for invasion success of <i>Solanum mauritanium</i> (bugweed) in Eastern Cape province, South Africa	<i>Thando Ntutha</i>
Effects of long-term fire exclusion on grass species composition, tuft density and soil physical properties in the Dohne Sourveld	<i>Nolonwabo Jokani</i>

18:00

## QUIZ EVENING AND DINNER

**THURSDAY, 27 JULY 2017****Parallel Sessions: 08:00 - 09:30**

	<b>Biodiversity Initiatives and Conservation Planning</b>		<b>Communal Livestock Farming Systems</b>	
<b>08:00</b>	Planning for the maintenance of floristic diversity under global change <i>Distribution permission withheld</i>	<i>Debbie Jewitt</i>	Climate change adaptation strategies in the communal areas of Namibia and South Africa	<i>Igshaan Samuels</i>
<b>08:20</b>	The Gauteng Biodiversity Stewardship Programme	<i>Emily Taylor</i>	The future of communal livestock farming in semi-arid Namaqualand	<i>Khululiwe Ntombela</i>
<b>08:40</b>	Carbon tax and the need for carbon sequestration and offset	<i>Josef van Wyngaard</i>	Using the socio-ecological system in understanding the challenges in collective management of communal rangelands in the rural Eastern Cape	<i>Andiswa Finca</i>
<b>09:00</b>	Strengthening rangeland stewardship and restoration through Research, Development and Innovation (RDI) learning platforms	<i>Dan'sile Cindi</i>	Addressing constraints to increase livestock production in Taleni and Shweni communities, Chris Hani District municipality, South Africa	<i>Nobuntu Matyholo-Mapeyi</i>

**09:30-10:00****TEA and STANDARD POSTER VIEWING SESSION**

	<b>Biodiversity Initiatives and Conservation Planning</b>		<b>Communal Livestock Farming Systems</b>	
	Response of migratory <i>Falco amurensis</i> to common grassland roost sites after short-term drought	<i>Norman Magoro</i>	Performance of livestock production in north Eastern Cape communal areas: a stochastic frontier analysis	<i>Bukho Gusha</i>
	Rangeland biodiversity research in sub-Saharan Africa lacks attention to spatial, temporal scale of disturbance	<i>Devan McGranahan</i>		
	Railway side mapping of alien plants distribution in Mpumalanga, South Africa	<i>Collen Rabothata</i>		

**Special Session: Grasses as Invasive Aliens: 10:00 - 12:30**

<b>10:00</b>	Grasses as invasive plants in South Africa	<i>Vernon Visser</i>
<b>10:20</b>	Global impact assessment of alien grasses occurring in South Africa	<i>Khensani Nkuna</i>
<b>10:40</b>	Are invasive grasses ( <i>Poaceae</i> ) suitable targets for biological control? A case study of two African <i>Sporobolus</i> spp. invading Australia	<i>Guy Sutton</i>
<b>11:00</b>	Competitive ability of vetiver grass: Does vetiver allow germination and establishment of native grasses?	<i>Lindokuhle Dlamini</i>
<b>11:20</b>	Developing management guidelines for the cultivation of alien bamboos in South Africa	<i>Susan Canavan</i>
<b>11:40</b>	Discussion led by session chair	

**13:00-18:00****Mid-Congress Tours with PACKED LUNCH****Special Session: Grasses as**

<b>1.</b>	<b>Wildlife breeding</b>	<b>Discussion session continues</b>
<b>2.</b>	<b>Herding 4 Health: rangeland management in an FMD area</b>	
<b>3.</b>	<b>The challenges of managing protected areas in the Lowveld Savannas: perspectives from national parks, provincial parks and private reserves</b>	
<b>4.</b>	<b>Invasive alien plant control and biomonitoring: ecosystem restoration from grasslands to rivers</b>	
<b>5.</b>	<b>WITS Rural Facility: Savanna ecology field experiments</b>	

**19:00****GALA DINNER**



## Congress Organising Committee

Mike Peel (Chairperson)	Agricultural Research Council
Sweetness Myeni	Agricultural Research Council
Wayne Twine	University of the Witwatersrand
Erica Joubert (Administrator)	Grassland Society of Southern Africa
Freyne du Toit (Administrator)	Grassland Society of Southern Africa
<b>SCIENTIFIC COMMITTEE:</b>	
Igshaan Samuels	Agricultural Research Council
Janke van der Colf	Western Cape Department of Agriculture
Josef van Wyngaard	Western Cape Department of Agriculture
Sigrun Ammann	Western Cape Department of Agriculture
Tony Swemmer	SAEON
Florence Nherera-Chokuda	Agricultural Research Council

## Grassland Society of Southern Africa: 2016/17 Council

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## Protecting our water factories – our grasslands



South Africa cannot secure water production without conserving our grasslands, which are our natural water factories. They are critical for water and food production, and they are home to a high number of threatened wildlife species, which are key indicators of the health of our ecosystems.

Understanding this crucial interdependence, the WWF Nedbank Green Trust has supported major water and grassland conservation projects for the past 15 years. This has contributed to the proclamation of several Protected Environments in high-water-yield areas in Mpumalanga, KwaZulu-Natal and the Free State. These areas provide water for the cities, rural communities, agricultural sector and industries in these provinces, as well as for Gauteng.

'It is encouraging and inspiring to consider how the legacy that the investment from the WWF Nedbank Green Trust into grassland conservation has catalysed since 2002,' says Angus Burns, Senior Manager of the WWF-SA Land and Biodiversity Stewardship Programme.

'Starting with the WWF Enkangala Grassland Project, over 200 000 ha of critically important, water-producing grasslands have been formally conserved through our Biodiversity Stewardship partnerships. If one was to attempt to purchase this land, the figure would amount to well over R1,8 billion'.

South Africa's first Protected Environment was proclaimed in 2010. Called the KwaMandlangampisi Protected Environment, it is a critical water catchment area for South Africa that includes the headwaters of the Pongola and Assegai Rivers. It spans 23 600 ha of privately owned farmland in the high-altitude grasslands of southern Mpumalanga in the Enkangala Grassland Project region – a high-water-production area for South Africa, spanning 1,6 million hectares of grasslands across KwaZulu-Natal, Mpumalanga and the Free State.

'The experience of working with the landowners, including commercial farmers and communities committed to conserving our precious, biodiverse grasslands, has been immensely rewarding. It has emphasised the incredible spirit of generosity and commitment that epitomises South Africans working together for positive change,' Burns says.

'From humble beginnings 15 years back to significantly impressive results achieved through shared visions, meaningful collaborations and critically important support from the WWF Nedbank Green Trust, this is a story worthy of celebration.'

To read about the WWF Nedbank Green Trust grassland projects please visit <https://www.nedbank.co.za/content/nedbank/desktop/qt/en/news/nedbankstories/affinity-projects/2017/protecting-our-water-factories--our-grasslands-.html> and [http://www.wwf.org.za/what\\_we\\_do/wwf\\_nedbank\\_green\\_trust/](http://www.wwf.org.za/what_we_do/wwf_nedbank_green_trust/).



### **Nedbank Green Affinity Programme**

With the Nedbank Green Affinity Programme every time a client uses a current, savings and/or investment account, and/or short-term insurance that is linked to the Nedbank Green Affinity, Nedbank donates money to the WWF Nedbank Green Trust, at no cost to the client. Since its inception in 1990 Nedbank has donated more than R235 million to the WWF Nedbank Green Trust in support of over 200 environmental and sustainability projects. For more information please visit: <http://www.nedbankgreen.co.za>

### **Nedbank and the WWF Water Balance Programme**

Nedbank recognises its responsibility to contribute towards water security and became a proud participant of the WWF Water Balance Programme in 2011.

The WWF Water Balance Programme focuses on removing invasive alien plants, actively restoring landscapes by planting indigenous seeds and plants, maintaining cleared areas and turning removed plant biomass into usable raw material. For more information please visit [http://www.wwf.org.za/what\\_we\\_do/freshwater/water\\_balance/](http://www.wwf.org.za/what_we_do/freshwater/water_balance/) and YouTube clip <https://youtu.be/shvL5zjn2So>.

### **Nedbank sustainability guides**

Nedbank has produced a number of easy-to-read sustainability guides, including the *Nedbank Smart Living Guide*; *Guide to biodiversity in your garden*; *Ten Steps to Greening Your Business*; *The WWF Nedbank Green Trust: 25 years of foresight* and *Carbon Footprint Guide*, which can be downloaded for free at: <https://www.nedbank.co.za/content/nedbank/desktop/gt/en/aboutus/green-and-caring/Publications.html>.



## AWARDS

**ADJUDICATION FORMS ARE INCLUDED ON THE CONGRESS APP FOR SMARTPHONES AND IPHONES. WE APPEAL TO ALL THE DELEGATES TO COMPLETE THESE FOR PRESENTATIONS THAT THEY ATTEND AND ASSIST IN THE JUDGING PROCESS.**

### PLATFORM PRESENTATIONS

Each year the Society awards a medal and certificate for the following categories, based on platform presentations:

- **Best Presentation**
- **Best Presentation by a Young Scientist.**
- **The Norman Rethman Planted Pastures Award**

Congress delegates are asked to help in this process by judging the platform presentations. The primary objective of these awards is to encourage and promote the standard of presentation of papers at the Congress. Platform presentations are expected to last for no more than 15 minutes and the audience and presenter are then provided with a five minute question and answer period.

**To qualify for the Best Presentation by a Young Scientist award, the presenter should meet one of the following criteria:**

- be under the age of 35 at the start of the Congress, or
- have given seven or less presentations at prestigious scientific meetings, or
- have done seven or less years of work in the respective discipline associated with their presentation.

***NB: Any person wishing to be considered for the Best Presentation by a Young Scientist award should enter their name with the Congress administrator before the start of the Congress.***

Session chairs should preferably appoint the adjudicators for the presentations in their session several hours before the session begins. Each platform presentation should be adjudicated by as many judges as possible, but session chairs should appoint **at least four judges per presentation.**

Adjudicators give a value (1-5) to each of four questions. Considerable guidance is provided here to try to reduce variation. Additionally, judges are asked to indicate whether the subject of the presentation lies within their own interests. These values should provide some interesting patterns that will help us to be fairer in following years. Space is given for general comments about the presentation and these may be used in the case of a tie occurring but also to provide general feedback to the

### POSTER PRESENTATIONS

**STANDARD POSTERS WILL BE VIEWED DURING THE TEA AND POSTER SESSIONS DURING WHICH TIME PRESENTERS CAN INTERACT WITH DELEGATES ABOUT THEIR WORK.**

An award is also given to the **Best Poster** on display during the Congress. Congress delegates are asked to assist in judging this award according to certain criteria which are given on the adjudication sheet. **The Best Research Proposal Poster will be judged by an appointed panel of adjudicators.**

Session chairs must appoint the adjudicators for the presentations in their session several hours before the session begins. Each poster presentation should be adjudicated by as many judges as possible, but session chairs should appoint **at least four judges per presentation.**

Essentially a poster should convey its primary message concisely, preferably within a three minute reading time. Adjudicators give a value (1-5) to each of four questions relating to the poster. Considerable guidance is provided here to try to reduce variation. Additionally, judges are asked to indicate whether the subject of the presentation lies within their own interests. These values should provide some interesting patterns that will help us to be fairer in following years. Space is given for general comments about the presentation and these may be used in the case of a tie occurring but also to provide general feedback to the presenters. An example of a poster adjudication sheet follows after the platform adjudication sheet.

**GSSA ANNUAL CONGRESS PLATFORM PRESENTATION ADJUDICATION SHEET**

<b>Session Name:</b>		
<b>Presentation Title:</b>		
<b>Presenter Name:</b>		
<b>One</b>	<b>The speaker's interaction with the audience was (CIRCLE YOUR SCORE):</b>	
<b>A</b>	Worse than I'd expect at this congress (no eye contact, stood with back to audience, did not speak audibly, etc)	1
<b>B</b>	Slightly below average – the speaker was not too bad, but needs to work on presentation skills.	2
<b>C</b>	Normal – I'd expect most presentations to be of this quality	3
<b>D</b>	Slightly above average – not a perfect presentation, but enjoyable	4
<b>E</b>	Better than I'd expect at this congress (the speaker had a very good rapport with the audience)	5
<b>Two</b>	<b>The quality of the visual aids was (CIRCLE YOUR SCORE):</b>	
<b>A</b>	Worse than I'd expect (too little/much information, too many/few, writing too small, pictures/graphs unclear, etc.)	1
<b>B</b>	Slightly below average – visual aids were not bad, but could use some work.	2
<b>C</b>	Normal – visual aids were understandable and supportive, and what I'd expect.	3
<b>D</b>	Slightly above average – visual aids on average were as I'd expect, but some of them stood out nicely	4
<b>E</b>	Better than I'd expect (the visual aids supported the presentation but did not distract the viewer, were exciting, gave me ideas on how I should structure visual aids in future)	5
<b>Three</b>	<b>The supporting evidence (data, case studies, reviews, etc.) was (CIRCLE YOUR SCORE):</b>	
<b>A</b>	Worse than I'd expect (too few data to draw conclusions, inappropriate analysis of data, omission of other important studies, poorly explained, over-complicated)	1
<b>B</b>	Slightly below average – the evidence generally held together, but there were some problems	2
<b>C</b>	Normal – the conclusions were supported by evidence and I understood what was going on	3
<b>D</b>	Slightly above average - similar to most presentations, but some of the information was particularly valuable	4
<b>E</b>	Better than I'd expect (complex ideas presented clearly, appropriate and interesting graphs, thorough reviews of other studies, clear link between data, theory and conclusions)	5
<b>Four</b>	<b>The overall value to the congress of this presentation was (CIRCLE YOUR SCORE):</b>	
<b>A</b>	Low (the talk did not contribute significantly to the session; perhaps should have been presented as a poster)	1
<b>B</b>	Slightly below average – valuable, but perhaps not to this audience, or the quality was a bit below average	2
<b>C</b>	Normal (this is the type of presentation I'd expect at this congress)	3
<b>D</b>	Slightly above average – similar to most other presentations, but more presentations should emulate this one	4
<b>E</b>	High (this contributed more than most other presentations)	5
<b>Five</b>	<b>The subject of this presentation is (TICK ONE):</b>	
<b>A</b>	Relatively foreign to me – many of the issues that are being discussed fall outside my experience and interests	
<b>B</b>	Relatively familiar to me – while I do not consider myself an expert in this field, I have an interest in the subject	
<b>C</b>	My area of direct interest – I am highly familiar with the subject, and I have direct experience in this field	
<b>GENERAL COMMENTS RELATING TO THIS PLATFORM PRESENTATION:</b>		



**GSSA ANNUAL CONGRESS POSTER PRESENTATION ADJUDICATION SHEET**

<b>Session Name:</b>		
<b>Presentation Title:</b>		
<b>Presenter Name:</b>		
<b>One</b>	<b>The length and detail of the poster were (TICK ONE):</b>	
<b>A</b>	Too brief and lacking in detail	1
<b>B</b>	Just right – I could read and understand it in 3 minutes or less	3
<b>C</b>	Too busy, took too long to read and understand	2
<b>Two</b>	<b>Poster presentation, i.e. colours, font size, use of graphs and pictures, etc. was (CIRCLE YOUR SCORE 1 - 10):</b>	
<b>A</b>	Terrible – this poster gave me a headache, and I could not work out what was going on	1
<b>B</b>	Below average – I could see what was going on, but some editing would really have improved things	2
<b>C</b>	Average – most of the posters at this congress have this quality presentation	3
<b>D</b>	Above average – fonts, colours, and pictures are well presented, and allow rapid appraisal and understanding	4
<b>E</b>	Spectacular - this should be used as an example of how to do a poster	5
<b>Three</b>	<b>The scientific content of the poster (CIRCLE YOUR SCORE):</b>	
<b>A</b>	Zero – the scientific content of this poster is totally unconvincing. Most information is wrong	1
<b>B</b>	Below average –too little information, faulty reasoning, statistics and/or results are flawed	2
<b>C</b>	Average – the information in this poster is what I would expect from this congress	3
<b>D</b>	Above average – the information here is interesting, exciting, and made me think	4
<b>E</b>	Fantastic – very interesting, publishable results	5
<b>Four</b>	<b>The overall value to the congress of this presentation was (CIRCLE YOUR SCORE):</b>	
<b>A</b>	Non-existent (no relevance to this type of congress)	1
<b>B</b>	Low (the poster did not contribute significantly to the session)	2
<b>C</b>	Acceptable (this is the type of poster I was expecting to see)	3
<b>D</b>	High (this contributed more than most other posters)	4
<b>E</b>	Exceptional (this was a highlight of the session, and one of the top contributions to the congress; this poster presenter should be encouraged to present platform presentations around this topic in the future)	5
<b>Five</b>	<b>The subject of this presentation is (TICK ONE):</b>	
<b>A</b>	Relatively foreign to me – many of the issues that are being discussed fall outside my experience and interests	
<b>B</b>	Relatively familiar to me – while I do not consider myself an expert in this field, I have an interest in the subject	
<b>C</b>	My area of direct interest – I am highly familiar with the subject, and I have direct experience in this field	
<b>GENERAL COMMENTS RELATING TO THIS POSTER PRESENTATION:</b>		



## THE FAUX PAS AWARD

*“Every village has its own idiot . . .*

*Every circus has its own clown . . .*

*But this trophy is dedicated*

*to our very own star . . .”*

Johannes Evert Kappeyne van de Coppello was the first recipient of this coveted award which first made itself known at the 30th Annual Congress held in Kroonstad in January 1995. Each year, Congress delegates have kept their eyes and their ears open to find the most deserving Village Idiot amongst the group and so far it has always found a home to keep it safe and in prominent view for the year.

So make a note of all the hilarious moments, the embarrassing moments, the “oops” moments, and cast your vote for the winner of the Faux Pas award of the 52nd Annual Congress of the Grassland Society of Southern Africa. Nominations should be received by Thursday 27th July at 3pm. Hand them in at the registration desk.



## OPENING PLENARY SESSION, TUESDAY 25TH JULY 2017

**SESSION CHAIR: MIKE PEEL**

*Tuesday 25 July 2017, 08:30 - 10:30*

**Venue: Mhelembe (Rhino) Hall**

### **INVITED KEYNOTE ADDRESS: HETEROGENEITY AS THE BASIS FOR RANGELAND MANAGEMENT**

*Sam Fuhlendorf*

Oklahoma State University, email: [sam.fuhlendorf@okstate.edu](mailto:sam.fuhlendorf@okstate.edu)

Rangeland management, like most disciplines of natural resource management, has been characterized by human efforts to reduce variability and increase predictability in natural systems (steady state management often applied through a command and control paradigm). Examples of applications of traditional command and control in natural resource management include wildfire suppression, fences to control large ungulate movements, predator elimination programs, and watershed engineering for flood control and irrigation. Recently, a robust theoretical foundation has developed that focuses on our understanding of the importance of variability in nature. This understanding is built upon the concept of heterogeneity, which originated from influential calls to consider spatial and temporal scaling in ecological research. Understanding rangeland ecosystems from a resilience perspective where we recognize that these systems are highly variable in space and time cannot be achieved without a focus on heterogeneity across multiple scales. We highlight the broad importance of heterogeneity to rangelands and focus more specifically on: 1) animal populations and production, 2) fire behaviour and management, and 3) biodiversity and ecosystem function. Rangelands are complex, dynamic, and depend on the variability that humans often attempt to control to ensure long-term productivity and ecosystem health. We present an ecological perspective that targets variation in rangeland properties including multiple ecosystem services as an alternative to the myopic focus on maximizing agricultural output, which may expose managers to greater risk. Globally, rangeland science indicates heterogeneity and diversity increase stability in ecosystem properties from fine to broad spatial scales and through time.

### **INVITED KEYNOTE ADDRESS: BIODIVERSITY FOR SOCIETY – A REFLECTION ON THE DIVERSITY OF DIRECT IMPACTS OF THE KRUGER NATIONAL PARK**

*Louise Swemmer\* and Helen Mmethi*

SANParks - Kruger National Park, email: [louise.swemmer@sanparks.org](mailto:louise.swemmer@sanparks.org)

Conservation in the context of protected area sustainability is becoming increasingly dependent on having societal support at various levels. It is believed that effective benefit sharing from conservation will lead to vested interests in protecting biodiversity as a result of the positive impacts on human well-being created through specific interactions with the natural environment. This could lead to both pro-conservation behaviour (sustainable practices and reduced illegal wildlife trade) and increased conservation support (constituency). We develop a framework that provides a tool for protected area managers to report collectively on benefit sharing and to identify gaps in benefit distribution for managing cost-benefit trade-offs. We highlight the importance of understanding the benefits pathway from the biophysical template that gives rise to ecosystem services to the processes that give rise to cost/benefit outcomes impacting on human well-being. We suggest that this is helpful in both accounting for and understanding the links between benefits and conservation. Furthermore we explore benefit sharing examples both within and outside South Africa in order to distil the critical factors required for effective benefit sharing to lead to positive conservation outcomes, going beyond ecosystem service audits.

**STANDARD POSTER VIEWING SESSION**

Tuesday 25th July 2017, 10:30 – 11:30

**Rangeland Ecology****POSTER PRESENTATION: EFFECT OF REST AND DISTANCE FROM WATER ON THE VEGETATION IN THE GAMKA KAROO, SOUTH AFRICA**

Nelmarie Saayman\*, Hannes Botha and Rudi Swart

Western Cape Department of Agriculture, email: [nelmaries@elsenburg.com](mailto:nelmaries@elsenburg.com)

The Gamka Karoo vegetation type in the Central Karoo municipal district is dominated by small shrubs and grass, while trees are rare. It covers 46% of the Central Karoo and the average rainfall varies from < 150 mm to more than 250 mm from west to east across the vegetation type. Extensive livestock farming is the main income of the area. The conservation of this natural resource and the sustainable utilization thereof is thus of the utmost importance since most of the people living in the Central Karoo are dependent on the veld for their income. We addressed the question “Should the Gamka Karoo be divided in two areas with different grazing management recommendations for each area?” Line point surveys to record plant cover and species composition, and density plots were done at different distances from the watering point (50 m – 950 m) on 36 farms in 18 camps with no rest, 16 camps with short rest (< 4 months) and 16 camps with long rest (> 3 months). A Detrended Correspondence Analysis (DCA) showed clear vegetation differences between areas receiving on average less than 150 mm rainfall per annum (Zone 1) where *Stipagrostis ciliata* and *Rhigozum obovatum* dominated, and those receiving more than 150 mm (Zone 2) per annum where *Pentzia incana* and *Eriocephalus ericoides* dominated. Despite having different dominant species and average annual rainfall, the vegetation in both areas reacted the same to grazing. In both areas plant cover, density and species richness increased with increased resting period, but not significantly. The piosphere effect is visible in both rainfall zones, with significant increases in plant cover ( $p = 0.0063$ ), density ( $p = 0.004$ ) and species richness ( $p < 0.0001$ ) after 250 m in Zone 1. In Zone 2 density ( $p = 0.0015$ ) improved significantly only after 450 m and species richness ( $p = 0.0001$ ) at 850 m from the watering point. Although the species richness increased with increased rest period and with distance from water in both rainfall zones, the dominant species remained the same. Highly palatable species were found at all distances from water, but their abundance increased with increasing distance from the water. We can conclude that despite differences in species composition between the rainfall zones, the overall reaction to grazing is the same and it appears that the same recommendations can be applied. The effect of grazing management systems, type of animal utilizing the vegetation and the reaction of the different plant growth forms and palatable plants to grazing should be further investigated.

**POSTER PRESENTATION: BIG TREES AND ELEPHANT IN THE ASSOCIATED PRIVATE NATURE RESERVES**

Mike Peel\*, John Peel and Lukas Manaka

Agricultural Research Council - Animal Production Institute, email: [mikep@arc.agric.za](mailto:mikep@arc.agric.za)

We present results obtained in the Associated Private Nature Reserves. The effect of savanna trees on grass productivity has been well researched with both negative and positive effects having been described. The tree component therefore plays a major role in determining forage quality (higher soil nutrient concentrations under tree canopies) and quantity and consequently has an influence on the composition of the herbivore assemblage. Elephant can modify habitats and as such may precipitate a cascading effect through the ecosystem, affecting many co-existing plants and animals. As previously stated we accept that the aesthetic value of large trees is as acceptable an aspiration as the more “concrete” objectives such as preventing biodiversity loss. The “perceived” decline in tall trees due to elephant is therefore a concern. Results are provided based on the following: Damage severity, proportion of impact measured per species surveyed, relative overall impact, and impact per height class. The second approach investigates the impact of elephant in the > 5m size class using some 1000 trees taller than 5m. We focus on *Sclerocarya birrea* and *Acacia nigrescens* where the primary impact of elephant may: lead to elevated adult mortality through direct impact and reduced recruitment from shrubs, saplings and seedlings; be magnified due to attributes that affect selection and manner of utilisation which render the species vulnerable to mortality; act in synergy with other environmental or biotic factors (O'Connor et al.).



## POSTER PRESENTATION: DO GRAZING RESPONSE GROUPS EXPLAIN THE RELATIVE DEFOLIATION TOLERANCE OF MESIC GRASSLAND SPECIES?

Naledi Zama<sup>1,2\*</sup>, Craig Morris<sup>1</sup>, Ntuthuko Mkhize<sup>1</sup> and Michelle Tedder<sup>2</sup>

<sup>1</sup>Agricultural Research Council - Animal Production Institute, <sup>2</sup>University of KwaZulu-Natal, School of Life Sciences,  
email: [naledizama7@gmail.com](mailto:naledizama7@gmail.com)

Tolerance to herbivory is an important aspect of plant survival. However, few studies have investigated the ability of plants to grow following defoliation. Several studies have shown that herbivory affects relative abundance and species composition within communities. Plant communities respond to grazing in different ways and their response is affected by 1) how frequently plants are grazed and 2) the intensity of grazing. We addressed the question “Does grazing response group explain relative defoliation tolerance?” A pot trial experiment was conducted with four common mesic grass species. We selected two grass species that decrease in abundance under heavy grazing (*Themeda triandra* and *Tristachya leucothrix*) and two which increase in abundance when heavily grazed (*Eragrostis curvula* and *Eragrostis plana*). For each species, an undefoliated control was established. Simulated herbivory (clipping) was used to imitate grazing by herbivores. The single well-watered and fertilized tufts of each species were clipped to 5 cm (high intensity) and 10 cm (low intensity) at each of three clipping frequencies: defoliated once, twice and three times during the growing season (150 days). Grazing sensitivity, relative to the control plant growth, was measured by recording the accumulative dry matter yield (leaf material harvested at each clipping plus final yield). Species differed in their grazing sensitivity ( $p = 0.005$ ), with an interaction effect of species, defoliation frequency and defoliation intensity ( $p = 0.027$ ). Expectations were that increasers would be more tolerant of defoliation than decreasers would. Contrary to expectation, there was no significant effect of grazing response group on grazing sensitivity ( $p = 0.174$ ). Therefore, categorizing grass species in this manner may not be useful when explaining defoliation tolerance. We conclude that the defoliation tolerance of common mesic grass species is not determined by grazing response groups but rather by an interaction of individual species, frequency and intensity of defoliation. Further studies focusing on the interactive effects of competition, defoliation frequency and intensity are necessary to better our understanding of how mesic grassland communities respond to herbivory.

## POSTER PRESENTATION: THE EFFECT OF LAND-USE ON HERBACEOUS PRODUCTION AND GRAZING CAPACITY IN THE MOLOPO DISTRICT OF THE NORTH WEST PROVINCE

Franci Jordaan\*, Jaco van Rooyen and Wynand Strydom

North West Department of Rural, Environment and Agricultural Development, Pasture Science Division,  
email: [fjordaan@nwpq.gov.za](mailto:fjordaan@nwpq.gov.za)

The influence of climate, soils, and grazing pressure on the characteristics of the herbaceous layer are reasonably well understood in savannas, at least at intermediate to large scales. However, the influence of gradients on these factors at a finer scale within landscapes is less understood. The aim of this study was to investigate the individual and interactive effects of rainfall, topographical, and disturbance gradients on herbaceous vegetation composition and structure in a communal rangeland. The study was conducted in the communal rangelands of southern Bushbuckridge, Mpumalanga province. Herbaceous vegetation was sampled in 56 plots stratified by position along a rainfall gradient (> 700 mm/year in the west, 700-600 mm/year, and < 600 mm/year in the east), catenal position (upland and bottomland), and distance from village as a proxy for grazing intensity and general anthropogenic disturbance (0-599 m, 600-1800 m, and > 1800 m). The centre of each plot was marked, and four transects, each 25 m long, were drawn in the four cardinal directions. A falling point method was used to sample the herbaceous vegetation along these transects. If the pin fell on the base of a grass tuft (0/1), the functional growth form of the herbaceous plant nearest to the pin (annual grass, perennial grass, sedge, herby forb, woody forb), species of nearest grass tuft, species of nearest perennial grass tuft (if nearest was annual), and distance to nearest perennial grass tuft were recorded. From these data, species composition, species richness, Simpson's Diversity Index, mean distance to perennial and percent basal cover were determined, and compared between rainfall zone, catenal position, and village distance category. Perennial grasses predominated in all sites, although the mean abundance of annual grasses was higher in upland sites and closer to villages. Grass species richness increased with increasing rainfall, as did species diversity, to a lesser extent. Conversely, species richness decreased with increasing distance from village (i.e. decreasing disturbance), but did not differ significantly between catenal positions. Species composition was more strongly influenced by rainfall zone than catenal position and distance to village.



Mean distance to perennial increased and mean percent basal cover decreased with increasing rainfall. Tufts in the high rainfall zone tended to be larger but more dispersed than in the low rainfall zone. Catenal position had no discernible influence on distance to perennial or basal cover, while only distance to perennial decreased with increasing distance from village (i.e. tuft density increased). In this heavily utilized landscape, the rainfall gradient, followed by disturbance gradient had the strongest influences on the herbaceous vegetation, with comparatively little influence of catenal position other than on species composition.

**POSTER PRESENTATION: THE INFLUENCE OF RAINFALL ZONE, CATENAL POSITION, AND DISTANCE FROM VILLAGE ON COMPOSITION AND STRUCTURE OF HERBACEOUS VEGETATION IN A COMMUNAL RANGELAND**

*Wayne Twine\* and William Seabi*

University of the Witwatersrand, email: [wayne.twine@wits.ac.za](mailto:wayne.twine@wits.ac.za)

The influence of climate, soils, and grazing pressure on the characteristics of the herbaceous layer are reasonably well understood in savannas, at least at intermediate to large scales. However, the influence of gradients in these factors at a finer scale within landscapes is less understood. This aim of this study was to investigate the individual and interactive effects of rainfall, topographical, and disturbance gradients on herbaceous vegetation composition and structure in a communal rangeland. The study was conducted in the communal rangelands of southern Bushbuckridge, Mpumalanga province. Herbaceous vegetation was sampled in 56 plots stratified by position along a rainfall gradient (> 700 mm/year in the west, 700-600 mm/year, and < 600 mm/year in the east), catenal position (upland and bottomland), and distance from village as a proxy for grazing intensity and general anthropogenic disturbance (0-599 m, 600-1800 m, and >1800 m). The centre of each plot was marked, and four transects, each 25 m long, were drawn in the four cardinal directions. A falling point method was used to sample the herbaceous vegetation along these transects. If the pin fell on the base of a grass tuft (0/1), the functional growth form of the herbaceous plant nearest to the pin (annual grass, perennial grass, sedge, herby forb, woody forb), species of nearest grass tuft, species of nearest perennial grass tuft (if nearest was annual), and distance to nearest perennial grass tuft were recorded. From these data, species composition, species richness, Simpson's Diversity Index, mean distance to perennial and percent basal cover were determined, and compared between rainfall zone, catenal position, and village distance category. Perennial grasses predominated in all sites, although the mean abundance of annual grasses was higher in upland sites and closer to villages. Grass species richness increased with increasing rainfall, as did species diversity, to a lesser extent. Conversely, species richness decreased with increasing distance from village (i.e. decreasing disturbance), but did not differ significantly between catenal positions. Species composition was more strongly influenced by rainfall zone than catenal position and distance to village. Mean distance to perennial increased and mean percent basal cover decreased with increasing rainfall. Tufts in the high rainfall zone tended to be larger but more dispersed than in the low rainfall zone. Catenal position had no discernible influence on distance to perennial or basal cover, while only distance to perennial decreased with increasing distance from village (i.e. tuft density increased). In this heavily utilized landscape, the rainfall gradient, followed by disturbance gradient had the strongest influences on the herbaceous vegetation, with comparatively little influence of catenal position other than on species composition.

**Rangeland Management**

**POSTER PRESENTATION: CURRENT RANGE CONDITION IN RELATION TO LAND OWNERSHIP TYPES IN THE GAUTENG PROVINCE, SOUTH AFRICA**

*Lucas Letsoalo\* and Gilbert Pule*

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Emerging livestock farmers practice farming under different land ownership types. Very little is known about the effect of land ownership on rangeland condition in the Gauteng province. The purpose of this study was to: 1) evaluate and compare three land ownership types (leased land, communal land and private land) on the basis of species richness, basal cover, veld condition score and herbaceous biomass, and 2) determine the relationships between veld condition score and herbaceous biomass. Fifty grazing areas under different land ownership types (10 leased grazing lands, 8 private grazing lands and 32 communal lands) were assessed using nearest plant technique (objective method of determining the botanical composition and total cover of herbaceous vegetation) irrespective of the veld types. Land ownerships were defined as follows: (1) leased land - area granted by the government to certain



individuals, who hold the rights to use some parts of the land under leasehold, (2) private land - livestock farmers who own the land, and (3) communal land - open access to all members of the community living in the area, where natural resources are utilised and also managed communally. In total, 51 grass species were identified, of which 62% and 38% were perennials and annuals, respectively. The most commonly distributed and highly palatable species, *Digitaria eriantha*, showed the greatest frequency under the privately owned land (32.3 %) and the lowest in the communal owned lands (12.3%). The species richness was similar in leased and communal owned lands ( $6.32 n \pm 0.49$  (SE)) and higher in private owned lands ( $8.27 n \pm 0.69$ ). Basal cover was low and similar on all the study sites (4.2%). There were significant differences ( $P \geq 0.01$ ) among the private ( $69.63 \pm 5.01\%$ ), leased ( $56.68 \pm 3.11\%$ ) and communal ( $52.55 \pm 1.13\%$ ) lands on veld condition score. Similarly, private, leased and communal lands produced on average  $2\ 990.30 \pm 214$  kg DM/ha,  $2\ 069.85 \pm 196$  kg DM/ha and  $1\ 331.04 \pm 102$  kg DM/ha, respectively. Biomass production was positively correlated with rangeland condition ( $r = 0.895$ ;  $P < 0.005$ ). This suggests that rangelands in good condition produced more forage than those in fair or poor condition. The significant differences in most of the vegetation variables observed among land-ownership types suggested that grazing intensity was higher in the communal grazing lands relative to leased and private owned grazing lands. Hence, more efforts are needed to manage these rangelands sustainably.

## POSTER PRESENTATION: THE EFFECTS OF HOLISTIC PLANNED GRAZING, CONTINUOUS GRAZING AND 4-CAMP ROTATIONAL GRAZING SYSTEMS ON TICK LOADS AND WORM COUNTS ON GRAZING ANIMALS

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This study was conducted to compare the effects of holistic planned grazing, continuous grazing and 4-camp rotational grazing systems on tick loads and worm counts on the grazing animals. A total of 30 steer's weaners of 10 Bonsmara, 10 Boran and 10 Tuli breed from private farm located at Matatiel in Alfred Nzo District Municipality (ANDM) in the north parts of the Eastern Cape province, South Africa were used for the study. The farm was randomly divided into three sections, each treated with a different management practice that included holistic planned grazing (HPG); four-camp rotation (FCR) and continuous grazing (CG). Ticks were observed and counted each season from each steers. The fecal samples were collected from each cattle rectum every season and analyzed in Grahamstown Research Centre laboratory. The tick species observed from the 30 steers were *Rhipicephalus evertsi evertsi*, *Amblyomma hebraeum*, *Hyalomma spp* and *Rhipicephalus (Boophilus) decoloratus*. The result showed a significant difference ( $P < 0.05$ ) in tick load on in three breeds under continuous grazing in the hot-wet season. There was a significantly different ( $P < 0.005$ ) in the tick load observed in the hot-wet season among the grazing with, continuous grazing having the highest tick loads followed by four-camp rotational and holistic grazing with less tick counts with mean values of 23.758, 17.856 and 17.487, respectively. There was no significant difference ( $P > 0.05$ ) among the breeds, although Bonsmara breed shows a high tick count compared Boran and Tuli under all grazing systems and season. Furthermore, high faecal egg count was observed during hot-rainy season (42.29%), follow by post-rainy (33.93%), hot-dry (23.78%) and cold-dry (0%) with very low faecal egg count. On the other hand, high worm count was observed under continuous grazing system (47.58%) followed by four-camp rotational (42.28%) while holistic planned grazing (10.13%) has low faecal egg count. Therefore, it was concluded that holistic grazing and four-camp rotational grazing do not have an effect on the parasitic load than continuous grazing.

## PLANTED PASTURES: CULTIVAR ADAPTATIONS AND MANAGEMENT

### POSTER PRESENTATION: EVALUTION OF FORAGE YIELD OF PIGEON PEA( *CAJANUS CAJAN* (L.) MILLSPAUGH) VARIETIES IN EASTERN CAPE, SOUTH AFRICA

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The objective of this study was to evaluate the forage yield of three different Pigeon pea (*Cajanus cajan* (L.) Millspaugh) varieties when grown during the summer rainfall season in Alice, Eastern Cape, South Africa. A

randomized complete block design was used. The experimental Pigeon pea seed varieties were allocated to nine plots and each variety was replicated three times. In each plot 50 kg/ha of single super phosphate was applied and all seeds were inoculated with an appropriate *Rhizobium* inoculant. At the initiation of flowering stage, the legume forage was harvested at 20cm above ground (in a 1m<sup>2</sup> quadrat) and two samples were harvested in each plot. There were no significant differences ( $P > 0.05$ ) between the whole plant fresh yield. The fresh leaf yield (the undried forage including the stem material) of CIMMYT 100/01 was significantly ( $P < 0.05$ ) higher compared to the other two varieties (ICEAP 00557 and ICEAP 01415) which did not differ significantly ( $P > 0.05$ ). The highest dry matter content of leaf forage recorded was 36.65% (CIMMYT 100/01) and was not significantly different ( $P > 0.05$ ) from the dry matter content of leaf forage produced by the other two Pigeon pea varieties. The highest dry matter yield of the leaf fraction was produced by CIMMYT 100/01 and was significantly different ( $P < 0.05$ ) from variety ICEAP 01415, whereas the Pigeon pea variety ICEAP 00557 did not differ from either variety. Thus, the highest yielding Pigeon pea variety in this experiment was Pigeon pea CIMMYT 100/01. Therefore, the CIMMYT 100/01 Pigeon pea variety is the superior variety in forage production.

### POSTER PRESENTATION: THE CHARACTERISATION OF AN *OPUNTIA FICUS-INDICA* (CACTUS PEAR) COLLECTION CONSERVED BY THE ARC - NATIONAL FORAGE GENE BANK

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Cactus pear, a member of the *Opuntia* genus, has been introduced and used in developing countries for various purposes, especially as a source of fodder for cattle, sheep and goats during periods of drought. To facilitate the characterisation of the cactus pear accessions conserved at the Agricultural Research Council's Roodeplaats Experimental Station, descriptors published by the International Plant Genetic Resources Institute were used to describe 42 varieties originating from Glen, Bloemfontein. Because characterisation describes the genetic diversity within a collection, the results can be used to identify important agronomic traits and be applied in breeding programs. Table 1 list some of the 42 varieties' growth characteristics such as plant vigour, size, shape and habitus. Descriptors for cladodes included, for example, thickness, waxiness and spine size, for flowers density, length and colour and for fruit shape, weight and glochids.

**Table 1.** Varieties classed in plant vigour, plant size, habitus and plant shape growth descriptors.

<b>Plant vigour</b>	<b>Variety</b>	<b>Plant size</b>	<b>Variety</b>
Low	Amersfoort, Zastron	Small	Messina, Postmasburg
Low-Intermediate	Messina, Postmasburg	Small - Medium	Meyers, Van As
Intermediate	Ofer, Roedtan	Medium	Corfu, Ofer
Intermediate-High	Corfu	Medium - Large	Sicilian Indian Fig
<b>Habitus</b>	<b>Variety</b>	<b>Plant shape</b>	<b>Variety</b>
Upright	Blue Motto	Flat	None
Medium	Vryheid, Messina,	Round	Vryheid, Ofer
Spreading	Roly Poly, Schagen	Elongated	Amersfoort, Morado
Prostrate	None		
Shrubby	Meyers		
Arborescent	Sicilian Indian Fig		



**PLANTED PASTURES: PRODUCTION SYSTEMS AND MANAGEMENT****POSTER PRESENTATION: SEASONAL EFFECT ON QUALITY, DRY MATTER YIELD AND BOTANICAL COMPOSITION OF CULTIVATED BEEF PASTURE***Josef van Wyngaard\**, Janke van der Colf and Robin MeeskeWestern Cape Department of Agriculture, Outeniqua Research Farm, email: [JosefVW@elsenburg.com](mailto:JosefVW@elsenburg.com)

Dryland pasture (secondary grassland on old lands over-sown with pastures species) is a fundamental feed source for extensive beef cattle systems in the southern Cape, as cattle can be reared and finished on it with minimum supplementation during ideal climatic conditions. Unfortunately, ideal climatic conditions are scarce and fluctuate annually to a great extent. Pasture quality and botanical composition of pasture is driven primarily by season (temperature and precipitation), soil characteristics and agricultural practices (grazing and tillage). Average daily gain of beef cattle directly reflects pasture quality and pasture dry matter (DM) intake (influenced by botanical composition and pasture availability). Therefore, to achieve a linear growth curve for beef cattle on pasture, seasonal fluctuations in pasture quality and palatability as it relates to botanical composition should be mapped, to allow for precision animal supplementation. This strategy will reduce supplemental wastages and improve the efficiency of the system. The aim of this paper is to characterise pasture quality and botanical composition of beef pasture systems as affected by seasonal changes in the southern Cape, ultimately aimed at allowing for precision animal supplementation. A 24ha dryland paddock divided into 24 camps was monitored for two years in terms of pasture quality, DM yield and botanical composition. A grazing management system was implemented where animals were removed after 7 to 10 grazing days to avoid grazing regrowth and limit pasture removal to 50% of available biomass. All parameters were measured at point of grazing (ca. after 60 rest days). Four quadrats (0.25m<sup>2</sup>) were cut per camp for quality, and ten quadrats for pasture yield and botanical composition purposes. Samples were pooled and fractioned into seven categories: kikuyu (*Pennisetum clandestinum*), Tall Fescue (*Festuca arundinacea*), cocksfoot (*Dactylis glomerata*), *Eragrostis plana*, volunteer grass (temperate and tropical species), legumes and broad-leaved weeds. Pasture biomass availability before grazing varied between 1500 and 2954 kg DM/ha. Spring and summer yield was higher than winter and autumn yield. However, following below average rainfall in winter 2016, yield was lowest during spring 2016 relative to all other seasons. Pasture was comprised primarily of kikuyu, *E. plana* and other grasses. The kikuyu fraction increased from summer to autumn, and then declined from autumn to spring. The *Eragrostis plana* content remained relatively constant (approximately 15%) throughout the study. Other grasses increased from 14 to 44% from spring2014 to spring2016. The contribution of temperate grasses and legumes remained below 10% for all seasons. Pasture protein, neutral detergent fibre and metabolisable energy content (% DM) for autumn were 13.5±3.45%, 63.3±4.29% and 8.93±0.71 MJ/kg, for winter 16.0±4.61%, 58.4±7.96% and 10.1±1.82 MJ/kg, for spring 14.6±3.49%, 56.3±3.89% and 10.7±0.62 MJ/kg, and for summer 10.2±2.23%, 66.7±4.52% and 8.65±0.99 MJ/kg, respectively. To conclude, it is difficult to predict pasture parameters for precision animal supplementation, because pasture yield and botanical composition was affected by season and rainfall conditions in the preceding season. Nonetheless, the relative high pasture protein content during the winter months due to an increase in volunteer species suggests that no protein supplementation is needed during that time.

**POSTER PRESENTATION: INTAKE OF GRASS HAY BY JERSEY COWS AS AFFECTED BY SUPPLEMENTATION WITH ESSENTIAL OILS AND ITS EFFECT ON MILK YIELD AND COMPOSITION***Portia Moshidi<sup>1</sup>\**, Claude Muya<sup>1</sup>, John Mupangwa<sup>2</sup> and Florence Nherera-Chokuda<sup>1</sup><sup>1</sup>Agricultural Research Council - Animal Production Institute, <sup>2</sup>University of Fort Hare, email: [moshidip@arc.agric.za](mailto:moshidip@arc.agric.za)

Dry matter intake is fundamentally important in nutrition because it establishes the amount of nutrients available to an animal for health and production. In this study, the effect of supplementing essential oil (EO; source: *Eucalyptus globulus* leaves) on the forage intake and milk production of Jersey cows was evaluated. Eight primiparous non-grazing Jersey cows (7.7±1.92 kg/d; 139±14 days in milk; body weight (BW): 327±34.0 kg) were used in a quadruplicated 2 x 2 Latin square design experiment. The adaptation to treatments (control and EO) and measurement periods were 21 and 7 days, respectively. Cows in both groups were individually fed 3 kg (as is basis) of a dairy concentrate twice a day during milking time (7:00 and 15:00) and had ad libitum access to *Eragrostis curvula* hay and clean water. The EO-treated cows were orally dosed with 1.5 ml EO on a daily basis. Individual milk



yield and hay intake were recorded daily, and milk samples were collected daily to determine composition. Hay intake data was used to re-arrange and analyse the data as a 2 x 2 factorial with EO supplement (with or without) and forage intake (<1 kg and >1 kg as % of BW) as the main effects. The daily forage dry matter intake (DMI) was 3.7 kg/d and 0.99 kg as % of animal BW (average) and was not affected by EO. Consequently, no differences were observed on forage neutral detergent fibre intake (kg/d and as % of BW) between the two groups. Milk yield and milk fat concentration of EO-fed cows (11.4 kg/d; 4.30 %) did not differ from control cows (11.3kg/d; 4.04%). Milk fat yield was, however, greater ( $P = 0.02$ ) for cows supplemented with EO than control cows (500 vs. 400 g/d). Milk protein concentration was higher ( $P = 0.03$ ) for cows supplemented with EO compared to control cows (4.0 vs. 3.7%), but the yield did not differ between groups. Both control and treated cows consuming more than 1.0 kg forage DMI as % of BW, increased ( $P < 0.01$ ) milk, milk fat and milk protein yield by 4.3, 0.19 and 0.18 kg/d, respectively. These results suggest that supplementation with EO does not influence voluntary intake of grass hay and that more than 1.0 kg forage intake as % of animal BW is necessary for improving milk production.

**POSTER PRESENTATION: THE EFFECT OF PHOSPHORUS APPLICATION AND RHIZOBIUM INOCULATION ON GROWTH PERFORMANCE AND BIOMASS PRODUCTION OF LABLAB PURPUREUS IN ALICE, SOUTH AFRICA**

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Forage quality of rangelands in the rural Eastern Cape areas can be low during the dry winter periods. This can lead to a decrease in livestock production. The evaluation of annual forage legumes as feed for livestock production in the Eastern Cape, South Africa, can reduce feed scarcity during the dry period as they have a high protein content and dry matter (DM) digestibility, therefore enhancing intake of livestock. A field experiment was conducted to investigate the response of *Lablab purpureus* (cv. Rongai) to phosphorus application and rhizobium inoculation under dryland farming conditions at Alice in South Africa during the 2014/2015 growing seasons. The trial was laid as a Complete Randomized Design (CRD) with 4 x 4 m plot size replicated two times. Rhizobium inoculation levels (inoculated and un-inoculated) were assigned in plot whilst phosphorus was applied at with three P rates at 0, 20 and 40 kg P/ha. Growth parameters (seedling emergence, plant ground cover, plant nodule numbers and plant height) and yield data were collected during the course of the study at three different growth stages. The results of this study showed that the 20 kg P/ha with inoculation and 40 kg P/ha with inoculation treatments had greatest ( $p \leq 0.05$ ) plant seedling emergency, plant ground cover, plant height and nodule numbers. Lablab produced highest dry matter yield of 6.36 t/ha at anthesis where 40 kg P/ha and inoculum were used ( $p \leq 0.05$ ). In contrast, leaf: stem ratio was observed to decrease with stage of growth. Phosphorus application and rhizobium inoculation, particularly 40 kg P/ha, have a significant influence ( $p \leq 0.05$ ) on all parameters measured in the experiment. It is, therefore, recommended that inoculation and phosphorus fertilization is a requirement for optimum production of dryland Lablab in this region.



## PARALLEL SESSION A: RANGELAND ECOLOGY

SESSION CHAIR: IGSHAAN SAMUELS

Tuesday, 25th July, 11:30—13:30

Venue: Mhelembe (Rhino) Hall

### PLATFORM PRESENTATION: PATTERNS OF GRASS PRODUCTIVITY IN COMMUNAL RANGELANDS AND PROTECTED AREAS IN SEMI-ARID MOPANEVELD, AND IMPLICATIONS FOR REHABILITATION

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Many semi-arid rangelands in the Mopaneveld region within South Africa appear to be severely degraded, with low grass cover, widespread soil erosion, and bush encroachment. Mortality of cattle following the drought of 2014-2016 provides additional evidence of this. Yet there are few studies that have quantified grass production in these areas, nor identified determinants of productivity. Herbaceous biomass at the end of the dry season, as well as the frequency of bare soil patches, were used as indices of degradation at 3 communal rangeland sites in the Ba-Phalaborwa area, as well as two benchmark sites nearby (one in the Kruger National Park and one in a private nature reserve). End-of-winter biomass was extremely low in the rangeland sites, ranging from  $50.5 \pm 37.2$  g/m<sup>2</sup> (mean  $\pm$  SD) in 2014, following above-average rainfall, to a low of  $6.8 \pm 7.2$  g/m<sup>2</sup> in 2016, following two years of drought. These values were significantly lower than the benchmark sites (140 to 15 g/m<sup>2</sup>) and indicate that the herbaceous layer generally cannot produce enough forage to sustain the current density of grazers throughout the dry season. By the end of the 2016, many of the cattle in these rangelands had either died, were moved to rangelands elsewhere, or were surviving on feed brought into the area. Rehabilitation of the herbaceous layer in these areas therefore appears to make economic sense, at least in terms of reducing financial losses (incurred through livestock mortality or the purchasing of forage) during droughts. However, critical research is needed if rehabilitation is to produce a sustainable rangeland system. Grazer densities are far greater in the communal rangelands than in protected areas (~23-47 compared to ~6-7 animals / ha). Would livestock farming be culturally or economically acceptable if cattle populations were reduced to densities comparable to more natural systems? Alternatively, could the herbaceous layer support greater grazer densities than the protected areas currently do? Results from 7 years of annual sampling of productivity at a benchmark site provide some insights into constraints on grass productivity in the area, particularly the effects of tree competition and drought on perennial grasses.

### PLATFORM PRESENTATION: THE IMPACT OF LIVESTOCK GRAZING ON INSELBERG VEGETATION ALONG A GRAZING GRADIENT IN THREE BIOMES IN SOUTH AFRICA

*Laetitia Piers<sup>1,2\*</sup>, Igshaan Samuels<sup>2</sup> and Mmoto Masubelele<sup>3</sup>*

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Inselbergs form vital parts of communal rangelands as they provide a refuge for livestock fodder. They also provide mesic refugia for a variety of plant species that otherwise would not survive on the xeric rangeland matrices, thus they are classified as “islands of diversity™”. However, heavy grazing on these inselbergs in communal areas put them at risk of degradation. Yet, inselbergs in communal areas have not been adequately studied. This study aims to determine whether inselbergs that are subjected to high grazing pressure should still be considered “islands of diversity™”. Twenty-one sites were allocated to one of four grazing intensities (low, moderate, high or very high) to test the differences in vegetation parameters (plant diversity and density, vegetation cover and growth form diversity) along a grazing intensity gradient. A plot and corresponding line transect was used to assess the vegetation parameters of inselbergs and the surrounding rangeland matrices. The results showed that there were no significant differences in vegetation parameters along a grazing gradient within inselbergs and rangeland matrices respectively, and when comparing rangeland matrices with inselbergs. However, plant density showed an increase along the grazing gradient on rangeland matrices. We conclude that inselbergs are not islands of diversity but merely refugia for Succulent Karoo endemics. Vegetation on inselbergs is perceived to have a higher forage value for livestock compared to the rangeland matrices thus there is heavy grazing-induced homogeneity along grazing gradients increasing the abundance of unpalatable shrubs. Since these small inselbergs are also ideal forage resource areas



in unfavourable climatic conditions, grazing should be managed by introducing rest periods or using inselbergs solely as drought forage reserves.

### PLATFORM PRESENTATION: WHAT ARE THE LONG-TERM EFFECTS OF HIGH DENSITY, SHORT DURATION STOCKING ON THE SOILS AND VEGETATION OF MESIC GRASSLAND IN SOUTH AFRICA?

Kevin Kirkman<sup>1\*</sup>, Sindiso Chamane<sup>1</sup>, Craig Morris<sup>2</sup> and Tim O'Connor<sup>3</sup>

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High density, short duration stocking (aka HDG) is currently gaining popularity amongst farmers in the South African mesic grasslands, but little is known about its potential impact on the soils, vegetation composition and diversity, particularly the forbs. The aim of this study was to assess the effect of HDG with cattle on soil properties, vegetation structure, composition and forb growth habits of a mesic grassland in South Africa. This study was conducted on a fence-line contrast at a landscape scale between two properties at two study sites, Kokstad and Cedarville. At each study site, one property had been stocked with cattle in a short duration rotational system at a high density (HDG) and the other had a rotational grazing system at a much lower density (LDG) for >15 years. At Kokstad, HDG had zero burning for 19 years and LDG had a burning frequency of 2 to 4 years, whereas at Cedarville both HDG and LDG had a burning frequency of 10 to 15 years. Soils from Kokstad and Cedarville were 31% and 19% more compacted under HDG than LDG, respectively, but did not differ in any of their chemical properties (total nitrogen, total carbon, available phosphorus and pH) at both sites. HDG resulted in higher litter mass accumulation which reduced irradiance at both study sites. At Kokstad, palatable, grazing-sensitive grass species (e.g. *Themeda trianda*) decreased and some unpalatable species (e.g. *Eragrostis curvula*) increased under HDG. HDG increased abundance of four forb species including the alien weed, *Taraxacum officinale*, whereas under LDG, the abundance of ten forb species was increased. The intense grazing and trampling under HDG resulted in the replacement of forbs with a cauline erect growth habit by those with prostrate growth. At Cedarville, only a few grass and forb species were responsive to HDG and LDG, possibly because of the overriding influence of the absence of burning in both grazing systems. These results indicate that HDG potentially has negative impact on a South African mesic grassland.

### PLATFORM PRESENTATION: EFFECT OF BUSH CONTROL ON SPECIES COMPOSITION, TILLER AND LEAF PRODUCTION OF GRASSES

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Bush encroachment reduces rangeland biodiversity, production and carrying capacity. This study was conducted in the Radi and Kgomokgomo areas of Makapanstad in North West province to assess short-term changes in plant abundances, tiller and leaf production after mechanical bush control. Three encroached sites of 50 X 50 m<sup>2</sup> were marked in each study area. In each encroached site, eight 25 m<sup>2</sup> plots were marked and two 1,7 m<sup>2</sup> quadrats were placed at the corners and one at the centre of each plot (3 sites — 2 rangelands — 8 plots — 3 quadrats). Thereafter, plant identification to species level, and tiller and leaf counting for grasses was conducted. Afterwards, half of each 50 X 50 m<sup>2</sup> encroached site was mechanically debushed. In each debushed or undebushed treatment, four 25 m<sup>2</sup> plots were marked. Species composition, tiller and leaf production were determined a year after debushing using the same technique as originally used. At Radi, herbaceous vegetation was composed of 17 grasses, 20 forbs and 6 legumes. *Eragrostis lehmaniana*, *Aristida bipartita* and *Brachyaria eruciformis* significantly ( $p < 0,05$ ) dominated at Radi. Furthermore, there was an insignificant interaction between species and treatments on abundances, tiller and leaf production. However, *E. lehmania* (17%) was significantly higher than the other species at Radi. Despite lack of interaction, debushing triggered an increase ( $p = 0,05$ ) in tiller numbers of *B. eruciformis* from 9 to 22 tillers per plant compared with undebushed sites. At Radi, tiller and leaf production were higher and insignificantly different for *A. bipartita* and *E. lehmaniana* in debushed and undebushed sites compared to results prior to debushing, indicating that other factors, e.g. rainfall, had an effect rather than encroachment. Plant species significantly responded to treatments for abundances ( $p = 0,016$ ), tiller ( $p = 0,035$ ) and leaf ( $p = 0,050$ ) production at Kgomokgomo. *Digitaria eriantha* and *Panicum maximum* declined from 15 to 5% after debushing while *Eragrostis pseudosclerantha* remained similar. *Urochloa mozambicensis* was the only species that increased significantly from 4 to 9% after debushing. Despite the decline in abundance, *P. maximum*, *D. eriantha* and *U. mozambicensis* exhibited high tiller and leaf production in debushed than undebushed areas. We conclude that despite lack of improvement in plant abundance, bush control plays a pivotal role for improvement of forage production through increased tiller and leaf production. Therefore, we recommend debushing followed by resting for seed production.



## PLATFORM PRESENTATION: THE IMPORTANCE OF ECOSYSTEM STATE FACTORS TO THE HYDROLOGIC RESPONSES OF WOODLANDS TO LAND MANAGEMENT ACTIVITIES

*Jason West<sup>1\*</sup>, April Mattox<sup>1</sup> and Carissa Wonka<sup>2</sup>*

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During the last century, grasslands and savannas throughout the world experienced increases in woody vegetation. This shift from a grassland/savanna state to shrubland/woodland has been attributed to anthropogenic causes and is often associated with ecosystem degradation, declines in forage productivity, declines in biodiversity, and loss of socioeconomic potential. Many of these plants are considered “woody weeds,” although their effects on ecosystem functions such as hydrologic fluxes and biogeochemical cycling often remain poorly understood. This process of increasing woody abundance is ongoing in the plains of south Texas, having already converted much of what was once grassland or savannah to complexes of dense thickets of shrubs and small trees. The structure and function of these woodlands is, however, far from uniform. Variability of soil characteristics in particular interacts with rooting patterns and other drivers to result in a varied abundance and distribution of life-forms across these landscapes. These ecosystem state factors affect not only the current structure and function of these ecosystems, but also the trajectories they may take following anthropogenic activity. Unfortunately, we know very little about the potential for key drivers, such as soil, to control these responses. Our group conducted a landscape-scale, manipulative experiment to assess responses of these altered landscapes to common land management activities. The project was conducted in the recharge zone of an unconsolidated aquifer and sought to assess both vegetation and hydrologic responses. A total of twenty-seven (27) 0.10-hectare plots were established. Three replicated treatments were applied in a randomized block design (3 blocks or sites, 3 soil types, 3 treatments). The treatments applied were: (1) a control that was left untreated; (2) a cut-stump removal method: cutting the brush off with a chainsaw and then applying herbicide to the stump; and (3) a roller-chop removal method (large, weighted roller pulled by a tractor). Fire was also applied in a follow-up treatment two years after the initial treatments. While the shrubland community composition did not differ prior to the study, shrubland resilience was highest on coarse-textured soils. The hydrologic responses were also tied to soil texture, but reflected an inverse response in terms of desirable states: coarse-textured soils exhibited the largest soil moisture responses to the manipulations. Our findings suggest challenges to achieving multiple land management goals given the potential for individual, desired ecosystem states and functions to respond in divergent ways.

## PLATFORM PRESENTATION: BROWSING EFFECTS ON SPECIES COMPOSITION, STRUCTURAL DIVERSITY AND BIOMASS PRODUCTION UNDER PASTORAL AND COMMERCIAL RANCHING IN SEMI-ARID SAVANNA, NORTHERN KENYA

*Staline Kibet*

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The Savanna systems cover more than half the area of the African continent and support a large fraction of its human population, make up the majority of its rangeland and livestock biomass, and are home to the greatest density of wild herbivores and carnivores of any ecosystem on Earth. Besides their obvious socioeconomic importance, several savanna grazing systems have been noted to suffer from woody/bush encroachment especially in the African region. Bush encroachment has been associated with a decline in grass resources for livestock, decrease in soil carbon, decline in biodiversity, and proliferation of invasive species. The role of herbivory in woody plant dynamics within the savanna has been a subject for investigation for many years but limited studies have looked at managed systems dominated by wildlife and domestic herbivores. The study adopted a “natural experiment” design to test the effects of heavy browsing on species composition, structural diversity and biomass production. Two adjacent ranches (a lightly browsed private ranch with low stocking rates  $< 17$  TLU/km<sup>2</sup> and an intensely browsed adjacent communal ranch  $> 28$  TLU/km<sup>2</sup> were compared. Data were collected using square plots with an area of 400m<sup>2</sup> nested on 3 purposely selected transects per site. A total of 421 plots were sampled. The data was subjected to Canonical Correspondence Analysis (CCA) to isolate environmental factors influencing vegetation dynamics from herbivory effects. Kruskal-Wallis analysis of variance was used to test intra-variation between transects per site while the non-parametric Mann-Whitney U-test was used for a significance test between sites. Shannon Weiner index and Similarity index were used to compare species diversity and similarity. There was significant ( $P < 0.05$ ) difference in species diversity between sites. Intense herbivory mediated by soil nutrients diminishes woody species richness and abundance. Palatable and unpalatable woody species dominated intensely browsed ranch and lightly browsed ranch respectively. Intense herbivory diminishes vegetation heterogeneity but enhances biomass production of browsing-



tolerant species through compensatory re-growth and/or perhaps through reduced competition. Compensatory re-growth dampens once the species escape “browsing trap”™ zone and therefore to sustain enhanced biomass production in the landscape; browsing-tolerant species should be regularly pruned at the average height of the dominant herbivore species kept. The functional properties of ecosystems that are maintained by migratory behaviour of major herbivores on savanna may have been lost by high frequency, high intensity grazing due to limited mobility in GR and low frequency, low intensity grazing in PR. This perhaps explains the increase in unpalatable species in both ranches.

## PARALLEL SESSION A: RANGELAND MANAGEMENT

**SESSION CHAIR: TONY SWEMMER**

*Tuesday, 25th July, 14:30 –16:50*

**Venue:** Mhelembe (Rhino) Hall

### **KEYNOTE ADDRESS: SOCIAL AND LEGAL BARRIERS AND OPPORTUNITIES FOR USING PRESCRIBED FIRE ON PRIVATE LAND IN THE SOUTHERN GREAT PLAINS, USA**

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In this paper, we review the social and legal barriers affecting the use of prescribed fire in the Southern Great Plains of the USA. We also discuss the effectiveness of providing fire liability insurance, changing the legal statute for applying prescribed fire, and expanding prescribed burn associations as strategies for enhancing the use of prescribed fire. Widespread perceptions that fire is inherently destructive and dangerous have contributed to fire suppression policies that have resulted in plant community shifts, fuel load accumulations and increasingly destructive wildfire in fire-prone ecosystems. In the Southern Great Plains, fire suppression has led to the widespread expansion of Ashe Juniper (*Juniperus ashei*) and Redberry Juniper (*J. pinchotii*) as well as declines in biodiversity and forage production in fire-maintained grasslands and savannas. Prescribed fire has been found to be the most effective and affordable tool for reducing woody plant encroachment in many rangelands. However, the combination of social norms that favour fire suppression and laws that hold those who use prescribed fire liable for damages from escaped fire and smoke hazards has resulted in suboptimal use of this land management tool on private properties across the Southern in Great Plains. One study found that positive attitudes by landowners towards using prescribed fire on their land are strongly influenced by perceived support from family members and neighbours for this management tool. Another study found significantly more hectares were burned in counties with gross negligence liability standards for using prescribed fire than in adjacent counties with simple negligence standards. Other studies discovered that members of prescribed burn associations are more favorably disposed to fire as a management tool and more likely to use it on their land than non-members. By contrast, an on-going study has determined that access to fire-specific liability insurance has little effect on the incidence of burning; rather, such insurance reinforces the idea that prescribed fire is inherently dangerous and may even increase the probability of law suits being initiated by landowners affected by an escaped prescribed fire. These findings suggest that the provision of fire liability insurance is not an effective strategy for increasing prescribed fire on private land. By contrast, changing legal statutes for burning from the dominant simple negligence standards to less common gross negligence standards will likely increase the use of prescribed fire. Additionally, expansion of prescribed burn associations across larger geographic areas would enable more landowners to obtain: (1) assistance with planning burns, (2) fire safety training, and (3) labour and fire management equipment on burn days. This simultaneously removes several barriers to landowner willingness to use fire on their land. These findings are relevant not only in the Southern Great Plains but also across the globe where private landowners endeavour to maintain the biodiversity and productivity of fire-dependent rangelands that provide ecosystem goods and services upon which human wellbeing depends.



## INVITED KEYNOTE ADDRESS: MANAGING AFRICAN RANGELANDS USING HETEROGENEITY CHARACTERISTICS

*Rina Grant<sup>1\*</sup>, Thelani Grant<sup>2</sup> and Mike Peel<sup>3</sup>*

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Wild herbivores are adapted and have co-evolved with African rangeland. They should therefore be good indicators of how the rangeland could be optimally utilized. To determine how wild herbivores use a natural landscape, we did road transects on a monthly basis in central Kruger National Park (KNP) covering four geological systems: granite, basalt, ecca shale and gabbro. We recorded the species, number of animals, type of vegetation and visibility for each sighting as well as grass height and faecal counts in selected frequently utilized patches (FUPs) as well as areas that seemed to be avoided. Grazers and some browsers selected open patches with shorter grass more frequently in all the geological areas. Nutrient concentrations were determined in soil and grass of FUPs and avoided areas in similar habitats. Nutrient concentrations in soil differed significantly in the different geological areas, but no differences were found between FUPs and areas not utilized. Soil moisture was significantly lower in FUPs while electrical conductivity was significantly higher. The phosphorous, nitrogen and digestibility of the forage was also significantly higher in the FUPs than in the non-utilized sites, with higher phosphorous levels recorded in forage on basalts. Wild herbivores, particularly grazers, select patches in the landscape. The first selection criterion is probably higher digestibility which seems to be associated with slower growth rates. Once herbivores start concentrating on a forage patch, it stimulates new growth as long as sufficient soil moisture is available. Patches with higher digestibility and nitrogen are more palatable and a positive cycle is initiated with animals creating and benefitting from short green grass patches. Adapting our rangeland management approaches using this knowledge could be beneficial to animal production without causing degradation of the rangeland. This would imply that in heterogeneous systems, animals would benefit from being allowed to select FUPs especially during the growth season. These patches would provide more phosphorous and nitrogen with higher digestibility without increased costs. Grasses that occur on these patches are generally stoloniferous and are adapted to high levels of herbivory. These patches can be created through fertilization or mowing and can be maintained if herbivore numbers are high enough. It is very important to realise that these patches are not productive in the dry season and that sufficient dry season forage is essential to ensure animal survival and maintenance during the dry season. The ratio between FUPs and dry season resources needs to be determined to ensure optimal production and is likely to be influenced by rainfall and soil quality.

## PLATFORM PRESENTATION: A CONSOLIDATION OF THE WILDLIFE ESTATE: MANAGEMENT CHALLENGES AT DIFFERING SPATIAL SCALES WITH SPECIAL REFERENCE TO DROUGHT

*Mike Peel<sup>1\*</sup> and Jeremy Anderson<sup>2</sup>*

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Large private nature reserves (referred to as Adjacent Private Protected Areas - APPAs) bordering the Kruger National Park (KNP) have embraced the basic philosophies of the KNP management approach since the removal of the fences between them in the 1990s, have similar general objectives, but function at different spatial scales. In the APPAs, movement is possible but due to management actions such as the provision of artificial water points these areas function at a different spatial scale to the KNP. This presents a unique set of management challenges. We illustrate this by comparing the density of water points in the APPAs with that of a 10km buffer within the adjacent KNP. We further examine the effect of the apparent 'over-supply' of water within the APPAs on the density and type of animals found and their potential effect on the forage resource particularly during periods of drought. Proactive management scenarios are presented for the APPAs, bearing in mind that these management actions are implemented within a larger system (including the adjacent KNP). The latter further highlights the need for an integrated approach to management within these areas.

**PLATFORM PRESENTATION: COMPARISON OF HOLISTIC, CONVENTIONAL ROTATIONAL AND COMMUNAL GRAZING MANAGEMENT PRACTICES IN THE EASTERN CAPE GRASSLAND BIOME OF SOUTH AFRICA: IMPACTS ON GRASS AND SOIL PROPERTIES***Solomon Tefera*University of Fort Hare, Department of Livestock and Pasture Science, email: [teferabeyenesolomon@yahoo.com](mailto:teferabeyenesolomon@yahoo.com)

In South Africa rangelands, two main livestock production and management practices can be recognized: communal-continuous (CG) and commercial-rotational (RG) ranching. After decades of trials, another management planning practice known as Holistic Planned Grazing (HPG) has been suggested and its recognition is growing. This planning allows much higher animal densities staying over a short time period and then moving to mimic nature. The current study evaluated variations in vegetation and soil characteristics in response to the three grazing management systems in the grassland biomes of South Africa. For each management practice, two farms were selected giving a total of six farms. Each farm was divided into three landscape units namely; bottomlands, slope and uplands. Three 100 m by 50 m transects were established in each landscape unit to record vegetation and soil data. Results showed that farms under HPG had higher ( $P < 0.05$ ) basal cover, followed by RG, whereas CG had the lowest basal cover. Biomass production was highest ( $P < 0.05$ ) in RG and lowest in the CG grazing system. Communal grazing sites were characterized by a high abundance of grass species that have low grazing and ecological benefits, whereas the dominant grasses under RG and HPG were strong perennials with high grazing values. Aggregate stability, particulate organic matter, organic carbon and many soil nutrients were relatively higher in soils collected from RG followed by HPG. Landscape greatly influenced many vegetation and soil variables and this appeared to interact significantly with grazing management. Significant variations for several vegetation and soil variables between the land management practices suggest that differences in grazing pressure and system might be the primary cause. This supports the equilibrium models that stress the greatest role of livestock density and movement on soil and vegetation dynamics. We conclude from this study that RG and HPG may promote soil and vegetation stability, whereas CG resulted in poor soil and vegetation conditions. Therefore, we recommend studies to evaluate best practices based on RG and HPG principles under communal rangeland systems.

**PLATFORM PRESENTATION: HOLISTIC PLANNED GRAZING FAILS TO BEEF UP FARM PRODUCTION: AN OX'S-EYE VIEW***Zander Venter<sup>1\*</sup>, Michael Cramer<sup>1</sup>, Heidi Hawkins<sup>1,2</sup>*<sup>1</sup>University of Cape Town, Department of Biological Sciences <sup>2</sup>Conservation South Africa  
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Practitioners of Holistic Planned Grazing™ (HPG) advocate the regular movement of livestock at high densities ( $\geq 20$  LSU ha<sup>-1</sup>) with the intension of mimicking natural herbivore grazing patterns. High grazing densities have been proposed to increase the trampling and incorporation of organic material into the soil ('herd effect' and 'animal impact'), thereby increasing soil nutrient cycling, basal ground cover and animal production. Further, it has been suggested that high densities reduce grazing selectivity, thus preventing overgrazing and consequent mortality of palatable grasses. Claims that HPG enhances productivity have been both supported and contradicted by the literature, but few studies have investigated the behavioural mechanisms behind these vegetation responses.

To test the assumptions related to the 'herd effect', we use data collected over 18 months from an on-going grazing management farm trial in Cedarville, Eastern Cape, comparing HPG with conventional four-camp rotation and season-long grazing systems. We test the hypotheses that, relative to conventional systems, HPG (1) will increase the time cattle spend grazing, trampling, and proximity to one another when grazing; (2) thereby, increasing forage utilisation and decreasing grazing selectivity at the plant and patch scale; (3) resulting in greater biomass production and basal cover; (4) supporting higher animal production.

Behavioural observations and data from cattle fitted with tri-axial accelerometers reveal that animals spend less time grazing and more time resting under HPG compared to four-camp rotation ( $p < 0.05$ ). HPG cattle grazed at significantly greater distances (54 cm) than season-long grazing cattle ( $p < 0.01$ ). There was no evidence that HPG increases dung trampling ( $p = 0.406$ ) and number of steps taken ( $p = 0.227$ ).

Vegetation bite-mark sampling showed that HPG cattle utilized a smaller proportion of available biomass compared to season-long grazing cattle ( $p < 0.001$ ). HPG, four-camp, and season-long grazing cattle selected for 57, 83 and 71% of available grass species, respectively. Aggregation of GPS tracking points from cattle were similar between HPG, four-camp, and season-long treatments (Clark-Evans aggregation indices of were  $R = 0.87, 0.84, \text{ and } 0.88$ , respectively). Thus, HPG did not produce lower grazing selectivity indices at the plant or patch scale.





The change in standing biomass did not differ between HPG and conventional systems ( $p = 0.238$ ), however HPG resulted in the smallest increase (0.22%) in bare soil ( $p < 0.05$ ).

Cattle in the HPG system gained an average of 0.13 kg less weight per day over the sampling period compared to those in the season-long treatment during summer ( $p < 0.001$ ), whereas no difference was found in winter ( $p = 0.106$ ).

In the early stages of the farm trial, HPG has not caused cattle to spend more time grazing at closer proximities, nor has it increased trampling and reduced grazing selectivity. Further, it has not facilitated greater vegetation or livestock production thus far. Although vegetation responses, particularly compositional changes, to grazing management may vary over the long-term, these results indicate that the 'herd effect' mechanisms by which HPG is proposed to operate are not valid in the short-term.



## PARALLEL SESSION B: PLANTED PASTURES: CULTIVAR ADAPTATIONS AND MANAGEMENT

SESSION CHAIR: DERRYN NASH

Tuesday, 25th July, 11:30—13:30

Venue: Hongonyi (Wildebeest) and Xidzidzi (Honey Badger) Rooms

### PLATFORM PRESENTATION: THE PRODUCTION POTENTIAL AND BOTANICAL COMPOSITION OF KIKUYU OVER-SOWN WITH TEMPERATE GRASS-LEGUME MIXTURES USING DIFFERENT ESTABLISHMENT METHODS

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The continued implementation of kikuyu-ryegrass pasture systems in the southern Cape has been motivated by the ease of management and relatively high dry matter (DM) yield obtainable from these pastures. High fertilisation and irrigation requirements of kikuyu-ryegrass pastures, however, threaten the sustainability of such systems in the future. Alternative systems, based on the inclusion of more drought tolerant grass species and legumes, will have to be developed. Albeit, information on the over-sowing methods of these species, their production potential and persistence is limited. The aim of this study was to evaluate the pasture production potential of four grass-legume mixtures established into kikuyu using three different tillage methods. The mixtures consisted of red clover (*Trifolium pratense*), white clover (*T. repens*) and one of four temperate grasses viz. Italian ryegrass (*Lolium multiflorum*), perennial ryegrass (*L. perenne*), Tall Fescue (*Festuca arundinacea*) or cocksfoot (*Dactylis glomerata*). The establishment methods used during the study are described in Table 1. During year 2 and year 3, pastures were over-sown using the planter method to maintain the temperate component. Dry matter yield (kg DM/ha) was determined ca. every 28 to 35 days by cutting four 0.25 m<sup>2</sup> quadrats to a height of 50 mm per plot prior to grazing.

**Table 1.** Establishment method and description

Treatment	Description
Planter	Graze to 50 mm Mulch to ground level Plant with Aitchison seeder Roll with teff roller
Rotavator	Graze to 50 mm Mulch to ground level Rotavate to 120 mm Roll with teff roller Broadcast seed Roll with teff roller
Planter and paraquat	Spray 5 L/ha paraquat Mulch to ground level Plant with Aitchison seeder Roll with teff roller

When comparing within the different mixtures during year 1, the establishment method did not affect the total annual DM yield of the perennial ryegrass, Italian ryegrass or Fescue mixtures ( $P > 0.05$ ). The only mixture where establishment method affected total annual DM yield was when cocksfoot was over-sown into kikuyu, with the planter+paraquat method resulting in a higher annual DM yield during year 1 and 2 ( $P < 0.05$ ), than when a planter or rotavator was utilised. However, by year 3, all establishment methods resulted in a similar annual DM yield for the cocksfoot mixture ( $P > 0.05$ ). Botanical composition displayed a complex interaction between mixture and establishment method. The higher clover content observed during the establishment period where grass competition was low, could be attributed to either the companion grass itself (Tall fescue or cocksfoot) or the establishment method (cultivation or herbicide). However, these treatments also tended ( $0.10 < P < 0.05$ ) to have lower DM yields during the first year and a higher content of voluntary grasses such as *Bromus* spp., *Paspalum notatum* and *Eragrostis plana*. Irrespective of the species mixture or establishment method used, a decline in clover content and pasture DM yield potential occurred over years. Management strategies that can either improve the production potential or clover component in these pasture systems thus need to be developed.



## PLATFORM PRESENTATION: EFFECT OF CUTTING ON DRY MATTER AND TOTAL NON-STRUCTURAL CARBOHYDRATE PERCENTAGES OF TEN SELECTED ITALIAN RYEGRASS CULTIVARS

Patrick Rakau, Khutso Mohubedu\*, Dave Goodenough and Kpho Nzeru

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Changes in non-structural carbohydrates (TNC) before and after winter are one of the major plant responses to winter stress, which affect dry matter yield. This study compared the relationship between dry matter (DM) and total non-structural carbohydrate (TNC) percentages of ten selected Italian ryegrass (*Lolium multiflorum*) cultivars, both diploids (D) and tetraploids (T), namely: Tabu (D), Supreme Q (D), Sukari (D), Sophia (D), Feast II (T), Enhancer (D), Dargle (D), AgriBoost (D), ARC 148 (D) and ARC 214 (T). The trial was conducted on a Hutton soil type at Cedara Research Station in KwaZulu-Natal, South Africa (29° 32'S 30° 16' E). Seed of 34 *L. multiflorum* cultivars, including the 10 cultivars referred to above, and of two *L. perenne* cultivars was sown on 13 April 2015 in a 6 x 6 balanced lattice trial with three replications, each with a gross plot size of 2 m x 6 m and a nett plot size of 1.4 m x 4.6 m. Sowing rate was 25 kg/ha for diploids and 30 kg/ha for tetraploids, and the seed was hand-sown in rows 200 mm apart. The trial received supplementary irrigation of 25 mm per week. Each plot was fertilised with 50 kg nitrogen (N)/ha and 50 kg potassium (K)/ha as 1:0:1 application after each cut. Plots were harvested (Cut) nine times over the growing season when the plants had reached the three-leaf "ready for grazing" stage. Harvesting was done with a mower set at 5 cm above ground level and the total fresh herbage was weighed within five minutes of sampling. A grass sample from each plot was then taken, weighed and dried at 75°C for 72 hours. The dried samples were then weighed in order to determine the DM percentages. Dried samples of the 36 cultivars were milled to pass a 1 mm screen and, subsequently, analysed by wet chemistry for their TNC percentage contents. According to this study, mean DM percentage was generally higher for Sukari (18 %), Enhancer (19 %), AgriBoost (18 %), while the two new Italian ryegrass lines bred at ARC-API Cedara; the diploid ARC 148 (18%) and the tetraploid ARC 214 (16 %), also had satisfactory mean DM percentages. Conversely, the mean TNC of AgriBoost was the highest (14 %), where ARC 148 (11 %) and ARC 214 (12 %) were higher than Tabu (9 %) ( $P < 0.05$ ). Even though AgriBoost had the highest total TNC percentage, Sukari was considered the best, because of its TNC increase during the winter months of July and August (10.9 % and 11 %, respectively). This trend can contribute towards an increase in milk yield, particularly during winter. This can be financially beneficial to the dairy farmer.

## PLATFORM PRESENTATION: MORPHOLOGICAL DIFFERENCES BETWEEN CHICORY VARIETIES AND THE POTENTIAL OF USING PLANT HEIGHT AS A MEASURE OF DRY MATTER YIELD

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Forage herbs, consisting of chicory (*Cichorium intybus*) and plantain (*Plantago lanceolata*) are increasingly incorporated into pasture systems for dairy production. Variety trials commenced at Outeniqua Research Farm in October 2016. In the current trial, 10 varieties of chicory and one plantain variety were evaluated for dry matter (DM) yield, sward height, persistence and disease tolerance. In addition, morphological differences between varieties in terms of leaf shape, growth form and flowering behaviour have been identified. The varieties Commander, Choice, Puna II and Spada have a generally entire leaf margin, or slightly dentate, spatulate leaf shape, with an upright growth habit. Varieties such as LaNina, SixPoint and Trigger have a broadly hastate leaf shape and dentate leaf margin with an intermediate growth form. The third type, also known as a "root type" used mainly for harvesting the root, was very low growing with a compressed spatulate leaf and slightly dentate margin. The variety LaNina exhibited prolific flowering from the third harvest onwards. Other varieties had a low degree of flowering or none. In a pasture-based system the allocation of pasture to animals, and in turn successful grazing management of the pasture, is dependent on the ability to predict DM yield, often by means of indirect measurement methods. For example, a common method for grass and grass-legume mixtures is the disc meter, which uses height and to some extent density as an indication of DM yield. In New Zealand, sward height, determined through the simple method of a sward stick, has been used for forage herbs. In the variety trial underway at the Outeniqua Research Farm, both actual DM yield and sward height were determined. This yield and height data from all varieties over seven harvests used for the prediction equation had a low R<sup>2</sup> value of 0.36. Grouping the varieties into three growth types improved the R<sup>2</sup> to range from 0.44 for the low growing type to 0.47 for the upright type and 0.56 for the intermediate type. These values are too low and would not allow for accurate or reliable yield predictions. On a variety level there is potential for better values, with a R<sup>2</sup> of 0.73 for the variety Choice. However, the range was also wide, with a low R<sup>2</sup>



of 0.38 for Commander. It thus seems that the sward height method can be applied to certain varieties more successfully than to others and this could be linked to the specific growth form. The potential does, however, exist to develop more rigorous calibration equations and improve the R<sup>2</sup> values for the height method by collecting and including more data and thereby potentially be able to use equations for morphological groups rather than individual varieties. In future, measurement methods such as a sonar-based sensor, taking into account both height and density, could be considered, and may possibly be more accurate in view of the growth form differences between varieties.

### PLATFORM PRESENTATION: EFFECTS OF SALINITY ON GERMINATION PERFORMANCE OF SELECTED *LOLIUM* AND *ERAGROSTIS* GRASS SPECIES

Mziwanda Mangwane<sup>1,2\*</sup>, Casper Madakadze<sup>2</sup> and Florence Nherera-Chokuda<sup>1</sup>

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Coal mining in South Africa causes huge environmental damage, particularly the destruction of the soil structure and changes in chemical components. Rehabilitation of disturbed lands is therefore critical. A wide range of grass species are used for rehabilitation of mine-disturbed areas. Selection criteria include adaptability to high levels of elemental contaminants such as sodium chloride. The experiment was conducted in a glass house at the University of Pretoria Experimental Farm with automated air-conditioning. Variations in salinity tolerance were determined in two grasses species: *Eragrostis curvula* varieties Agpal and Ermelo, and *Lolium multiflorum* varieties Archie and Agriboost. Eight levels of salinity were imposed: distilled water (control) or solutions of 100, 200, 400, 600, 800, 1000 mS/m of NaCl and KleinKopje mine (557 mS/m) water in saline solutions. For each species, 100 seeds were placed in 9 cm Petri dishes lined with Whatman #2 filter paper. Factorial experiment: 4 spp and 8 levels. Seeds were germinated in a glass house with a constant temperature set at 25°C and with 14 hours of light per day. Cumulative germination percentage and T50 were used in estimating salinity tolerance levels. Variations were recorded among and within species. Results showed that the mean cumulative germination percentage for *E. curvula*: Ermelo was significantly ( $P < 0.05$ ) higher (93.1%) under DDH<sub>2</sub>O. Mean cumulative germination percentage for *E. curvula*: Agpal was, therefore, lower compared to the highest mean cumulative germination for *E. curvula*: Ermelo which was 80.1 % obtained under DDH<sub>2</sub>O. Whereas the *L. multiflorum*: Agriboost had a relatively lower ( $P > 0.05$ ) final germination percentage under DDH<sub>2</sub>O (62.3%) compared to all other species. The values obtained under EC for *L. multiflorum*: Agriboost were also lower than for those of the other species. At 400-800 mS/m of NaCl all grasses reached 50% germination on day 6-9, demonstrating their highest germination potential under EC conditions. However, *L. multiflorum*: Archie had a relatively high (EC) tolerance ( $P < 0.05$ ) compared to other grasses. The work presented in this experiment has profound implications for future rehabilitation programmes on disturbed mines soils. The results suggested that *Lolium multiflorum*: Archie could be an excellent candidate for rehabilitation of disturbed mining areas with elevated levels of salinity.

### PLATFORM PRESENTATION: EFFECT OF CUTTING STAGES ON RE-GROWTH DRY MATTER PRODUCTION AND NUTRITIONAL VALUE OF THE FIVE WINTER CEREAL CULTIVARS IN MOLOTO DISTRICT GAUTENG AND NOOIGEDACHT, MPUMALANGA PROVINCE

Patrick Rakau<sup>1,2\*</sup>, Chris Dannhauser<sup>2</sup> and Jorrie Jordaan<sup>2</sup>

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A shortage of winter grazing is the major problem on most farms in South Africa. Animals lose weight in winter, which leads to low reproduction, and decreases production of milk, mutton and meat. The emphasis of this study was to look into the effect of cutting stages on re-growth dry matter production and nutritional value of five different cultivars. The study was conducted 2007. Two planting dates were used: February in Mpumalanga and April in Gauteng respectively. Cultivars (Witteberg oats, Overberg oats, LS 35 rye, LS 62 stouling rye and Cloc 1 Triticale) were planted in three replications. Each main plot was divided into five split-plots with different cutting treatments. Five cutting treatments were applied in five split plots: Sub-plot A was cut 8 weeks after planting, and after that re-growth was cut every six weeks. (Ct 8), Sub-plot B was cut 10 weeks after planting, and after re-growth was cut every six weeks. (Ct 10), Sub-plot C was cut 12 weeks after planting, and after re-growth was cut every six weeks. (Ct 12), Sub-plot D was cut 14 weeks after planting, and after re-growth was cut every six weeks. (Ct 14), Sub-plot E was cut when more than 50% of plants were in the reproductive stage (RS). The study found that when planted in April, LS



stooling rye and Cloc 1 triticale can be described as a late winter/spring producing cultivars. LS 62 and Cloc 1 triticale were on average the highest producers (above 6.0 t/ha) when defoliated initially 14 weeks after planting and two re-growth cuts were achieved in every treatment. On average, this defoliation treatment (Ct 14) resulted in the highest production for all cultivars. The acid detergent fibre (ADF %) of all five cultivars was below 30% in the early growth stages. During the mature stage the ADF percentage of LS 62 stooling rye, Witteberg and Overberg oats rose higher than 30%. The neutral detergent fibre (NDF %) of all five cultivars was below 45% in the early stage. During the mature stage, the NDF percentages of LS 62 stooling rye, Witteberg and Overberg oats were above 50%. The crude protein content was in most cases above 14 %, except Witteberg and Overberg oats in a young stage and Overberg oats and LS 62 stooling rye in a mature stage. These high nutritional values are indicators that animals grazing this winter fodder will be able to gain weight and increase their production in winter. Under the cool climate of Mpumalanga, LS 35 and LS 62 cultivars could be classified as early to mid-winter producers, Cloc 1 triticale and Witteberg oats as mid-winter producers and Overberg oats as a late winter producer.

**PLATFORM PRESENTATION: BIOMASS PRODUCTION OF PERENNIAL RYEGRASS (*LOLIUM PERENNE* L), COCKSFOOT (*DACTYLIS GLOMERATA* L) AND TALL FESCUE (*FESTUCA ARUNDINACEA* SCHREB) VARIETIES GROWN UNDER IRRIGATION AT ALICE, SOUTH AFRICA**

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The objective of this study was to determine the biomass production potential of irrigated perennial ryegrass (*Lolium perenne* L), cocksfoot (*Dactylis glomerata* L) and tall fescue (*Festuca arundinacea* Schreb). Two varieties of each species were evaluated, equating to a total of six varieties. The study was carried out in the form of a completely randomized block design with three replicates at the University of Fort Hare Research Farm, Alice, Eastern Cape province of South Africa during 2014-2015 growing season. The plots were harvested at four week intervals, with 70kg N/ha applied after each harvest. Biomass yields (kg/ha) were determined for fresh forage and dry matter yield. Biomass results show that throughout the year the average mean biomass yield is significantly different ( $p < 0.05$ ) between species. Tall fescue had the highest total annual mean biomass yield (2 771kg/ha) followed by Ryegrass (2 188kg/ha) and lastly Cocksfoot (1 702kg/ha). During summer and autumn Tall fescue varieties had the highest yields (1 978 to 3 856 kg/ha and 1 900 to 3 878 kg/ha, respectively), while Ryegrass had the highest biomass yield in winter (2 975kg/ha). Tall fescue varieties maintain a higher biomass yield throughout the year compared to Ryegrass and Cocksfoot species. It is concluded that the biomass production of the six varieties of the three grass species was different throughout the year under irrigation. According to biomass production determined in this study, Ryegrass and Tall fescue are recommended for farmers in the region.

**PARALLEL SESSION B: PLANTED PASTURES: FERTILIZER APPLICATIONS FOR MAXIMUM PRODUCTION**

**SESSION CHAIR: SIGRUN AMMANN**

*Tuesday, 25th July, 14:30 - 15:10*

**Venue:** Hongonyi (Wildebeest) and Xidzidzi (Honey Badger) Rooms

**PLATFORM PRESENTATION: THE EFFECT OF NITROGEN FERTILISATION ON DRY MATTER PRODUCTION AND BOTANICAL COMPOSITION OF GRASS-LEGUME PASTURES IN THE SOUTHERN CAPE**

*Bernhard Jordaan<sup>1,2\*</sup>, Janke van der Colf<sup>1</sup> and Pieter Swanepoel<sup>2</sup>*

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A large proportion of cultivated pastures in the southern Cape of South-Africa are based on kikuyu (*Pennisetum clandestinum*). In order to reduce nitrogen fertilisation input costs and improve forage quality, producers have adopted legumes into kikuyu based systems. However, to maintain high production rates, they continue to apply nitrogen at varying rates, to the detriment of nitrogen fixation by legumes, potentially leading to a reduced legume

proportion. Research concerning the effect of N fertilisation on the production potential and sustainability of grass-legume pastures in the southern Cape is limited. The aim of this study was to determine the effect of N fertilisation on the yield and botanical composition of kikuyu-lucerne (*Medicago sativa*) (KL) and kikuyu-perennial ryegrass-clover (*Lolium perenne-Trifolium* spp.) (KPrCl) pastures. The study consisted of two pasture types to which five nitrogen application regimes were applied. The two pasture types, KL and KPrCl, were established on two separate sites, with the five fertilisation treatments applied to each site consisting of: 0 ( $N_0$ ), 20 ( $N_{20}$ ), 40 ( $N_{40}$ ), 60 kg N ha<sup>-1</sup> ( $N_{60}$ ) and a strategic N application ( $N_{strat}$ ). Nitrogen was applied after each grazing event. Pasture yield was determined before each grazing and botanical composition seasonally. For the KL pasture type,  $N_{60}$  had a higher ( $P \leq 0.05$ ) total annual yield than all the other treatments except  $N_{20}$ . Kikuyu content was not affected by treatment ( $P > 0.05$ ) within seasons. During winter and spring lucerne content did not differ ( $P > 0.05$ ) between treatments. However, during summer, lucerne content was highest ( $P \leq 0.05$ ) for  $N_{40}$ , while it was similar ( $P > 0.05$ ) between the other treatments. For the KPrCl pasture type,  $N_{60}$  produced a higher ( $P \leq 0.05$ ) total annual yield than the other treatments, except  $N_{40}$ . During winter, spring and autumn  $N_{40}$  and  $N_{60}$  were the only treatments that maintained the highest or similar to the highest ( $P \leq 0.05$ ) seasonal yield. However, in the summer, yield did not differ ( $P > 0.05$ ) between treatments. During spring, the ryegrass content of  $N_{40}$  and  $N_{60}$  was similar ( $P > 0.05$ ), but higher than other treatments. During summer, ryegrass content of  $N_{60}$  was higher ( $P \leq 0.05$ ) than  $N_{strat}$ . During spring, kikuyu content of  $N_{40}$  and  $N_{60}$  were similar ( $P > 0.05$ ) and lower than  $N_0$  and  $N_{strat}$ . However during summer, kikuyu content did not differ ( $P > 0.05$ ) between treatments. During spring and summer clover content of  $N_0$  and  $N_{strat}$  was higher ( $P \leq 0.05$ ) than  $N_{60}$ . The rate of nitrogen application affected the yield and botanical composition of both KL and KPrCl during the first year of the study. At both sites  $N_{60}$  had a higher annual yield than  $N_0$  and  $N_{strat}$ . The impact of applying  $N_{40}$  and  $N_{20}$  on yield relative to not applying N ( $N_0$ ) was not consistent between sites, indicating that the legume mixture over-sown into kikuyu can impact the ideal fertilisation regime. Clover content tended to be promoted by the  $N_0$  and  $N_{strat}$  regimes, while lucerne content, particularly in the summer, was higher in the  $N_{40}$  regime. Further studies on the long-term impact of N fertilisation rates on the pasture production parameters of kikuyu-legume pastures should be undertaken.

## PLATFORM PRESENTATION: THE EFFECT OF NITROGEN FERTILISATION ON THE YIELD AND BOTANICAL COMPOSITION OF KIKUYU-BASED PASTURES

Charne Viljoen<sup>1,2\*</sup>, Janke van der Colf<sup>1</sup>, Pieter Swanepoel<sup>2</sup>

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Dairy production in the southern Cape commonly utilises kikuyu (*Pennisetum clandestinum*) and kikuyu over-sown with ryegrass (*Lolium multiflorum*). Due to the change in cultivation methods from tillage to minimum-tillage on these pastures, previous nitrogen (N) fertilisation guidelines may no longer be applicable. The aim of the study was to determine both the seasonal and annual effect of different N fertilisation regimes on pasture yield, botanical composition and agronomic N use efficiency (ANUE) of kikuyu-based pastures. The study was conducted on two sites characterised by two different pasture types viz. a pure kikuyu pasture (KIK) and kikuyu over-sown with annual ryegrass (KAR), on the Outeniqua Research Farm in the southern Cape. Five fixed nitrogen treatments, namely 0; 20; 40; 60 and 80 kg N ha<sup>-1</sup> ( $N_0$ ,  $N_{20}$ ,  $N_{40}$ ,  $N_{60}$ ,  $N_{80}$ ) were applied to each pasture site. A sixth treatment, a strategic application ( $N_{strat}$ ) based on maintaining soil water nitrate concentration at ca. 75 mg L<sup>-1</sup>, was also applied. Pasture dry matter (DM) yield (kg DM ha<sup>-1</sup>) was determined every 28 days prior to grazing, and N was applied after each grazing event, ca. 10 grazing events annually. Botanical composition was determined on a seasonal basis.

For the KIK pasture type, the total annual DM yield of  $N_{20}$ ,  $N_{60}$  and  $N_{80}$  was higher ( $P \leq 0.05$ ) than for  $N_0$  and  $N_{strat}$ , but similar ( $P > 0.05$ ) to  $N_{40}$ . During winter, the kikuyu content of  $N_{40}$  was lower ( $P \leq 0.05$ ) than for  $N_0$ ,  $N_{20}$  and  $N_{60}$ ; concurrently it had a higher proportion of volunteer ryegrass than all other treatments. Although voluntary legume content varied according to both treatment and season,  $N_0$  and  $N_{strat}$  had a higher content than the other N treatments during summer. The  $N_{20}$  treatment had a higher ANUE than  $N_{60}$  and  $N_{80}$  ( $P \leq 0.05$ ), but similar to  $N_{40}$  ( $P > 0.05$ ).

On the KAR pasture type,  $N_{20}$ ,  $N_{60}$  and  $N_{80}$  had a higher annual DM yield than  $N_0$  ( $P \leq 0.05$ ), but not  $N_{40}$  and  $N_{strat}$  ( $P > 0.05$ ). During winter, the kikuyu content was higher ( $P \leq 0.05$ ) in  $N_0$  than other treatments; while ryegrass content was lower ( $P \leq 0.05$ ). This is likely due to less competition from ryegrass when compared to  $N_{20}$ ,  $N_{40}$ , and  $N_{80}$ . Fertilisation rate did not affect ( $P > 0.05$ ) the kikuyu or ryegrass content of KAR during summer. During spring and



summer, the volunteer legume content was higher in treatments receiving  $N_0$  and  $N_{strat}$ . There was no significant difference between treatments in terms of ANUE.

Kikuyu and ryegrass content were affected by fertilisation rate during winter at both pasture sites, but not during summer on the KAR site. Higher volunteer legumes under  $N_0$  and  $N_{strat}$  regimes could impact the forage quality of pasture and require further investigation. Pasture DM yield tended to increase with increasing application rates in  $N_{20}$ ,  $N_{60}$  and  $N_{80}$ . However, the  $N_{40}$  treatment did not conform to this increase in yield, as its production was similar to  $N_0$ . The reason for the latter observation is not apparent. Future research should thus focus on quantifying long-term effects of N fertilisation regimes on soil N properties and pasture DM yield.

## PARALLEL SESSION B: PLANTED PASTURES: PRODUCTION SYSTEMS AND MANAGEMENT

**SESSION CHAIR: JOHN MUPANGWA**

*Tuesday, 25th July, 15:10 - 16:50*

**Venue:** Hongonyi (Wildebeest) and Xidzidzi (Honey Badger) Rooms

### PLATFORM PRESENTATION: DESIGNING DIVERSE FORAGE CROP MIXES FOR WEED SUPPRESSION

*Chloe MacLaren<sup>1\*</sup>, James Bennett<sup>1</sup> and Pieter Swanepoel<sup>2</sup>*

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Ecological niche theory suggests that monoculture crops and pastures may be vulnerable to weed ingression due to inefficiency in resource uptake. A single crop species takes up resources in a certain way, and so can access only a certain part of the overall resource base. Weeds are then able to invade by exploiting the remaining available resources. In contrast, a diverse crop mix could allow the crop to capture a greater proportion of the resource base, and thus reduce the resources available to weeds. This effect is expected to be greater if the crop mix consists of species that are functionally diverse, with different strategies for resource uptake. The objective of this research was to investigate whether a diverse forage crop was more effective at suppressing weeds than a monoculture, and to identify whether functionally diverse mixes were more effective than functionally similar mixes. Trials were undertaken on two farms in the Western Cape's winter rainfall region using mixes of legume, cereal and brassicas. Differences in height, growth form and root form were used to distinguish functionally diverse species, as these traits define a plant's spatial access to the key resources of light, soil moisture and soil nutrients. Seven forage crop treatments were trialed: two monoculture treatments, three four-species mixes (two functionally similar mixes and one functionally diverse mix), and two twelve-species mixes (one functionally similar and one functionally diverse). A bare ground control treatment was used to quantify weed pressure in the absence of a crop. Mixes were planted in 20 m x 4 m plots, in a randomised blocked layout with three replicates of each treatment. The relative cover of each crop species and each weed species was recorded once per month, and biomass samples were collected in the middle and at the end of the growing season. To identify whether capture of key resources mediated the relationship between different forage crop mixes and weed suppression, indicators of light, moisture and soil nitrogen uptake were also measured throughout the season. This study is ongoing, with a second year of trials underway, but preliminary results indicate that rates of resource uptake by individual crop species are more important than overall functional diversity. Species that can capture resources more rapidly confer more capacity to suppress weeds than a diversity of species. Rapid uptake of the limiting resource, in this case moisture, may be most important to weed suppression. However, where several species with rapid resource capture can be included in a mix, then there is some evidence that diverse mixes outperform monocultures. Overall, this study shows that resource capture rates are an important consideration in choosing forage crops for weed suppression, and that diversity only confers a benefit when all crops in a mix are capable of rapid resource capture.



## PLATFORM PRESENTATION: INFLUENCE OF SOCIAL DYNAMICS ON INTENSIFICATION OF FODDER INNOVATIONS IN COMMUNAL AREAS OF LIMPOPO PROVINCE

*Ntuweseni Mmbi<sup>1</sup>, Florence Nherera-Chokuda<sup>2\*</sup>, Claude Muya<sup>2</sup>, Vincent Maphahla<sup>1</sup> and Grace Makgobatlou<sup>1</sup>*

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Inefficiencies in resource utilization and unpredictable weather affects the performance of livestock in communal areas, where the native pastures are the main nutrient source. The Cactus Innovation Platform (ARC and Limpopo Department of Agriculture) aimed to intensify livestock production through increased dairy cattle nutrition farms, and income security on smallholder. The cactus innovation is aligned to the global theme on “food and nutritional security, economic development and sustainable natural resource management”. Farmer groups (Vh1-owned dairy cattle, Vh2-no dairy cattle, Sk1-cooperative without dairy cattle and Sk2- cooperative with dairy cattle) in two districts of Limpopo province established dryland spineless cactus pastures in 2015. Each group planted three fodder varieties (c1-upright, c2-spreading, c3-upright habit) selected for the project. Growth measurements and biomass were assessed yearly and potential income estimated. The Sk2- pasture was neglected and data excluded. Variety c3 out performed c1 and c2 in both years. Mean plant height at 12 months was 0.75 m and maximum 1.1 m; width ranged between 0.4 to 1.4 m and mean of leaf number was 26. Growth performance also differed ( $P < 0.001$ ) in year 2; c3 leaf numbers/plant exceeded 100. Varieties c1 and c2 had means of 9 and 21 leaves/plant compared to c3 with 59 leaves. Mean plant heights were 0.68, 1.1 and 1.48 m, and width 0.6, 1.2, 1.8 m for c1, c2 and c3, respectively. Plant height and width were significant predictors of leaf numbers ( $R^2 = 0.81$ ;  $R^2 = 0.79$ ;  $P < 0.001$ , respectively). Estimated wet biomass yields differed ( $P < 0.001$ ) and were 5.9, 10.8 and 44.5 tons for c1, c2 and c3, respectively. Total estimated income based on 60% harvest/plant in year 2 and prevailing market rates were R13.32, R15.48 and R34, 56 (c1, c2, c3). Vh1 had the best performing pasture but no sales in year1, Sk1 had sales in year1, which was impetus for further investment and Vh2 was least. This scenario indicates that direct financial gains influenced farmer inputs into a pasture system. Both Vh1 and Sk1 had no dairy cattle whilst Vh2 and Sk2 had dairy cattle and therefore a direct need for fodder and yet farmer behaviour was inconsistent with this need. It is important to investigate why dairy cattle owners were not competitive in fodder production compared to non-dairy farmers.

## PLATFORM PRESENTATION: YIELD AND CHEMICAL COMPOSITION OF NATIVE PASTURES IN SIX SEMI-ARID COMMUNAL GRAZING LANDS LOCATED IN THREE SOIL TYPES: EFFECT OF DISTURBANCE AND SEASON

*Ayanda Kwaza<sup>1</sup>, Solomon Tefera<sup>1\*</sup>, Victor Mlambo<sup>2</sup> and Keletso Mopipi<sup>1</sup>*

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Within communal areas in semi-arid and arid areas in South Africa, grazed rangeland is virtually the sole source of feed for both domestic and wild ruminants. Low forage production and deteriorating conditions of rangelands have been widely reported under continuous grazing practised in many extensive of these communal lands. In the Eastern Cape province, there is a lack of adequate data on the spatial and temporal distribution of forage biomass and nutrients, and the response of these variables to exclosures. The objectives of the current study were therefore to determine the yield potential and mineral (P, K, Ca, Mg, Fe, Cu, Zn and Mn) content of grasses i) along a distance gradient from the fence-line, and ii) between enclosed (protected) and open (unprotected) grazing lands characterised by three soil types. The areas were protected for two growing seasons. In each communal area, six transects radiating out from the fence line along the main road were established (length 1-2km). Each transect was divided to form sub-transects, with initial points at near (0-100 m), middle (> 100 - ≤ 300 m) and far (> 300 m) sites/distances from the fence line depending on the vegetation change. Grass samples were collected from the protected and unprotected plots distributed across the near, middle and far sites. In all soil types, forage yield showed variation ( $P < 0.05$ ) between distance gradients. Yield differed significantly ( $P < 0.05$ ) between protected and unprotected in all soil types. Exclosures, distance from the fence and season affected ( $P < 0.05$ ) K, Ca, Mg and Mn contents of harvested forages. The study indicated that forage availability, and the resultant low nutrient intake, may limit animal production in the communal areas investigated and subsequently, most periods of the year. Therefore, resting these rangelands for at least two years may improve the forage production and nutrient intake.



**SESSION: TREE- GRASS INTERACTIONS****SESSION CHAIR: JULIUS TJELELE**

Wednesday, 26th July 2017, 08:00 - 10:00

**Venue:** Mhelembe (Rhino) Hall**PLATFORM PRESENTATION: COPPICE DYNAMICS OF TWO COMMON SAVANNA TREE SPECIES UNDER DIFFERENT POST-HARVEST TREATMENTS**

Wayne Twine\* and Christopher Rankin

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Most savanna tree species coppice (resprout) after being damaged. This ability to regenerate vegetatively is key to the resilience of these disturbance-prone ecosystems. It is particularly important in the context of increasing pressure being placed on savannas by humans, through harvesting of trees for fuelwood. However, remarkably little is known about coppice dynamics in savannas. This project sought to address this knowledge gap by investigating the influence of different post-harvest treatments on the coppice response of two common savanna tree species. This was achieved in an experiment in which *Terminalia sericea* and *Dichrostachys cinerea* trees (108 each) were felled at 25 cm and then exposed to one of four coppice harvest treatments. The treatments were: 1) 'harvest', in which all new regrowth was harvested monthly, 2) 'largest', in which coppice shoots were pruned monthly to leave only the largest shoot, 3) 'dominance', in which any shoot reaching a diameter of 2 cm was harvested in order to interrupt the establishment of apical dominance, and 4) 'control', in which no coppice shoots were harvested. The experiment was conducted in three sites at the Wits Rural Facility in the Limpopo province lowveld, and commenced in July 2015. A random sample of nine trees per species was exposed to a treatment in each site. This yielded a total sample of 27 trees per treatment per species across the sites. Coppicing stumps were protected from browsing by a cylindrical chicken mesh cage. Each month, the following measurements were made before applying the relevant treatment: diameter and length of each coppice shoot, number of coppice shoots, and position of each shoot (stump collar, side of stump, or rootstock). Harvested shoots were weighed in the lab. Most cut stems coppiced vigorously in both species, and stump mortality rate after felling was low. Few shoots in the 'dominance' treatment reached the 2 cm threshold in the first 24 months, so this treatment was similar to the control in most respects. The mean number of shoots produced by pruned or totally harvested stumps was significantly higher than that of the control in both species in the first year. However, pruning hastened the onset of apical dominance, especially in *T. sericea*, in the second year, so that by March 2017, many stumps did not produce any new shoots after the pruning. Pruning promoted shoot growth, with the single 'largest' shoots having significantly higher mean diameters and lengths than shoots in the control in both species. The cumulative shoot biomass produced by stumps in the 'harvest' treatment was equal to roughly 50% of the standing shoot biomass on the control stumps in *T. sericea*, and 70% in *D. cinerea*. Most stumps exposed to the monthly harvest continued to coppice vigorously, but shoot production shifted from being predominately from the stump, to coming mainly from the rootstock over time. This could be due to exhaustion of either stored reserves or meristems in the stumps. This experiment is ongoing, and will yield useful data on longer-term coppice dynamics in these species.

**PLATFORM PRESENTATION: COMPARING THE EFFECTS OF CANOPY COVER INCREASE ON GRASS BIOMASS BETWEEN *DICHRSTACHYS CINEREA* AND *TERMINALIA SERICEA***

Tilly Randle\*, Nicola Stevens and Guy Midgley

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Woody encroachment is occurring globally. The vast expanse of open grassy ecosystems which dominate Africa are particularly vulnerable to encroachment. Encroached grassy ecosystems experience changes in ecosystem functioning and service provisioning, and we need to accurately predict the impacts on these systems. One of the most important ecosystem services in these systems is the provisioning of grazing, yet encroachment has the potential to reduce grass production through the shading of otherwise shade intolerant grasses. However, encroaching species can affect grass production differently, depending on the architecture of the tree canopies. This study therefore aimed to compare the effects of two structurally different encroaching species (*Dichrostachys cinerea* and *Terminalia sericea*) on grass biomass. I used their canopy architectural traits to predict their different impacts on grass biomass. Data collection was conducted in a savanna conservation area in Zimbabwe. Nine transects down



gradients of encroachment were made in patches dominated by both *D. cinerea* and *T. sericea*. Canopy cover was a strong predictor of grass biomass and with increasing canopy cover grass biomass was significantly reduced by both species. However, the shrubby appearance of *D. cinerea*, typified by a large crown diameter and crown height and a small crown base-height, created more shade and lower grass biomass than *T. sericea* for the same tree density. These traits can be used to predict the impact of an encroaching species on the grass biomass. The findings show that encroachment of *D. cinerea* has the potential to cause a regime shift of an open system to a closed system as a result of its extensive canopy cover.

### PLATFORM PRESENTATION: THE EFFECTS OF ENVIRONMENTAL FACTORS ON *SERIPHIMUM PLUMOSUM* L. ENCROACHMENT SUSCEPTIBILITY

Gilbert Pule<sup>1,2\*</sup>, Michelle Tedder<sup>2</sup> and Julius Tjelele<sup>1</sup>

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A complex interaction of environmental (abiotic and biotic) factors is responsible for the spread of unpalatable *Seriphium plumosum* L. in encroached South African grassland. The aim of this work was to explore whether: site (encroached versus un-encroached), slope position (top, mid and bottom), utilization level (over, under, optimal and selective), erosion type (terraces, pedestal, crustbrokenness, rills and gullies) and their interaction were discriminated in terms of 1) abiotic: altitude, aspect, catena gradient, soil structure (sand and silt) and fertility (Soil organic carbon (SOC), Total nitrogen (TN), Phosphorus (P), calcium (Ca), Magnesium (Mg), Potassium (K), Sodium (Na)), and 2) biotic variables: Basal cover and Veld Condition score. Data was analysed using Wilks' Lambda discriminant analysis. Site, erosion type and slope position indicated a significant effect on biotic and abiotic factors ( $P < 0.05$ ). However, utilization level was not significantly different ( $P=0.386$ ) on abiotic and biotic factors. An interaction effect of site x slope and site x utilization level revealed a significant difference in abiotic and biotic variables ( $P < 0.05$ ). The first functions (F1) explained 100% of the differences amongst sites, and best discriminated abiotic and biotic variables studied. Calcium had the highest relative weight (0.6446) in the expression of the differences between all variables. The functions (F1 and F2) explained 88% of the differences amongst erosion types, with (P: -0.605 (F1)) and (K: 0.606 (F2)) having relatively higher weight in the expression of the relationship between all variables. The first and second functions explained 100% of the differences amongst slopes, with rockiness (F1: 0.550), having relatively higher weight in the expression of relationship between all variables. In an interaction effect of site x slope position and slope position x utilization level, the functions explained 87.84% and 63.65 % respectively, of the differences between all variables. During interaction effect of site x slope position; slope gradient (F1: 0.802), stones (F1: -0.527 and F2: -543), silt (F1: -0.624), and Organic carbon (F1: -0.567) had relatively higher weight in expression of the differences between variables. During interaction of site x utilization level, calcium (F1: -0.612) had relatively higher weight in the expression of the differences variables. There was a clear discrimination between sites where *S. plumosum* was present at the top (F: -5.880 and F2: -0.798), present at the bottom (F1: 2.821 and F2: -2.157) and absent at the bottom (F1: 2.821 and F2: -2157). Furthermore, over-utilized site with no *S. plumosum* (F1: -2785) were completely discriminated from selectively (F1: 0.689 and F2: -1.724), optimal (F1: 0.630 and F2: 1.350) and under-utilized sites. However, slopes and utilization levels in sites where *S. plumosum* was present were not completely discriminated. This study revealed that over-utilized, bottom slopes are more likely to be invaded by *Seriphium plumosum*.

### PLATFORM PRESENTATION: WOODY PLANT DENSITIES, COVER, HEIGHT CLASS DISTRIBUTION AND THEIR USES IN SIX SEMI-ARID COMMUNAL GRAZING LANDS LOCATED IN THREE SOIL TYPES

Victor Mlambo<sup>1</sup>, Ayanda Kwaza<sup>2\*</sup> and Solomon Tefera<sup>2</sup>

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This study investigated focal point (fence) use effects on the woody vegetation cover and encroachment level and on their indigenous utilisation. Six communal grazing lands, two in soil type A, three in soil type B, and one in soil type C, were selected. The woody vegetation survey was conducted at near, middle and far from the fence. *Acacia karroo*, *Coddia rudis* and *Ehretia rigida* were the dominant woody species in all areas. A total of 27 woody plant species were identified. Based on the opinions of local communal farmers, 74% of the identified encroaching woody



plants were utilised by livestock. In soil type A, *A. karroo* density was affected by distance from the fence ( $p = 0.0105$ ), while the density of bush clump was low ( $p < 0.05$ ) at near. In soil type B, the lowest and highest ( $p = 0.0519$ ) of *C. rudis* densities were recorded at near and middle from the fence, respectively. The density of seedlings and young trees was affected ( $p < 0.05$ ) by distance gradient from the fence. In soil type C, the highest and lowest ( $p = 0.0711$ ) of *C. rudis* were recorded at far and near zones from the fence, respectively. Inconsistent results were found on the piosphere formation of total woody density and cover. Nevertheless, large areas in these grazing lands had a bush cover of  $> 48\%$ . The levels of woody plant encroachment recorded in this study were expected to impact ruminant production. Therefore, it is suggested that specific management strategies should be adopted and practised to help overcome woody plant encroachment, because it causes a significant reduction in the extent of high quality communal grazing lands. Therefore, implementation of woody plant control measures in all encroached areas is proposed in order to restore the productivity of communal grazing lands in the long term.

**PLATFORM PRESENTATION: EFFECTS OF *PTERONIA INCANA* (BLUE BUSH) INVASION ON GRASS BIOMASS PRODUCTION, SPECIES DISTRIBUTION AND SOIL CHEMICAL CHARACTERISTICS UNDER SYSTEMATIC CONTROL METHODS**

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*Pteronia incana* (Blue bush) invasion of communal rangelands in Ngqushwa district of the Eastern Cape has emerged as a serious problem, raising the need for the development of control methods to improve the ecosystem. The objective of this study was to investigate the invasiveness, control methods and effects of *Pteronia incana* on grass species distribution, herbage production and soil chemical characteristics. The experiment was conducted in a 270m x 100m trial site that was established in 2014. The site is located at 33°14' 287"S, 027° 08' 284"E and is 322m above sea level. The area was divided into 3 open (grazing) and 3 fenced (rested) plots, each measuring 45m x 100m and were established down a slope gradient. Each plot was divided into four equal subplots to apply the control treatments. Therefore, the trial layout was a stratified block experiment of four treatments replicated three times. The four control treatments were chopped and rested (CR), rested without chopping, (RWOC), grazed and chopped (GC), grazed without chopping (GWOC). The species composition was not affected ( $P > 0.05$ ) by the treatment but most of the grasses were perennial species. The herbage height and basal cover had greater values ( $P < 0.05$ ) under rested and chopped (CR), followed by grazed and chopped (GC) treatments. Grass biomass production and essential nutrients showed greater concentrations ( $P < 0.05$ ) under the CR treatment. It was concluded that chopping and resting (CR) treatment was the most effective treatment in controlling *P. incana* invasion and allowing recovery of the herbaceous vegetation, though it is suspected that after some time the shrub may re-establish from the soil seed bank.

**PLATFORM PRESENTATION: THE EFFECT OF FIRE, FROST AND SIMULATED GRAZING ON THE SURVIVAL OF *VACHELLIA SIEBERIANA* (FORMERLY *ACACIA SIEBERIANA*) SEEDLINGS ALONG AN ALTITUDINAL GRADIENT**

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Throughout the world grasslands frequently alternate with savanna. The transition between the two biomes can be abrupt or gradual. The potential mechanisms that create the boundaries between grassland and savanna have been vigorously debated: fire and/or herbivory being the most frequently cited. The vegetation along the Drakensberg escarpment of KwaZulu-Natal consists largely of high altitude grasslands, with extensive savanna along the lower reaches and with pockets of forest reaching up into the higher altitudes. Both the grasslands and the savanna are subjected to fire and herbivory in varying degrees. Over the last few decades, the typical savanna woody species have been migrating into what were once pure grasslands. Although these changes have been well described, once again little is known about what is driving these changes. In our study, we observed the increase in *Vachellia sieberiana* into grasslands along an altitudinal gradient along Van Reenen's Pass (KwaZulu-Natal), using historic ground and aerial photographs. We set up three field trials along the altitudinal gradient, one at 1 100m, the second at 1 300m, the third at 1 700m. At these sites, we investigated the effect of fire, frost and simulated grazing of the grass sward on survival of *Vachellia sieberiana* seedlings. We also conducted pot trials with *Vachellia sieberiana* seedlings at the NM Tainton Arboretum at the University of KwaZulu-Natal in Pietermaritzburg to determine the effects of black and hoar frost on the seedlings. We expected that both fire and frost would have a negative effect on seedling survival and that simulated grazing would have a positive effect on seedling survival. Our preliminary findings will be discussed.

**STANDARD POSTER VIEWING SESSION**

Wednesday 26 July 2017, 10:00 – 11:00

**TREE-GRASS INTERACTIONS****POSTER PRESENTATION: THE EFFECT OF TEMPERATURE AND GROWTH MEDIUM ON GERMINATION POTENTIAL OF UNPALATABLE *SERIPHIMUM PLUMOSUM* L. SEEDS IN GROWTH CHAMBERS**

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The first step in understanding the shift from grasses to woody plant domination is through studying how woody plant seedlings establish in grasslands. This study was conducted to investigate the effect of temperature (15°C, 20 - 30°C and 25°C) growth medium (Potassium Nitrate and water) and their interaction on germination potential of unpalatable *Seriphium plumosum* seeds in the growth chamber. The study revealed a significant effect of temperature ( $P = 0.0503$ ) and growth medium ( $P = 0.0403$ ) on *S. plumosum* germination. Interaction of growth medium and temperature did not have an effect on *S. plumosum* seed germination ( $P > 0.05$ ). Seeds at 15°C temperature had a significantly higher ( $17.50 \pm 4.78$  (SE)) germination than seeds grown at temperatures of 20 - 30°C ( $9.20 \pm 2.00$ ) and 25°C ( $7.50 \pm 2.81$ ). However, *S. plumosum* seed germination did not differ between temperature of 20 - 30°C and 25°C. *Seriphium plumosum* seeds grown in water had higher ( $15.00 \pm 3.63$ ) germination than seeds grown with potassium nitrate ( $7.77 \pm 1.69$ ). This study revealed that higher temperatures in growth chambers discourage *S. plumosum* seed germination. This suggests that increasing soil temperatures caused by overgrazing does not alone facilitate *S. plumosum* encroachment in rangelands. More research on the factors that underlie *S. plumosum* seeds germination is required to assist in controlling its spread in grassland communities.

**POSTER PRESENTATION: EFFICACY OF DIFFERENT CONTROL METHODS ON *SERIPHIMUM PLUMOSUM* ON DEGRADED RANGELAND OF MPUMALANGA PROVINCE**

Thabile Mokgakane\*, Norman Magoro, Jan Theron, Collen Rabothata and Oupa Keromecwe

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Encroachment of *Seriphium plumosum* in natural grassland is a severe problem in most parts of Mpumalanga province. The plant is a small multi-stemmed woody shrub that grows to an average height of 60 cm. Through visual observation and monitoring this species does not occur in lower rainfall areas. However this plant acts as a successful protective measure against grazing by making it unpalatable and thus providing no fodder. Poor rangeland management ensures the retention and the survival of these plants. Generally rangeland encroached by *Seriphium plumosum* can experience a reduction in primary grass production by up to 75%. The threat of this is that profitable forage can be turned into a degraded piece of land on which sustainable cattle farming is no longer possible. Although heavy stocking rate can be a part of poor rangeland management, it is not directly the cause of increase of this plant. In spite of all efforts to make farmers aware of the disadvantages of the plant there is a huge tardiness to realize how serious the problem really is. The aim of this study was to determine the efficacy of different control methods of *Seriphium plumosum* which are economical and user friendly for farmers. The study was conducted on-farm at Holland farm 45 km away from Ermelo town in the 2015 -2016 growing season. It consisted of three treatments which are chemical, mechanical and salts methods. Different camps infested with *Seriphium plumosum* were selected and 5m X 5m plots, well fenced and replicated three times, were laid out. Three treatments were applied in each different plot. Single plant height and density within the blocks were counted and measured. The treatments applied include: chemical (foliar spraying), mechanical (hand hoe) and salts (granular). Plots subjected to the different treatments showed a positive response and efficacy of treatments with reduced densities of *Seriphium plumosum* plants the following growing season. Success rates of 100%, 95% and 88% were observed on hand hoe, mechanical and salt treatments respectively. Plant diversity was also observed and there was low plant diversity on mechanical treatment where disturbance showed the disappearance of climax grasses such as the *Themeda triandra* with high density and abundance of *Eragrostis spp* grasses, while chemical and salts treatments had a minimum disturbance of plant diversity.



## POSTER PRESENTATION: INVASION OF *PROSOPIS* SPECIES ALONG RIPARIAN AREAS OF THE MOLOPO RIVER, NORTH WEST PROVINCE, SOUTH AFRICA

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Woody plant species are invading the riverine systems of the Molopo River, bordering South Africa and Botswana. In this study, we determined the invasion of the 'problematic' *Prosopis* in selected sites of the Molopo River. This study was conducted on a commercially-owned farm (Black Heat Farm) and in a communal area (Bray). The total number of woody plant species determined in Bray was 4 955 TE/ha of which 4 463 TE/ha (90 %) of the density was *Prosopis* species. However, Black Heat Farm recorded a total density of 10 742 TE/ha woody plant species, where *Prosopis* species contributed a density of 2 029 TE/ha (18.9 %). Other woody species present in the study area included *Melia azedarach*, *Vachellia erioloba*, *V. hebeclada*, *Senegalia mellifera*, *Grewia flava* and *Ziziphus mucronata*. Furthermore, the total densities of woody plants determined in the reference sites of this study were 412 TE/ha in Bray Village and 2 462 TE/ha in Black Heat Farm. *Prosopis* tree densities were determined at 208 TE/ha (50.5 %) in Bray reference site and 1 596 TE/ha (64 %) in the Black Heat Farm reference site. The results of this study indicated that *Prosopis* contributed the most to the woody plant invasion in Bray. However, the invasion of *Prosopis* in Black Heat Farm is still at an early phase. This study recommended an eradication of *Prosopis* species in the study area.

## RANGELAND ASSESSMENT AND MONITORING

### POSTER PRESENTATION: SCIENTIFIC GRAZING CAPACITY NORMS FOR THE NORTH WEST PROVINCE

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Veld degradation in the North West province is a reality. There are several reasons for this degradation but one of the most important reasons is an overestimation of the grazing capacity. Farmers often ignore the grazing capacity figures of DAFF because one figure is often used for a large area, irrespective of the veld condition and the rainfall regime. The aim of the study was to determine the fodder production and thus also the grazing capacity in land types that have more than 50% veld. The study was conducted in seven (7) land types of the North West province over a period of 23 years. Firstly a degradation gradient was constructed for each landtype using the CA and DCA ordinations within the CANOCO package. Veld in a good, medium and poor condition was identified for each landtype. Fifty (50) enclosure pins were placed in each veld condition in each landtype. Before placement of the enclosure pins the area was cut clean at a height of 5cm. Total herbaceous production was done at the end of the growing season at all the sites using the Dry Weight Rank Method of T'Mannetje & Haydock (1963). The grass species were divided in four palatability classes, namely Highly Desirable (HD), Desirable (DE), Less Desirable (LD) and Undesirable (UD). These classes were used in the following formula to calculate the grazing capacity:  $GC = 10 / ((HD) \cdot 0.35 + (DE + LD) \cdot 0.2 + (UD) \cdot 0.05) \cdot 365$ . From the results we were able to derive nine (9) grazing capacity figures for each landtype, e.g. Table 1.

**Table 1** The production as well as grazing capacity averages for the Potchefstroom district.

Bc25		RANGELAND CONDITION					
RAINFALL		GOOD		MEDIUM		POOR	
		PROD	GC	PROD	GC	PROD	GC
GOOD	882.7	5668.6	2.6	6173.3	2.9	4064.5	5.3
AVERAGE	567.7	3217.4	4.5	2916.4	5.3	1967.3	14.1
POOR	473.4	2674.3	5.8	2536.4	6.7	1461.9	21.8



From the results regressions models were used to develop simple prediction models for herbaceous production as well as grazing capacity. The results were also used to calculate the percentages of the palatability classes for the different veld conditions in the different landtypes. From the results it is clear that it would be wrong to use only one grazing capacity figure for a landtype because veld condition and rainfall have a marked influence on production and grazing capacity.

We conclude that it is possible to calculate grazing capacity figures for different rainfall scenarios as well as different veld conditions. It is also possible to use the simple prediction models in the relevant landtypes to calculate damage compensation caused by accidental or deliberate veld fires.

**POSTER PRESENTATION: ECOLOGICAL MONITORING TO INFORM MANAGEMENT OF SEMI-ARID AFRICAN SAVANNAS: AN ASSESSMENT OF TECHNIQUES ACROSS THE WILDLIFE-LIVESTOCK INTERFACE AND THE EVALUATION OF A LONG-TERM DATA SET**

*Graeme Wolfaard<sup>1\*</sup>, Jacques van Rooyen<sup>2</sup> and Mike Peel<sup>3</sup>*

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It is critical for savanna rangeland managers to make management decisions based on the objective measurement of relevant ecological indicators. This ensures that, as far as possible, unintended (undesirable) consequences are avoided and that long-term productivity and sustainability of our rangelands is not compromised. We briefly assess a number of rangeland monitoring techniques taking into account efficiency (time and cost) and usefulness in achieving the objectives of the assessment across multiple land uses. We then illustrate the use of identified appropriate techniques for determining the impact of environmental (bottom up) and management (top down) variables on the identified critical response variables and their usefulness in making management decisions using long term data sets (up to 25 years in some instances) from a number of Lowveld savannas with different objectives and under differing management regimes.

**POSTER PRESENTATION: A COMPARISON OF THE BELT TRANSECT AND ADAPTED POINT-CENTRED QUARTER SAMPLING APPROACHES TO ASSESSING WOODY SAVANNA VEGETATION**

*Cobus Botha<sup>1\*</sup>, Winston Trollope<sup>2</sup>, Lynn Trollope<sup>2</sup>, Ross Goode<sup>2</sup>, Michelle Keith<sup>2</sup> and Jeanrick Janse van Rensburg<sup>2</sup>*

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Savannas are an important component of terrestrial ecosystems and support rural livelihoods by hosting a large proportion of the livestock and wildlife biomass. Woody plant density and composition are important variables to rangeland managers because of their impact on grass production, for detecting critical shifts in plant communities over time and for estimating carrying capacity. Assessing the woody layer should therefore aim at describing the species composition, plant density, physiognomic structure and phytomass production for ungulate usage. Different approaches to quantify the woody layer in terms of density and productivity yield variable results. The need to evaluate and adapt techniques to find the optimum survey approach for a specific situation therefore becomes an important rangeland management objective. Plant density and woody vegetation structure can be assessed using either fixed area techniques or plot-less distance methods. Belt transects and Adapted Point Centred Quadrats (APQCs) are fixed area and distance sampling methods respectively which are commonly used by rangeland scientists. Unfortunately an objective comparison of the accuracy of these methods as predictors of African savannah woody vegetation dynamics is rarely found in the scientific literature. The purpose of this study was to do an objective comparison between the accuracy of the belt transects and APCQ survey methods for assessing woody plant density, phytomass, structure and species composition when evaluated against a total count of woody plants in three preselected density classes. The study was conducted in the humid savannas of north-eastern KwaZulu-Natal. Sites with < 1 000 TE/ha, between 1 000 and 2 000 TE/ha and greater than 2000 TE/ha were preselected. Estimates of woody plant parameters were collected from 10 APCQ quadrats and 4 belt transects at each site and compared to data collected from a representative total assessment area of 6 400m<sup>2</sup>. Results indicate belt transect and APCQ as comparative predictors of plant density and phytomass when compared to that of the total assessment area with accuracies ranging between 70% and 99% throughout the density classes. Techniques were sufficiently sensitive to place sites into preselected density and phytomass classes, therefore addressing the demands from a bush encroachment perspective. Both techniques accounted for 50% accuracy in species composition, however, dominant



species are well accounted for. Both sampling approaches resulted in similar comparative results for predicting the structural composition of tree and shrub vegetation. However, the APCQ technique were insensitive in differentiating between on-going and very recent encroachment events because of its broad (< 2m) preselected height class. The belt transect sampling approach was more time efficient in the < 1 000 and between 1 000 – 2 000 TE/ha phytomass density classes whilst the APCQ sampling approach was more time efficient the > 2 000 TE/ha class. Whilst the current dataset is inadequate for rigorous statistical analysis, preliminary results indicate that the belt transect and APCQ sampling approaches provide comparative estimates of vegetation dynamics when evaluated against an actual total count tree and shrub surveys in the humid Zululand savannah. Both techniques will provide the land manager with adequate estimates of plant density, phytomass, dominant species and structural composition.

## RANGELAND FIRE ECOLOGY

### POSTER PRESENTATION: EFFECTS OF FIRE HISTORY ON GROUND DWELLING ARTHROPODS' ABUNDANCE, SPECIES RICHNESS & DIVERSITY IN AN ARID WOODLAND SAVANNA, WATERBERG PLATEAU PARK, CENTRAL NAMIBIA

*Nekulilo Uunona<sup>1\*</sup>, Dave Joubert<sup>1</sup> and Kai Schutte<sup>2</sup>*

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The response of ground dwelling arthropods to fire is a controversial topic in most ecosystems worldwide. A critical gap in our understanding remains, in that we know little about what fire history does to arthropods especially in the Namibian woodland savannas, despite the fact that fire has been used there as a management tool for many years. The study aimed to compare the effects of fire history on ground dwelling arthropods' abundance, species richness and diversity in the Waterberg Plateau Park, Central Namibia. The study was done in 4 fire zones with different fire histories. 2A: burned 3 years ago; blocks 1A, 2B and 1B burned 4, 16 and 26 respectively. The survey used pitfall traps. Six existing line transects (200 m) randomly selected were surveyed in each of the fire zones. Data was collected at 40 m intervals along each transect. Each transect had five pitfall traps and each fire block had 30 pitfall traps. A pitfall trap (500 ml clear plastic cup) was placed into the soil that was dug with a shovel and covered at ground level (rim flush with the soil). The cup had saturated salt water to prevent insects from escaping and preserving them afterwards before collection. Pitfall traps were emptied and collected after 3 days. The study combined each of the 5 cups in one transect (sample) to have a sample size of 6. Arthropod diversity was analysed using Shannon index and One way ANOVA was used to test for significant differences in diversity indices (H') and species richness among the different fire blocks (1a, 1b, 2a, 2b). Species composition was analysed using Ordination. A total of 1 755 individuals were collected and sorted. Of these, 96% were Insecta, 3% Arachnids and 1% Myriapoda and they represented 13 taxonomic orders. The survey collected 99 morpho species. The most abundant Order was Hymenoptera 62.6% (of which 97% were ants), Coleoptera 25.5%, (of which 60% were a common Tenebrionidae species), Orthoptera 3.1%, Blattodea 2.3%, Araneae 1.9%, Diptera 1.1%, Centipede 0.8%, Solifugae 0.6%, Hemiptera 0.6%, Lepidoptera 0.5%, Scorpions 0.4%, Mantodea 0.2%, and Isoptera 0.1% respectively. From this study, Arthropod diversity was unaffected by burning. Species composition revealed that litter was the main driving variable with a significant effect towards treatments burned 16 and 26 years ago. Current fire regimes have inconsistent and little effects on overall ground dwelling arthropod diversity but have clear trends (decline with increasing time since last burn) on overall ground dwelling arthropod abundance and species richness. There were low similarities among the treatments but not all species were a subset of similar species in other treatments, some species were unique in different treatments so each fire treatment at Waterberg Plateau Park is important and unique in terms of ground dwelling arthropod species composition. The management at the Waterberg Plateau Park should conserve all treatments to maximise beta diversity.



## POSTER PRESENTATION: IMPACTS OF HEAVY GRAZING AND FIRE ON ABOVEGROUND NET PRIMARY PRODUCTIVITY IN A HIGHVELD GRASSLAND

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Fire and grazing are two critical disturbances that shape grasslands. These disturbances interact and play an important role in the response of aboveground net primary productivity (ANPP) of grasslands. Grazing affects fire by reducing the accumulation of fuel through consumption and trampling of biomass which reduces the likelihood and intensity of a burn the following season. Fire in turn can remove low quality and older forage which allows for post fire growth of better forage quality. Thus, grazing pressure tends to be greater in recently burned areas compared to those with greater time since a burn, as grazers are attracted to this post fire flush. Heavy grazing appears to result in two different ecosystem states; a degraded state and a state of increased primary productivity. The objective of this study was to compare the ANPP of a frequently burned and heavily grazed site (a firebreak) to the adjacent area with a history of lower levels of fire and grazing and to substantiate if grazers select recently burned patches over the surrounding unburned areas. In so doing we aimed to have a better indication of the land condition of the firebreak and its ecosystem services. We conducted a movable enclosure experiment for six months during the rainy season from November 2015 to May 2016 to measure the response of ANPP to the two treatments. Camera traps were set up from January to May 2016 to record and identify species to monitor grazer preference. There was a significant difference in daily grazer biomass between the two sites, with a greater grazer biomass at the burned site. Furthermore, greater grazer selectivity for the burned site was also established. There was a positive but weak correlation between monthly ANPP and monthly rainfall for both sites. Although the firebreak is burned annually, more sparsely vegetated and water stressed, the total annual ANPP was nearly double at this site compared to the unburned site. As expected, the burn would have attracted grazers largely due to the new forage with greater nutrient content. ANPP was greater on the burn, as grazing optimisation is likely to have occurred as a result of the greater grazing pressure on the burned site. Thus, the firebreak is not considered to be in a degraded state; prompting reconsideration of how we define “degraded” rangelands. This may have important implications with regards to the management of grassland systems where small patches of frequent fires may be sustainable in terms of ecosystem services.

## LIVESTOCK DIET AND NUTRITION

### POSTER PRESENTATION: ASSESSING DIET SELECTION, PREFERENCES AND GRAZING PARAMETERS OF HERDED SHEEP IN THE SUCCULENT KAROO BIOME IN SOUTH AFRICA

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Semi-arid rangelands in South Africa are seen as heterogeneous landscapes with high temporal and spatial plant diversity allowing herbivores to make complex food consumption choices. Semi-arid rangelands are climatically stressed yet small-stock production is the main livelihood strategy used by farmers in these areas. This study provides information on the day-to-day foraging patterns of herded sheep in the semi-arid communal rangeland of Steinkopf focussing on: (1) What are the most selected forage species of herded sheep in the Steinkopf communal rangeland? (2) What are the most preferred forage species of herded sheep in the Steinkopf communal rangeland? (3) How do grazing parameters and distributions compare between sheep herds during the wet season in Steinkopf? (4) How do the herders' perceptions of forage species compare to livestock preference in the Steinkopf rangelands? Direct observations of grazing sheep from 12 different small-stock herds were carried out in the Steinkopf communal area. Herds were comprised of either only sheep breeds or mixed goats and sheep. This study was conducted in the wet season, which is the active growing season of annual plant species. Grazing parameters such as distance and speed of grazing were calculated and habitats in which they grazed were noted. Overall, 86 plant species were eaten by sheep and a total of 17 plant species were preferred. The herded sheep behaved as opportunistic foragers by grazing with a feeding preference for annual plants which include grasses and ephemerals. The sheep did utilise non-succulent and leaf succulent perennial plants, making them extremely flexible in their diet during the winter season. Leaf succulents such as *Ruschia* sp. and *Cheiridopsis denticulata* were common in the diets of sheep, however most succulent plants were ignored. Herds that only comprised of sheep walked significantly shorter distances than herds





which were comprised of goats and sheep. Herders are aware of palatable and unpalatable plant species found in the rangeland, as well as toxic species. The availability of food items in the Steinkopf rangeland has an influence on the food choices made by sheep. Sheep are essentially seen as grazers, but nevertheless fit the role of being intermediate feeders. Appropriate grazing management strategies should be implemented to ensure the survival of the livestock and this could contribute to biodiversity conservation of the rangeland.

### POSTER PRESENTATION: BIOACTIVE COMPOUNDS AND RUMEN POTENCY OF LEAF EXTRACTS OF SELECTED SAVANNA MIXED BUSHVELD TREES

Claude Muya<sup>1,2\*</sup>, John Mupangwa<sup>2</sup>, Florence Nherera-Chokuda<sup>2</sup> and Portia Moshidi<sup>1</sup>

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Cattle are predominantly grazers but also browse, which improves their intake of monounsaturated fatty acids, sterols and tocopherols. Browse is also notable for high levels of alkaloids, glucosinolates, isothiocyanates and thiocarbamates that inhibit the growth of or damage cells of pathogenic microorganisms. Tree leaves are rich in short cationic proteins that have potential for modifying rumen fermentation patterns. This study profiled antibacterial characteristics of bioactive compounds of three tree species (*Peltophorum africanum*, *Eucalyptus globulus* and *Vangueria infausta*) growing in the Savannah mixed bushveld and assessed the effects of the crude extracts as rumen modifiers. Leaves from mature trees were harvested mid-summer and aqueous extracts obtained. Extracts were analysed for phenols (as gallic acid equivalents: GAE), total flavonoid (as quercetin equivalent: QE) and condensed tannins (as catechin equivalents: CE), alkaloid and saponins (as %). All determinations were carried out in triplicate. The *P. africanum* extract had higher phenol, flavonoid and condensed tannin concentrations (200.6, 191.5 and 120.4; respectively) compared to the *E. globulus* extract (181.1, 175.0 and 62.9; respectively) and *V. infausta* extract (50.9, 62.9 and 0.5; respectively). Alkaloid content was highest in *E. globulus* (9.3 %). The concentration of saponin varied between 9 and 14%. There was a strong relationship ( $R = 0.99$ ;  $P < 0.001$ ) between phenol and flavonoid, the latter being the largest natural phenolic compound. The antibacterial test showed that at 0.015 g/mL and 0.020 g/mL, only gram positive bacteria were inhibited (halo zone > 9 mm) by the three extracts, suggesting a selective activity. Flavonoid enriched diets resulted in an improved rumen protein degradability within 24 h of incubation, suggesting the possibility of it acting as a bio-active regulator for ruminants.

### POSTER PRESENTATION: SEASONAL VARIATION IN NUTRITIVE VALUE OF FOUR INDIGENOUS BROWSE SPECIES USED FOR LIVESTOCK SUPPLEMENTATION IN THE EASTERN CAPE, SOUTH AFRICA

Siza Mthi<sup>1,2\*</sup>, Jean Rust<sup>2</sup> and Albertus Ras<sup>2</sup>

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Despite the high number of livestock in the Eastern Cape communal sector, the productivity is lower compared to the commercial sector. The most crucial constraint that limits livestock performance potential, especially under rangeland conditions, is year-round nutrient supply. Several studies have shown that browse plants, when compared to grasses, are richer in protein and minerals (except for protein levels in young grasses). The aim of this study was to determine the chemical composition and anti-nutrient components of browse species as potential fodder for livestock production. Samples of browse species (*Acacia karoo*, *Diospyros dichrophylla*, *Vepris lanceolata* and *Prunus persica*) were collected from June 2014 to January 2015 to evaluate the variations in the chemical composition between winter, spring and summer. After drying, leaves were separated from stems and ground before subsequent chemical analysis. The chemical composition of these samples was analysed for composition following procedures as outlined by the Association of Analytical Chemistry. The chemical composition of browse species sampled varied widely from season to season. Crude protein (CP) content was higher in spring compared to winter and summer season, with *P. persica* having the highest, and *D. dichrophylla* the lowest. Neutral Detergent Fibre (NDF) ranged from 19.74-37.11% with the highest being *V. lanceolata*. Condensed Tannins (CT) values ranged from 0.12-28.89% with the highest being *A. karoo*. Crude Fibre (CF) values ranged from 2.95-25.7% with the highest being *V. lanceolata* during summer and the lowest for *A. karoo*. Ash, Ether Extract (EE) and Acid Detergent Fibre (ADF) had the highest values in winter compared to spring and summer for *A. Karoo*, *P. persica* and *V. lanceolata* respectively. The highest calcium and potassium contents of 3.84 and 1.48% were recorded in *A. karoo* during winter season, whereas in spring, magnesium (*P. persica*), and phosphorous (*A. karoo*) were the highest. Sodium content was



higher in summer compared to winter and spring with *D. dichrophylla* being the highest. The highest value for zinc, copper and iron were recorded in summer, spring and winter respectively. These findings are in agreement with other studies where it was found that browse species contain higher levels of protein, vitamins, and minerals compared to that present in some grass species (except for protein level in young grasses). In the light of the present data, it is concluded that *A. Karoo*, *D. dichrophylla*, *V. lanceolata* and *P. persica* browse species are good sources of proteins and minerals. These plants can be effectively used as alternative feed resources to meet the nutrient requirements of livestock during feed-scarce periods of the year.

**POSTER PRESENTATION: THE EFFICACY OF ACETONE LEAF EXTRACTS OF *CHICORIUM INTYBUS* L. AND *LESPEDEZA CUNEATA* ON EGG HATCHING OF *HEAMONCHUS CONTORTUS*: IN VITRO STUDIES**

*Erika van Zyl, Francien Botha, Kobus Eloff, Phumzile Msuntha and Peter Oosthuizen\**

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*Haemonchus contortus* (wireworm), a gastro-intestinal parasite, causes serious production losses and mortalities in small stock. Bio-active forages, displaying anthelmintic properties, may assist in the control of the parasites. The aim of the study was to determine the efficacy of leaf extracts of *Cichorium intybus* L (chicory) and *Lespedeza cuneata* (poorman's lucerne) on the egg hatching of *H. contortus*. Plant extraction: Plant material (leaves only) from both species, was collected, dried in-house at room temperature and ground to a fine powder, followed by a standard procedure for leaf extraction with acetone (70%) as extractant. Nematode egg recovery assay: Faeces were collected from infected donor sheep and eggs were recovered. The concentration of eggs was adjusted to 100 eggs per 200  $\mu$ L. Egg hatch assay: An egg suspension was allocated in each well of a 24-flat-bottomed microtitre plate. The plant extracts, dissolved in dimethyl sulfoxide (5% DMSO), at concentrations of 2.5 to 20 mg mL<sup>-1</sup> in serial dilutions, were added to the egg suspension. Eggs were incubated in this mixture; subsequently eggs and first-stage larvae (L1) in each plate were counted under an inverted microscope. Results showed that both extracts displayed dose-response profiles at concentrations of 2.5 to 20 mg mL<sup>-1</sup>. At the highest concentration (20 mg mL<sup>-1</sup>), the Lespedeza extract was completely ovicidal and larvicidal. At the second highest concentration (10 mg mL<sup>-1</sup>), an egg hatch inhibition (EHI) of 97% was measured. Egg hatch inhibition decreased to  $\pm$  40% at the lower concentrations. Compared to Lespedeza, the chicory extract was less lethal. At the highest concentration (20 mg mL<sup>-1</sup>), 56% EHI was measured. The lower concentrations resulted in 45.5 to 50% EHI, which corresponds well to the effect of lower concentrations of Lespedeza extracts. In in vitro investigations, the specific extractant used may play a significant role in the efficacy of the extraction of the active compound. The acetone extraction that was used in the current study might not readily extract sesquiterpene lactones (the active anthelmintic compound in chicory) compared to the efficacy of extracting condensed tannins (the active anthelmintic compound in Lespedeza), which could affect the results. It can be concluded that the anthelmintic properties of bioactive plants are not only restricted to EHI, but can also influence the level of pasture contamination and affect the success of the infective third stage L3 larvae. This study, although more investigation is required, confirms that both forages have an inhibitory effect on the hatching efficacy of *H. contortus* eggs and that both forages therefore display anthelmintic properties, which can be applied advantageously for worm control in sheep.

**LAND TRANSFORMATION AND RESTORATION**

**POSTER PRESENTATION: AN INVESTIGATION INTO THE CONTROL OF THE INVASIVE *PHYMASPERMUM ACEROSUM* (CURRY'S POST WEED) IN THE KWAZULU-NATAL MIDLANDS MISTBELT GRASSLAND**

*Michelle Keith<sup>1\*</sup> and Isabel Johnson<sup>2</sup>*

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The indigenous plant, *Phymaspermum acerosum* (Asteraceae), is widely distributed in southern Africa, from Port Elizabeth in the Eastern Cape to Noodsberg in Limpopo. It occurs in grasslands and forest margins at elevations between 60 and 2200m. In KwaZulu-Natal it is commonly called Curry's Post Weed and is an invasive plant in the KZN Midlands Mistbelt. Invasion into these grasslands has considerable negative biodiversity and economic impacts,



such as lowering grazing capacity, oppressing and replacing other grassland species and forming dense stands which pave the way for invasive species such as *Rubus cuneifolius* (American bramble) and *Pteridium aquilinum* (bracken). Currently there are no registered herbicides or recognised management programmes for effectively controlling Curry's Post weed. The aim of this study is to assess the effectiveness of fire alone or in conjunction with a herbicide applied to the foliar regrowth of three different plant density classes as potential control methods for Curry's Post Weed. The study was conducted on the Bosch Berg Nature Reserve and Boston View Farm near Boston in the KZN Midlands Mistbelt grassland. Site selection was based on three density classes on each farm. The plant density, herbaceous biomass and canopy cover was determined within replicate quadrats in mid-winter. Sites were burned in July 2016 and efficacy of the fire treatment was assessed by measuring the regrowth two months post-burn. The herbicide, triclopyr (butoxyl ethyl ester) 480g a.i./l (Triclon) at a 2% solution mixed with a 1% solution of the adjuvant mineral oil 820g a.i./l (Actipron\* Super) was then applied. Triclopyr was selected due to its efficacy in controlling other invasive woody species by foliar application to new growth. Herbicide efficacy in conjunction with fire was determined eight months after application by measuring survival rates. Initial results indicate that fire alone is not an effective control measure for Curry's Post Weed but is an essential economical tool to reduce the plants' canopy volume facilitating more effective herbicide application. Preliminary results indicate that spot spraying new regrowth following a burn may provide effective control of this invasive species. This research has highlighted the need for additional trials using several herbicides at varying concentration rates, as new foliar growth or cut stump treatments in different seasons together with other management interventions, in order to identify additional effective control methods for Curry's Post Weed.

**POSTER PRESENTATION: INFLUENCES OF LAND-USE TYPES ON SOIL ORGANIC CARBON, TOTAL NITROGEN AND RELATED SOIL PROPERTIES IN SEMI-ARID AREA, PRETORIA**

*Deribe Talore, Abubeker Hassen\* and Eyob Tesfamariam*

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Carbon (C) and nitrogen (N) sequestration potential of different land-use types varies according to management practices, but such information is limited in sub-Saharan Africa. This study aimed at quantifying soil C, N and selected soil properties under various land-use types: tilled cropland (CL); cultivated pasture land (CPL); *Leucaena* sp. plot (LP); and enclosure plot around Pretoria, which represents the semi-arid agro-ecological zone of South Africa. Soil samples were collected at two soil layers (0–15 cm and 15–30 cm) in each land-use type, using four to five transects. Generally, all soil parameters considered in this study differed significantly between land-use types. The enclosure plot had higher C, N, and C : N ratios, but lower bulk density (BD) and pH than the LP, CPL and CL. The major cations (Ca, Mg, K and Na) showed wide variations among land-use types. The top soil layer (0–15 cm) demonstrated lower BD ( $P<0.01$ ) and pH ( $P<0.05$ ), but had higher C ( $P<0.001$ ), N ( $P<0.001$ ), Na ( $P<0.05$ ) and CEC ( $P<0.05$ ) than the lower 15-30 cm. There were interaction effects ( $P<0.05$ ) between land-use type and soil depth only for C and N concentration. The top 0–15 cm soil layer had generally higher C and N than the lower 15–30 cm layer, signifying their sensitivity to land-use types and soil depths. When potential C and N stock was estimated, the C sequestration rate was 1.41, 0.73, 0.40 and 0.33 Mg C ha<sup>-1</sup> yr<sup>-1</sup> in the LP, enclosure, CL and CPL while the corresponding values for N sequestration were 0.11, 0.05, 0.04 and 0.03 Mg N ha<sup>-1</sup> yr<sup>-1</sup>, respectively. Land-use management practices geared towards integration of multipurpose tree species in suitable niche areas in the grasslands as well as animal exclusion from fragile soils would potentially improve C and N storage in semi-arid areas of South Africa.

**POSTER PRESENTATION: EFFECTS OF BUSH CLEARING ON SOIL RESPIRATION IN NORTH-CENTRAL NAMIBIA: CHEETAH CONSERVATION FUND (CCF) AND ERICHSFELDE**

*Wihelmina Nuule<sup>1,2\*</sup> and Simon Angombe<sup>2</sup>*

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The exchange of carbon dioxide between the land and atmosphere is mostly mediated by soil respiration and its slight alteration would lead to a considerable change in the atmospheric carbon dioxide concentration (Fan et al., 2015). Any change in vegetation or land use that affects soil respiration is a major concern for global climate change (Kaur et al., 2006). Bush clearing in central Namibia has been used as a solution to problems of bush encroachment.

However, the effects of bush clearing on soil processes, such as the carbon cycle and soil CO<sub>2</sub> efflux have not yet been quantified. The aims of this study were (i) to determine the rate of soil respiration between the cleared and uncleared sites in different seasons (dry and wet), (ii) to determine the rate of soil respiration at different microsites (Shrub, Grass and Bare) in the dry and wet season and (iii) to investigate the effects of soil temperature and soil moisture on soil respiration. Measurements were carried out during the wet season (December & March) and dry season (June & September). Two sites were selected for measurements; cleared and uncleared. In each site, soil respiration was measured using a soil respiration chamber connected to a LI-COR 6400 XT Infrared Gas Analyzer. Measurements were taken from 18 points in each of the two sites. Soil temperature was measured at 10 cm depth at each point, using a temperature probe connected to the LI-COR 6400 XT. Soil samples were collected at each point. Soil moisture content was determined by weighing the mass of the soil samples and drying them at 105°C for 24 hours and weighing them again. Moisture content = wet mass (g) - dry mass (g). The results showed no significant difference in soil respiration between the cleared and uncleared sites of CCF for both seasons. The enhancement of microbial respiration and decomposition of increased litter inputs offsets the decrease in root activity after clearing, leading to a balance in soil respiration between the cleared and uncleared sites (Luo & Zhou, 2006). In Erichsfelde, both seasons showed that the uncleared site had significantly higher soil respiration than the cleared site. Numerous factors, such as reduction in root abundance and density, microbial activities, microorganism composition and changes in vegetation type and composition may have contributed to high soil respiration in the uncleared site. There was no significant difference in soil respiration between the microsites during the dry season. However, during the wet season, in the uncleared site, the shrub microsite had significantly higher soil respiration followed by the grass microsite and the bare soil had the lowest soil respiration. In the cleared site, the grass microsite had significantly higher soil respiration than the bare soil. Both study areas have shown that soil respiration was significantly higher in the wet season than in the dry season. There was no significant correlation between soil respiration and soil temperature during the wet season. However, in the dry season Erichsfelde showed a negative correlation between soil respiration and temperature which only accounted for 15%.

#### **POSTER PRESENTATION: GERMINATION AND SEEDLING ESTABLISHMENT OF INDIGENOUS LEGUME SPECIES: ASSESSING THE POTENTIAL FOR REHABILITATION OF MINE SOILS**

Zanele Ndhrazi<sup>1,2\*</sup>, Michelle Greve<sup>1</sup>, Wayne Truter<sup>2</sup> and Florence Nherera-Chokuda<sup>1</sup>

<sup>1</sup>Agricultural Research Council - Animal Production Institute <sup>2</sup>University of Pretoria, email: zanelendhlazi@yahoo.com

Herbaceous plants are a critical component in rehabilitation on areas disturbed by coal mining activities; soil fertility and above ground biomass production are improved. Seeding of disturbed areas using mixed grass species is a common practice, however, native herbaceous legumes have the additive advantage of atmospheric nitrogen fixation. The aim of this study was to assess germination potential of indigenous legume species and seedling establishment on degraded mine soils. Plant height, specific leaf area (SLA), chlorophyll content in the leaves and the root shoot ratio (RSR) were assessed. Hot water scarified seeds of indigenous species (*Tephrosia cordata*, and *R. adedoides*) were compared to *Medicago sativa*. For each species 24 seeds were sown in pots on four soil type namely: degraded mine soil with and without lime application, agricultural soil with and without lime application. Each treatment had 32 experimental units per soil type with three seeds per pot. The pots were randomly arranged and placed in a phytotron at 25°C for six weeks. Plant height was significantly effective in *R. adenoids* where plants grew taller in degraded soil than in agricultural soil, plants also grew taller in degraded soil than in agricultural with lime, they were also influenced in degraded soil with lime than in degraded without lime. Chlorophyll content in the leaves of *R. adenoids* was also significantly effective only in degraded soil, it was greater than agriculture with lime. Chlorophyll content in the leaves of *T. cordata* had a significant effect when degraded soil was greater than agriculture with lime. Plant height of *M. sativa* plants was taller and affected when degraded soil was greater than agricultural soil. It was also affected when degraded soil with lime was greater than agricultural soil. There was no strong evidence that support degraded soils can positively influence plant functional traits. Overall suggestion is that functional traits are influenced by soil type however lime application positively affected the seedlings in agriculture and in degraded soils with lime. Therefore lime application is recommended for use prior planting for rehabilitation of mine soils degraded to increase vegetation cover.



## PARALLEL SESSION A: RANGELAND ASSESMENT AND MONITORING

**SESSION CHAIR: JUSTIN DU TOIT**

*Wednesday , 26 July 2017, 11:00 - 13:00*

**Venue: Mhelembe (Rhino) Hall**

### PLATFORM PRESENTATION: SAVANNA LONG-TERM RESEARCH INITIATIVE IN THE SOUTHERN GREAT PLAINS

*John Walker*

Texas A&M AgriLife Research, Ecosystems Science and Management, email: [jwalker@ag.tamu.edu](mailto:jwalker@ag.tamu.edu)

Savannas cover approximately 20% of the terrestrial surface. In these ecosystems, the balance between grasses and woody plants is regulated by complex interactions between climate, atmospheric composition, soils, herbivory, and fire. In many savanna regions around the world, the woody-herbaceous composition has tipped increasingly in favor of shrubs and trees, and many savannas are transitioning to shrublands or woodlands. Although these transformations alter ecosystem processes, biodiversity, and the sustainability of savannas, the factors driving these vegetation changes are poorly understood. Scientists from several institutions are now collaborating to design a long-term study that would help elucidate the causes and consequences of vegetation transitions in savanna ecosystems. The study will be conducted at three locations in central Texas that lie within the Southern Great Plains biome of the US. Study locations span 120 km in latitude and represent 150 mm gradients for precipitation, 20% differences in woody plant cover, and substantial differences in plant species composition. This presentation will provide an overview of the proposed study to facilitate international collaboration that could lead to increased understanding of savanna ecosystem processes and leverage the resources invested at all locations. A factorial design is proposed to investigate fire alone, targeted browsing with goats, a combination of fire and goats, and a control. The control would represent livestock grazing typical of this region, which would also be the management with which fire and browsing treatments would be overlaid. Within each treatment, selected areas of woodlands will be thinned to create a mosaic of woodland, savanna, and grassland areas. This would allow us to observe the effect of the treatments as influenced by different initial conditions. Each treatment would be replicated three times, once at each of the locations. In addition to the factorial treatments, large-scale pyric herbivory would be investigated at locations on the east and west end of the study area to further elucidate scale dependencies. Plot-scale mechanistic experiments to investigate the effect of long-term manipulations of water and nutrients would also be conducted. The goals of this research are to: 1) Understand the drivers and mechanisms underlying short- and long-term changes in grass-woody plant abundance; 2) Quantify the effects of shifts in life-form composition on ecosystem function and services; and 3) Develop and evaluate strategies for restoring grasslands and savannas and the ecosystem services they provide. Ultimately, we hope to identify intervention points, i.e., variables that can be readily monitored to predict state-change so that management can be adjusted to avert undesirable transitions or to facilitate desired changes. Core measurements would include above- and below-ground vegetation composition, biomass, and production; soil C, N, and P storage and dynamics; soil microbial community structure and function; water and energy budgets; and vertebrate and invertebrate food webs. Results would be used to parameterize a simulation model (LPJ-GUESS) and simple, highly tractable mathematical models. The models would then be used to identify and better understand the key feedback processes that drive grass woody transitions in savanna.

### PLATFORM PRESENTATION: AN ASSESSMENT OF WOODY BIOMASS AS A SUSTAINABLE ENERGY SOURCE IN A BUSH THICKENED AREA OF NORTHERN NAMIBIA

*Nico Smit\*, Nico de Klerk and Martin Schneider*

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Bush thickening can be defined as the increase in the density of indigenous woody plants that exploit disruptions of the grass/bush balance at the expense of grasses. Due to the cost of bush control measures there is an increasing awareness of woody plants as a harvestable resource with a monetary value. The objectives of the study were to conduct a detailed assessment of the woody biomass resource in a selected area of Namibia and to make recommendations regarding the sustainable harvesting of woody plants as a source of energy. The study area is located north-west of Otjiwarongo in northern Namibia with a long-term average annual rainfall of 457 mm. A total of



28 plots were selected on eight commercial farms. A belt transect of 50 x 2.5 m was demarcated at each plot and all rooted, live woody plants measured according to the BECVOL 3-model (Smit 2014). Values calculated included: Tree density, Evapotranspiration Tree Equivalents (1 ETTE = leaf volume equivalent of a 1.5m tree), leaf DM, shoot DM (< 0.5 cm), stem DM (> 0.5-2.0cm) and wood DM (> 2.0cm). A total of 30 woody species were recorded. The total wood DM varied from 7 291 kg ha<sup>-1</sup> to 190 942 kg ha<sup>-1</sup> with an average of 36 222 kg ha<sup>-1</sup>. The wood > 2.0cm made up 70.1 % of the total wood mass, while the stems > 0.5-2.0cm and shoots < 0.5cm made up 20.8 and 9.1 %, respectively. The leaves added another 6.8% to the total biomass. A high wood DM ha<sup>-1</sup> was without exception related to the presence of very large trees. Based on the average of 36 222 kg ha<sup>-1</sup> the study area of 45 000 ha carries a wood biomass of 1.63 mil. tonnes. It was estimated that a target value of 4 500 ETTE ha<sup>-1</sup> can be retained without adversely affecting the grass layer. Based on this target an average of 10 811 kg ha<sup>-1</sup> wood can be harvested, which represents approximately 30 % of the total wood biomass. Reducing the target to 2 700 ETTE ha<sup>-1</sup> will increase the wood harvest to 12 653 kg ha<sup>-1</sup>, which represents approximately 35% of the total wood. It was concluded that wood harvesting at a target density of 4 500 ETTE ha<sup>-1</sup> will meet the minimum requirement of 10 000 kg ha<sup>-1</sup> for the viability of an electricity plant. It is recommended that trees be selectively harvested, starting with the smallest plants and progressively moving to larger plants until the target of retaining 4 500 ETTE ha<sup>-1</sup> has been reached. This approach will ensure the preservation of valuable trees that suppresses new woody seedlings and benefit grass production. Harvesting should concentrate on the potential problem species.

**PLATFORM PRESENTATION: ASSESSMENT OF GRASS SPECIES COMPOSITION AND NUTRITIVE VALUE AS INFLUENCED BY SOIL CHARACTERISTICS IN TWO DIFFERENT GRAZING AREAS IN NORTH WEST PROVINCE, SOUTH AFRICA**

*Khuliso Ravuhali, Sesupho Manyedi\*, Thabiso Seboli, Lebogang Motsei and Mogomotsi Keoletile*

North-West University, Department of Animal Science, email: [manyedigs@yahoo.com](mailto:manyedigs@yahoo.com)

The study was conducted to assess the effects of soil characteristics on grass species layer and their nutritional composition in two different grazing areas under two different districts, (Mafikeng grazing area-Ngaka Modiri Molema district (altitude 1 323m and 400mm rainfall received) and Potchefstroom-Kenneth Kaunda district (altitude 1 352m and 760mm rainfall received). The soil in Mafikeng area is a clay loam (CL) in texture and the soils resulting from this predominantly limestone lithology are haplic lxisols. Towards the town side, soils are ferrallic arenosols that are highly weathered and iron-rich sandy textured soils which also lack any significant soil profile development. The Potchefstroom soil consists of 15-30% vertic soil (swelling, cracking clay). At each grazing camp in both study areas 10m x 10m homogenous vegetation units (HVUs) were marked in different directions to serve as replicates. In each HVU, three 1m<sup>2</sup> quadrats were randomly placed to sample soil and grass species. Soil samples were analysed for pH, carbon, nitrogen and macro- and micro-minerals. The results from the study showed that soil type in Potchefstroom had a higher carbon percentage (1.88%), N content (2.67 mg/kg) P content (5.67 mg/kg) and K content (172.00 mg/kg) as compared to Mafikeng (0.68% C), (1.6 mg/kg N) and (1.67 mg/kg P) and (128.33 mg/kg K) while both grazing areas had similar soil pH values. Eighteen grass species were identified from two grazing areas and were harvested at maturity stage (autumn season) for biomass determination and analyzed for DM, CP, OM, cell wall components and dry matter degradability. Biomass accumulation of *Digitaria eriantha* (145.37 kg/ha DM) and *Themeda triandra* (152.79 kg/ha DM) in the Potchefstroom soil type was higher ( $P < 0.05$ ) than those in the Mafikeng soil type (105.17 kg/ha DM and 127.67 kg/ha DM) respectively. Crude protein content of *Cynodon dactylon* (101.55 g/kg DM), *T. triandra* (50.91 g/kg DM) and *Aristida congesta* (49.42 g/kg DM) was higher ( $P < 0.05$ ) in the Potchefstroom soil type than in the Mafikeng soil type. The NDF content of grass species from both areas were high ranging from 596-807 g/kg DM. *Digitaria eriantha* from the Mafikeng soil type and *Panicum coloratum* from the Potchefstroom soil type had lower ( $P < 0.05$ ) acid detergent lignin levels (133 g/kg DM and 75.30 g/kg DM). *Digitaria eriantha* from the Mafikeng soil type and *P. coloratum* from the Potchefstroom soil type had higher DM degradability at 48 (DMD48) (516.87 g/kg DM and 581.02 g/kg DM). The present study showed that the grass species in the Potchefstroom soil type had better nutritive value than those under the Mafikeng soil type. It is therefore concluded that soil type has an effect on biomass production and nutritional value of grass species. Supplementation might be required if animals, especially those in production, are fed those grass species with low CP value during the autumn season. However, further research is needed to assess the nutritive value of these grass species at different growing stages and seasons.



## PLATFORM PRESENTATION: COMPETITION AND DEFOLIATION TOLERANCE OF *THEMEDA TRIANDRA* AND *ERAGROSTIS CURVULA*

Naledi Zama<sup>1\*</sup>, Michelle Tedder<sup>1</sup>, Craig Morris<sup>2</sup> and Ntuthuko Mkhize<sup>2</sup>

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Plant performance is influenced by herbivory and competition. Therefore, plants need to tolerate these conditions for their survival. Grazing may affect competitive interactions within plant communities as it changes the competitive behaviour of species by removing leaf material. This may result in different growth rates following a series of defoliation events. When differences in defoliation intensity or frequency occur, species composition changes due to a shift in competitive interactions. This change in species composition then affects forage production. A shift in species composition towards low forage quality species will affect livestock production and managerial strategies. We conducted a pot trial at the NM Tainton Arboretum at the University of KwaZulu-Natal in Pietermaritzburg in 2016/2017 to measure the defoliation tolerance of two abundant mesic grassland species growing under competition, i.e. *Themeda triandra*, which is relatively sensitive to overgrazing, and *Eragrostis curvula*, which has a higher grazing resistance. The experimental design included the abovementioned species, with the two levels of defoliation (none and cut), applied to either the phytometer (target plant) or neighbouring plants or both. There were three levels of competition from the neighbouring plants (none, intraspecific competition and interspecific competition). Treatments were replicated six times and arranged in a randomized complete block design. Plants were defoliated by clipping to a height of 5 cm above the soil surface at two-week intervals. Plant performance was assessed by collecting aboveground clipped biomass removed at each clipping event as well as a final harvest. We aimed to determine the defoliation tolerance of *Themeda triandra* and *Eragrostis curvula* when grown under competition. We predicted that *Themeda triandra* would tolerate defoliation better than *Eragrostis curvula*. Understanding how these common mesic grassland species respond to defoliation and competition will better explain why *Themeda triandra* is commonly replaced by *Eragrostis curvula* in heavily grazed grasslands. The relative tolerance of these grasses to defoliation and competition along with the implications of their differing defoliation tolerance for their persistence in grazed mesic grassland will be discussed.

## PLATFORM PRESENTATION: DEVELOPMENT OF A ROBUST, EASY-TO-USE BIODIVERSITY INDEX FOR MESIC GRASSLANDS

Lize Joubert-van der Merwe

Stellenbosch University, Department Conservation Ecology and Entomology, email: [lizejoubert@gmail.com](mailto:lizejoubert@gmail.com)

The South African commercial forestry industry mitigates biodiversity loss by implementing large-scale ecological networks (ENs) of natural habitat among their plantations. Over the years, much research has been conducted to determine optimal ways to design and manage these ENs. The aim of this study is to integrate existing data into an easy-to-use, robust and accurate index of mesic grassland biodiversity and habitat quality. Following a review of primary literature and reputable grey literature, I built a database of ~ 800 bird, butterfly, plant, grasshopper and mammal species that shows a response to positive and negative drivers of diversity. Each species was categorized in terms of geographical distribution, regional conservation status and level of sensitivity. This species list is far too long to be meaningful for our index. So I compiled a shortlist of species based on consistency in their response to drivers of diversity. Checking for such consistency required a minimum of 3 data points (i.e. 3 publications), which had the added benefit of eliminating hard-to-identify species spotted only by a single researcher. The next step was to establish a strong link between meso- and large-scale phenomena, on the one hand, and fine-scale occurrence of species. Why? So that the index can focus on the less expensive and time consuming larger spatial scale, but attain the same resolution of answers as when monitoring species. Thus, I classified the scale at which drivers operate: 1) the large landscape scale (e.g. landscape features), or 2) the smaller meso-scale (e.g. rockiness or vegetation structure). I tested for the existence of correlations between meso-to-large scale phenomena and species occurrence at 67 sites in the KZN Midlands using a simple sampling protocol. In the end, I wish to include meso-to-large scale phenomena as indicators of biodiversity, and only a handful of species to complement these phenomena.



## PARALLEL SESSION A: RANGELAND FIRE ECOLOGY

SESSION CHAIR: DEBBIE JEWITT

Wednesday, 26 July 2017, 14:00 - 15:40

Venue: Mhelembe (Rhino) Hall

### PLATFORM PRESENTATION: HERCULES AND THE HYDRA REVISITED: COMBINING TRADITIONAL MANAGEMENT EFFORTS WITH FIRE TO CONTROL RESPROUTING WOODY PLANT ENCROACHMENT AND RESTORE SAVANNA ECOSYSTEMS

*Bill Rogers\*, Carissa Wonkka and Dirac Tidwell*

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In Greek mythology, Hercules was successful in slaying the nine-headed Hydra where others failed because he used fire to quickly cauterize the stump of each serpentine head he chopped off before it could regrow into multiple new heads. This may prove to be a fitting analogy for land managers who have difficulty controlling woody encroachment in savannas where persistent resprouting shrubs decrease biodiversity and degrade ecosystem services. Multiple management strategies are often employed to enhance the efficacy of woody control treatments and decrease economic costs associated with expensive machinery or synthetic herbicides. However, quantitative assessments of the effectiveness of these various treatment combinations are lacking. Using data from several experimental studies in woody encroached savannas we assessed the factorial effectiveness of mechanical cutting, chemical herbicide applications, or ungulate grazing on resprouting woody plants coupled with and without prescribed fire treatments. The first study assessed the interactive effects of fire and cattle grazing on a problematic shrub found in degraded South African grasslands. A companion study in Texas coastal grasslands examined the effects of fire and cattle grazing on woody encroachment and the composition of native and introduced herbaceous species. In the same coastal grassland, another study experimentally tested the effectiveness of coupling intense prescribed fire with herbicide applications to control mature resprouting woody shrubs. Lastly, we assessed the effectiveness of prescribed fire combined with mechanical-chemical treatments of resprouting woody species in South Texas. Our results suggest that attempts to control undesirable resprouting plant species using dual-treatment combinations of traditional management interventions is not a restoration panacea, but other novel methods of intervention may prove ecologically useful and economically pragmatic in addressing problematic resprouting woody plants and restoring degraded savanna ecosystems.

### PLATFORM PRESENTATION: FIRE ECOLOGY AND MANAGEMENT OF WILDFIRES IN INDONESIAN RAIN FORESTS GROWING ON PEAT BEDS AND THEIR POTENTIAL RELEVANCE TO GROUND FIRES IN SOUTHERN AFRICAN WETLANDS

*Trevor Wilson*

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Commercial forestry plantations planted in peat soils are unique in their sensitivity to wildfire. All sub-surface fires observed initially started on the surface and there was a very small window of time before the fire transitioned into the sub-surface fuels. Before the translocation of the fires into the sub-surface, even very low flame intensities caused the friable soils to collapse and weaken the tree root structures. Within 1 hour the live trees started falling over. The addition of the very heavy fuels to the peat fire caused a large scale re-burn that exacerbated the initial fire. Apart from the surface re-burn, the increased sub-surface fire intensity caused incineration to full peat depth, i.e. to the acidic clay level. The smoke pollution from the re-burn was much more intense as the newly added green fuels smoldered for an extended time before drying out. Once they were fully alight the new heavy fuels burned with extreme heat with high residence times. The sustained surface heat pushed the peat fires to full depth, destroying thousands of years' worth of biomass accumulation. One may ask the question: How do the tropical peats have any bearing on Southern African grasslands?" The answer is as simple as, look at every single wetland that is found in the said grasslands. A wetland is essentially a water accumulation above peat. There may be different properties in the biomass but the basic properties of the peat sponge are exactly the same as tropical peat. We all are aware of the sensitivities of dried wetlands but what do we do if they catch alight? This presentation and paper documents some Indonesian fire events and includes successful strategies and tactics employed to minimize the devastating environmental, societal and economic losses that could quite possibly be classed as globally influential events.



**PLATFORM PRESENTATION: THE NATIVE C3 GRASS *FESTUCA COSTATA* ALTERS GRASSLAND FUELS AND FIRE SPREAD IN THE DRAKENSBERG***Devan McGranahan*<sup>1\*</sup>, *Sally Archibald*<sup>2</sup>, *Kevin Kirkman*<sup>3</sup> and *Tim O'Connor*<sup>4</sup>

<sup>1</sup>North Dakota State University, Range Science Program, <sup>2</sup>University of the Witwatersrand, School of Animal, Plant and Environmental Sciences, <sup>3</sup>University of KwaZulu-Natal, School of Life Sciences, <sup>4</sup>South African Environmental Observation Network (SAEON), email: [devan.mcgranahan@gmail.com](mailto:devan.mcgranahan@gmail.com)

Although most fire ecology focuses on vegetation responses to fire, invasive species and climate change have prompted the study of fire responses to vegetation changes. Changes that introduce substantially different fuel types can alter the intensity, frequency, seasonality, or spatial extent of fire, with potential impacts on community succession and biodiversity. While grasses most often accelerate fire regimes when they invade shrub-dominated systems, there are few examples of grass invasions suppressing fire. In sub-Saharan Africa, the ecological function and composition of grasslands are threatened more by climate change than invasive grasses, especially in montane regions, where species distributions can shift as climatically-determined ranges are altered. We studied the impact of encroachment of the temperate C3 grass *Festuca costata* Nees into C4-dominated grassland at the transition between their subalpine ranges in South Africa's Drakensberg. We compared empirical data on fuel moisture and fuel load across *F. costata*-dominated patches in a C4-dominated matrix and used these data in fire spread models to predict the effect of larger, higher-moisture *F. costata* patches on the spatial extent of fire in these fire-prone grasslands. We predicted that (1) *F. costata* introduces high-moisture, live tissue to otherwise dormant late-winter fuelbeds; (2) this substantially different fuel type reduces fire spread and burn probability; and (3) the effects of *F. costata* on burn probability are exacerbated by patch size, live fuel moisture, and a higher proportion of live fuel, while wind speed and greater fuel loads mitigate *F. costata* effects. We sampled *F. costata* and C4 veld grasses at three locations in the Drakensberg twice prior to spring rains and once afterwards. Fuel load and moisture data parameterised fuel models. We used fire behaviour models to determine the effect of *F. costata* in C4-dominated, grassland fuelbeds. We created hypothetical landscapes to model subalpine Drakensberg grasslands as *F. costata* patches within the C4-dominated matrix and measured the burn probability of patch centres to determine the likelihood of fire penetrating *F. costata* patches. *Festuca costata* reduces fire spread and burn probability in patch centres, and the effect increases as live fuel moisture increases and patches get larger. Greater wind speeds mitigate this effect, although different wind speeds create different burn patterns on the landscape. Our data show that *F. costata* patches contain both greater live fuel moisture and higher fuel loads than surrounding C4-dominated grassland. Within fuelbeds, our models predict that this asynchrony in fuel moisture reduces fire spread, which might disrupt the spatial extent and temporal distribution of fire at a landscape level. At the very least, reduced fire spread through patches of high-moisture *F. costata* might increase variability in fire effects, although under extreme but theoretically possible scenarios, large areas of infrequent and/or low-intensity fire could alter community succession and increase the opportunity for woody plant encroachment.

**PLATFORM PRESENTATION: DOES FIRE FACILITATE BIODIVERSITY OR FORAGE PRODUCTIVITY IN RENOSTERVELD RANGELANDS IN THE KAMIESBERG UPLANDS?***Megan Simons*<sup>1\*</sup>, *Richard Knight*<sup>1</sup>, *Igshaan Samuels*<sup>2</sup> and *Clement Cupido*<sup>2</sup>

<sup>1</sup>University of the Western Cape, <sup>2</sup>Agricultural Research Council - Animal Production Institute, email: [simonsm@arc.agric.za](mailto:simonsm@arc.agric.za)

Fire plays an essential role in the vegetation dynamics of various ecosystems including semi-arid rangelands. Unplanned veld fires in these areas could alter management practices for both agricultural and conservation areas. Namaqualand Granite Renosterveld in the Kamiesberg Uplands occurs within an intermediate zone between fynbos and succulent karoo biome along an aridity gradient. The vegetation has been used extensively by livestock but is also of great conservation worthiness. Frequent fires in Namaqualand Granite Renosterveld have been documented, but their combined effect with grazing on the vegetation has not been studied. Therefore, the aim of this study was to determine and understand the implications of fire on biodiversity and land used for grazing within the Leliefontein communal area. Historical fire data obtained from NASA fire archives was used to determine the burnt areas in the Kamiesberg Uplands. Sampling commenced in 10 burned and 10 adjacent unburned sites during autumn and spring of 2014 and 2015. The descending point method was used to determine plant diversity and increaser and decreaser species. Species were assigned to categories (i.e. increaser and decreaser) in terms of their response to grazing pressure. The results show that there was no significant difference between increaser and decreaser ratio and species richness ( $p = 0.59$ ;  $R^2 = 0.04$ ) during the period of 15 years post-fire. The ratio of increaser species such as



*Elytropappus rhinocerotis*, *Crysocoma ciliata*, and *Anisodontea bryoniifolia* are relatively low within the first five years post-fire as fire ephemerals are abundant within these sites. Even though the results point to the fact that after seven years renosterveld could be burnt in the Kamiesberg, burning can be limited to areas dominated by increaser species. This will ensure that renosterveld communities maintain their diversity. Burning of Namaqualand Granite Renosterveld in the Kamiesberg could thus benefit conservation of the local biodiversity and improve the range conditions for livestock farmers.

## PLATFORM PRESENTATION: APPLICATION OF FIRE IN SAVANNA CONSERVATION AREAS

Bruce Brockett<sup>1\*</sup> and Art Bailey<sup>2</sup>

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Prescribed burning is both a science and an art requiring a background in weather, fire behavior, fuels, and plant ecology along with the courage to conduct burns, good judgement, and experience to integrate all aspects of weather and fire behavior to achieve planned objectives safely and effectively (Wright and Bailey 1982). Fire is an enigma, it's a killer of man, animals and plants and it can expose soil to erosion (Bailey 1996). However, most ecosystems evolved with fire, and fire may act as a renewal agent. Fire occurs in all the major rangelands of the world. However, its importance varies from: tundra and desert ecosystems, to major ecological importance in the humid grasslands and savannas. Savannas can burn any time weather and fuel conditions are favourable, with most fires ignited over the dry season when grasses are dormant. Fire is not as erratic or unpredictable as most people think. In Africa, man has been using fire as a management tool for approximately 180 000 years (Boysen and Tainton 1984). There are three essential elements required by all fires. There must be an ignition source, suitable weather and appropriate fuel. Sufficient fuel is required for both ignition and to sustain a fire. In addition, the human factor is the fourth element required in prescribed fire management. Correct fire management requires that a fire is staffed with an experienced fire boss, burning crew, and suppression crew (if needed). There are three primary types of fires: (a) unplanned fires (or wildfires), (b) controlled fires, and (c) prescribed fires. Prescribed fires are further sub-divided into: (1) security burns, and landscape-scale prescribed fires. Security burning is the use of fire to protect fire-vulnerable infrastructure and to construct firebreaks. One needs to be cognisant of all applicable legislation and regulations. The burning operation is divided into three functions: (1) preburn planning, (2) the burning operation, and (3) post-burn management. In pre-burn planning the first priority is to establish the objectives for the burn. Planning needs to take into consideration the season to burn, fuel loads, types, volatility, state of curing, fuel-breaks, and weather requirements to realize the objectives. A prescription for burning is prepared based upon the information collected. Prior to making a decision to proceed, a spot weather forecast is obtained a day before the burn is scheduled, and on the day of the burn, to assist the fireboss in reaching the decision to proceed. Based on the objectives and risk, the fire boss divides staff into: (1) an ignition crew and (2) a suppression crew. The key to success of most prescribed fires on rangeland lies with the effectiveness of post-burn management. Fires are applied for a number of purposes: (1) to conserve biodiversity, (2) for fuel hazard reduction, and/or (3) alter habitat, forage or production characteristics. Bush control burns in savanna are used to change woody plant structure and biomass, and are a sub-category of (3). This paper deals with the some of the art and science of successfully applying fire in savanna conservation areas.

**PARRALEL SESSION B: LIVESTOCK DIET AND NUTRITION****SESSION CHAIR: SIKHALAZO DUBE**

Wednesday, 26 July 2017, 11:00 - 13:00

Venue: Hongonyi (Wildebeest) and Xidzidzi (Honey Badger) Rooms

**PLATFORM PRESENTATION: RETROGRESSION IN RUMEN AND BODY METABOLISM OF STARVING CATTLE ON COMMUNAL AREA GRAZING LANDS: CASE STUDY OF SMALLHOLDER DAIRY CATTLE IN VHEMBE DISTRICT, SOUTH AFRICA**Florence Nherera-Chokuda<sup>1\*</sup>, Claude Muya<sup>1</sup> and Joyce Marumo<sup>2</sup><sup>1</sup>Agriculture Research Council - Animal Production Institute, <sup>2</sup>North-West University, Ruminant Production, email: [nhereraf@arc.agric.za](mailto:nhereraf@arc.agric.za)

Cattle starvation is a persistent problem in communal areas of Sub-Saharan Africa, especially the sub-tropical zone. Rainfall is low and seasonal, and natural pastures are overgrazed, which reduce plant species diversity and forage availability. Encroachment of rural settlements into communal grazing lands and frequent droughts exacerbate cattle starvation. Cattle often resort to browsing when the grass layer is depleted. Cows with suckling calves are affected most due to high nutrient demands for lactation. During extended starvation periods, intake of poor quality forage is low, gluconeogenesis reduced and severe starvation ketosis is induced. Body fat and fat at the base of the heart and bone marrow are mobilized, and muscle wasting sets in. Death eventually ensues or future productivity of surviving cows is affected. Animals adapt to prolonged periods of undernourishment by reducing maintenance requirements to about 30%; this could be an intervention opportunity to reduce dry season mortality on communal grazing areas. A survey was done to assess survival of lactating dairy cows on 10 smallholder farms in the Savannah Sweet Low Veld of Limpopo province during the 2015/16 drought. Data was collected from 22 cows from October 2015 to July 2016. Fermentation of poor quality forage was assessed in vitro using rumen fluid of fasting cattle. Eighty percent of the dairy herds scavenged on natural pastures and browsing was limited. Cows with high body condition scores (BCS) at onset of summer survived, but cows with BCS less than 2 (scale 1 to 5) died within 180 days into lactation. Milk yield was low (8 to 12.2 L at peak lactation); energy balance in early lactation was -9.62 to -28 Mcal/day; and mean rate of one-body condition score loss of 36±9 days before 100 days in milk. None of the cows milked beyond 180 days. Post-mortem evaluation of rumen contents showed low intake of poor quality forage (0.3 to 0.5% of body weight); mostly grass hay and sticks and soil. Rumen micro flora died *en masse* confirmed by lack of activity post incubation in vitro. The small portions of highly lignified sticks and grass were not degraded, which severely reduced volatile fatty acid production as a direct result of the prolonged absence of exogenous supply of gluconeogenic precursors. Mortality due to starvation was 45.5%. It is critical that cattle owners stretch the survival period by firstly delaying access to other forages until mid-dry season when cattle have adapted to starvation (reduced maintenance requirements) and then intervene by extreme restriction of access to other locally available forage resources. Currently, cattle freely access crop residues from autumn and eat to fill. This strategy of gluttoning on forages at the start of the dry season perpetuates cyclical hunger and cattle succumb to debilitating effects of starvation or death thereafter.

**PLATFORM PRESENTATION: COMPARING PRODUCTION OF ZULU AND MERINO SHEEP ON VELD AND GRAZING MAIZE AT THE DUNDEE RESEARCH STATION**

Peter Oosthuizen\* and Erika van Zyl

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Overwintering sheep on the Sour Veld of KwaZulu-Natal has its set of difficulties since veld deteriorates rapidly. Little is known about the production of the Zulu sheep. A trial was done to compare the performance of two breeds of sheep, namely the Merino and Zulu sheep breeds, on grazing maize as an alternative to veld for overwintering purposes. Animals used in the experiment were lactating Zulu ( $n = 28$ ) and Merino ewes ( $n = 24$ ) with lambs. The Zulu ewes had one twin with an average of 1.03 lambs per ewe and the Merinos had 13 twin lambs with an average of 1.54 lambs per ewe. The Zulu and Merino ewes were randomly assigned to either grazing maize or a grazing veld treatment, resulting in 12 Merino ewes and 14 Zulu ewes per treatment, respectively (two replicates each). Average daily gains, weaning weights and weaning percentages of the lambs were recorded and compared. Adaptation period was 14 days with the duration of the trial as 98 days. Areas of 40 ha of veld grazing and 4.5 ha of grazing

maize were used for the trial. Forage samples from five sites within the grazing plots were taken before grazing and monthly thereafter. Indicators of palatability and nutritional quality were considered. *Eragrostis curvula* hay was supplied *ad libitum* to both feeding treatments. Voermol Landelek® (protein supplement) was supplied to the sheep on the grazing maize and Voermol Maxiwool® (protein supplement) was supplied to the animals on the veld. Ewes from both breeds showed a positive live mass gain over the trial period on grazing maize, where the Merino ewes averaged  $85.8 \pm 39.3$  g day<sup>-1</sup> and the Zulu ewes averaged  $48.4 \pm 18.7$  g day<sup>-1</sup>. Ewes in both breeds lost weight on the veld treatment. Lambs from both breeds gained live weight on both treatments over the trial period: grazing maize treatment Merino lambs averaged  $200 \pm 64.8$  g day<sup>-1</sup> and Zulu lambs averaged  $143.1 \pm 46.5$  g day<sup>-1</sup>. The lambs on the veld treatment performed slightly worse, with the Merino lambs averaging  $67.8 \pm 21.3$  g day<sup>-1</sup> and the Zulu lambs averaging  $70.9 \pm 24.0$  g day<sup>-1</sup>. As was expected, veld did not manage to supply even the maintenance needs of ewes, indicating nutrient quality constraints. The quality of forage was used to explain sheep performance. The performance of the Zulu sheep was better than that of the Merino sheep on veld. It can be concluded that grazing maize provides a good alternative to veld for overwintering lactating ewes.

## PLATFORM PRESENTATION: ANTI-NUTRIENTS AND *IN-VITRO* DIGESTIBILITY OF *LABLAB PURPUREUS* AND *VIGNA UNGUICULATA* FORAGE LEGUMES

Soul Washaya\*, John Mupangwa and Voster Muchenje

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The anti-nutrient content and digestibility of forage legumes vary widely relative to vegetative growth and forage species. This significantly influences tropical ruminant animal production. The objective of this study was to determine the anti-nutrient content, *in vitro* dry matter digestibility (IVDMD) and organic matter (OMD) digestibility of lablab (*Lablab purpureus*) and cowpea (*Vigna unguiculata*). The anti-nutrients that were examined included phenols, tannins and saponins. The effect of inoculum source on digestibility of forage legume type was also evaluated. Forage legumes were grown at the University of Fort Hare Research Farm and harvested at three different vegetative stages of pre-anthesis, anthesis and post-anthesis. Eighteen samples were collected for each forage species at every harvesting stage in a completely randomised design. Rumen liquor (inoculum) was obtained from Adelaide Abattoirs from cattle (under range system with no supplements) and sheep fed a concentrate diet; 60 % grain and 40% roughage. Tannin, phenolic and saponin content were significantly influenced by forage species and stage of growth ( $P < 0.05$ ). Lablab exhibited higher ( $P < 0.05$ ) average tannin, phenolic and saponin content compared to cowpea; 3.35 mg catechin equivalent CAE/g of dry matter (DM) vs. 1.49 mg CAE /g DM; 13.5 mg gallic acid equivalent (GAE)/g DM vs. 9.40 mg GAE/g DM and 1.55% vs. 0.75% for tannin, phenolic and saponin, respectively. The tannin content of cowpea showed a general decline with stage of growth while for lablab there was an increase of 1.83 mg CAE/g DM from pre-anthesis to post-anthesis ( $P < 0.05$ ). Both forages showed a general decline in phenolic content with advancing stage of growth ( $P < 0.05$ ). Lablab recorded the highest saponin content pre-anthesis while cowpea showed higher saponin levels post-anthesis ( $P < 0.05$ ). There was a general increase with stage of growth for saponins in cowpeas, yet lablab showed a decline with advancing stage of growth ( $P < 0.05$ ). Results also indicated that forage type, harvesting stage and inoculum source significantly affected digestibility ( $P < 0.05$ ). Lablab recorded higher organic matter (OM) and DM (39.6% and 41.1%, respectively) contents than cowpea (19.4% and 39.9%, respectively). Both forages recorded higher DMD coefficients at the anthesis stage; 61.6% (cattle inoculum) and 51.5% (sheep inoculum) for lablab and cowpea, respectively. The OMD for cowpea increased (23.7% to 25.6%) with stage of harvest, yet with lablab, there was a decrease (44.6% to 43.9%) when cattle inoculum was used. Lablab recorded a higher ( $P < 0.05$ ) DMD (50.5%) when cattle inoculum was used while cowpea showed a higher digestibility co-efficient (38.5%) when sheep inoculum was used. Generally, OMD was lower in cowpea (19.4%) than lablab (39.6%). Cattle inoculum (DM 45.8% and OM 32.2%) performed better than sheep inoculum (DM 35.2% and OM 26.8%) for both forages. Lablab (6.21 MJ/kg DM) showed higher metabolisable energy (ME) values than cowpea (2.70 MJ/kg DM), irrespective of the source of inoculum. Tannin and phenolic levels of forages promoted digestibility, while saponin levels were too low to influence digestibility. Both forages can be used as protein supplement for ruminants, with lablab preferred for cattle and cowpea for small ruminants. Both forages can optimise ruminant animal production at their anthesis stage.



**PLATFORM PRESENTATION: A SYSTEMATIC STUDY OF *THEMEDA TRIANDRA* FORSSK.:  
ANATOMY, GENETICS AND CYTOLOGY**

*Sinethemba Ntshangase\* and Nigel Barker*

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*Themeda triandra* Forssk, commonly known as “Rooigras” in South Africa, is a perennial tufted grass that grows from 300 (Gibbs-Russell et al 1991) - 2000mm (Fish 2004), depending on population and location. This species is widely distributed, occurring in Africa (eastern and southern), Asia, Middle-East, India and Australia (Liebenberg et. al 1993 and Dell’Acqua et. al 2012). It is of great ecological and economic importance as it is a forage grass for livestock and wildlife (van Oudtshoorn, 2004). *Themeda triandra* is a morphologically diverse species (Gibbs Russell et al 1991). A number of studies have thus been done on the different forms of the species to understand the nature and causes of this morphological diversity from different regions of the world. These have not yet found any specific pattern for this morphological diversity. However there is some evidence the differences have ecological significance (Janse van Rensburg, 2003). This study aimed at determining whether the observed morphological differences are due to genetic differences caused by different ecological conditions; or if *T. triandra* is a plastic species without any genetic basis. This was done by analyzing genetic (DNA), anatomical (leaf blade and cross section) and cytological (chromosome counts) data. The results will benefit researchers and long-term management by resolving whether or not there is a genetic basis for the morphological and ecological differences observed. If taxonomic or population differences are confirmed, it may limit the extent to which results from localized areas can be generalized to avoid inappropriate management (Haywood, 1976). To study the DNA variability, Internal Transcribed Spacer (ITS) sequence data was used. To observe the anatomical variations, Scanning Electron Microscopy and Light Microscopy data was analyzed. A range of characters were recorded and analyzed through morphometrics. According to Ellis (1981), grass leaf micro-hairs, silica bodies and stomata (among other characters) are important diagnostic characters; therefore careful attention was paid to these characters. No significant pattern was found for anatomical traits and the genetic results. We conclude that the typical taxonomic anatomical traits may not reflect ecologically significant traits. Results from the DNA work will be further be used to determine if observed morphological differences are genetically based or not. We recommend that future work focuses on explicitly linking morphological, ecological and genetic/taxonomic traits.

**PARALLEL SESSION B: LAND TRANSFORMATION AND RESTORATION**

**SESSION CHAIR: KHULISO RAVHUHALI**

*Wednesday , 26 July 2017, 14:00 - 15:40*

**Venue:** Hongonyi (Wildebeest) and Xidzidzi (Honey Badger) Rooms

**PLATFORM PRESENTATION: CONTAINING DESERTIFICATION IN ARID NORTHERN KUNENE  
REGION, NAMIBIA**

*Axel Rothauge<sup>1\*</sup>, Zepee Havarua<sup>2</sup> and Tjakazapi Mbungu<sup>3</sup>*

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The mopane savanna of arid, mountainous north-western Namibia is desertifying rapidly because pastoralists apply inappropriate grazing methods. Kunene’s human population increased drastically due to improved nutrition and health services, causing an associated increase in cattle numbers and break-down of traditional rotational grazing practices, including seasonal evacuation of grazing grounds when temporary settlements migrated to traditional summer or winter grazing areas. Dense human settlement and constant access to borehole water allows livestock to stay in one place all year round with open, unrestrained access to all grazing areas at all times.

Continuous selective grazing initiates rangeland degradation and may lead to desertification. In Kunene, desertification is especially severe in fertile, steep-sided river valleys and flood plains with deep loamy soil (loess). Cavernous erosion gullies have removed nearly 40 m of loess and often cover the valley’s breadth, destroying the best grazing in the region and the only place where crops can be grown. Cattle are forced to graze steep mountains



and crop fields shrink to home garden size. Livestock fertility and growth rates decline and human poverty increases. This trend is not prevented by declaring nearly 85% of the area as community-based conservancies and 50% as community forests as neither CBNRM option secures the grazing resources for its resident community. "Pasture poaching" by non-residents is rife, discouraging planned grazing and the accumulation of drought reserves by resident communities.

The solution is to legally secure and practically enforce the grazing rights of resident communities. This may take long as it is not in the interest of powerful and politically-connected members of society. Until such time, soil erosion can be contained by securing the edges of gullies with transplanted indigenous, drought-tolerant fodder shrubs (DTFS) currently wiped out by injudicious utilisation. Furthermore, DTFS provide quality browse fodder, especially during the dry season.

A 3-year, EU-supported project grew 24 species of "former-local" DTFS in nurseries in 2015/16 and transplanted 5,500 DTFS into 3 bush-fenced field sites near the regional capital, Opuwo, where erosion is particularly severe. The project coincided with the first major (multi-season) drought this century, thus transplanted shrubs had to be watered once a month. Shrub mortality since transplantation in February 2016 is 20-30%, often induced by goats and rabbits penetrating bush-fences and selectively over-utilising palatable DTFS species like *Leucosphaera bainesii*. Shrublets were still too small during the 2016/17 rainy season to have a significant effect on surface run-off of rainwater (hence, soil erosion) in plantations compared to untreated areas. Yet, no gully edges in plantations caved in while caving regularly in untreated areas, indicating some soil stabilisation by root penetration.

The most valuable aspect of containing desertification in northern Kunene by transplanting DTFS is educational. Nearly 700 local participants at 7 events started appreciating the value of soil stabilisation, the potential nutritive contribution of DTFS and the value of deferring summer browsing to secure browse fodder for winter. The project ends this year; too short a time to exploit its full potential.

## PLATFORM PRESENTATION: TARGETED LIVESTOCK GRAZING TO IMPROVE AND RESTORE RANGELANDS

*John Walker<sup>1</sup>, Derek Bailey<sup>2</sup> and Karen Launchbaugh<sup>3</sup>*

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Targeted livestock grazing is the application of a specific kind of livestock at the appropriate season, duration, and intensity to accomplish defined vegetation or landscape goals. Grazing by wild and domestic animals is a powerful natural force working in all ecosystems. The ability of selective herbivory to shape plant communities was recognized early in the history of range management when plants were classified as increasers and decreasers, which indicated changes in their prevalence in plant communities in response to grazing. Along with fire, grazing is the oldest vegetation management tool. Knowledge of selective grazing habits of livestock and of how grazing influences vegetation communities can be used to address contemporary land management challenges, such as suppressing invasive exotic weeds on rangelands, reducing fire risk in the wildland-urban interface, and finding chemical-free ways to control weeds in organic agriculture. The major difference between good grazing management and targeted grazing is that targeted grazing refocuses outputs of grazing from livestock production to vegetation and landscape enhancement. Targeted grazing should be considered as another tool in the kit for constructing desirable ecosystems. It can and should be used in combination with other technologies, such as prescribed fire, mechanical or herbicide treatments, and seeding. The most important skill for people applying targeted grazing for vegetation management is patience and commitment. The effects of correctly applied targeted grazing are generally slow and cumulative. A minimum of three years is usually required before noticeable differences in perennial herbaceous composition become apparent. Browse may take much longer. A successful grazing prescription for vegetation management should: 1) cause significant damage to the target plant; 2) minimize adverse impact to the surrounding desirable vegetation; and 3) be integrated with other control methods as part of an overall landscape management strategy. A clear understanding of the palatability and effect of defoliation of all plants in the community is needed to design a grazing strategy that will compromise the target plants and benefit the desired plants. The challenge is to select the correct animal, grazing time, and grazing intensity to maximize damage to target plants or defoliation level of target location and minimize adverse effects on the surrounding desirable vegetation without compromising the animal's welfare. Vegetation management and landscape enhancement strategies must be ecologically based with careful attention to positively directing community change, not just suppressing an undesired species. Using grazing animals to purposely enhance rangeland landscapes is a viable approach because livestock grazing is already the dominant use of rangelands and may be as simple as switching to the appropriate livestock species for the current botanical composition of the land. Examples of successful application of targeted grazing will be provided.



## PLATFORM PRESENTATION: CHALLENGES TO MEASURING CARBON FLUXES IN THE ALBANY THICKET

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The Albany Thicket (AT) biome has been subjected to excessive herbivory by domestic livestock during recent times, with resultant transformation of large areas. Efforts to restore the AT are linked to its ability to store C efficiently. In order to determine whether AT is a viable sink for atmospheric carbon, we established an eddy covariance system at a site with a recent history of judicious management and low stocking of wild herbivores.

Portulacaria afra-dominated thicket on the Ezulu Game Reserve, Eastern Cape, South Africa. A Campbell Scientific eddy covariance system, comprising a CSAT sonic anemometer and an IRGASON infra-red gas analyzer were established at the study site in September 2015. Associated instruments provide 30 min values for radiation (Kipp-Zonen CR2 Lite Net Radiometer), soil heat fluxes, soil moisture and soil temperature. An adjacent scientific grade automatic weather station provides radiation, temperature, relative humidity and rainfall. The eddy covariance system provided instantaneous fluxes for C and H<sub>2</sub>O, which were corrected for site-specific parameters using EddyPro.

The daily CO<sub>2</sub> fluxes of the site are comparable with those being experienced by other semi-arid regions in southern Africa, with maximum midday rates of 25-30 mmols m<sup>-2</sup> s<sup>-1</sup> being recorded. Night-time respiration rates had been severely under-reported in an earlier analysis. Results for the growing season of 2015/2016 indicate that during this time the AT has been a weak C sink, accumulating 0.09gC m<sup>-2</sup> day<sup>-1</sup>. Results were compared with the MODIS GPP and PsnNet products, and with data from other African flux towers. Based on current daily accumulation, it is anticipated that the annual gain for this site will be 31.6 gC m<sup>-2</sup> year<sup>-1</sup>. This is equivalent to approximately 632kg DM ha<sup>-1</sup> yr<sup>-1</sup>. The data provided in this summary reflect a very dry year (2015/2016), when only 238mm of rain was recorded, and are not conclusive evidence of the long-term sequestration ability of the AT.

## PLATFORM PRESENTATION: SOIL NUTRIENT CONTENT AND FORAGE QUALITY ON OLD LANDS IN THE UMZIMVUBU CATCHMENT

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Unreliable rainfall and high frequency of drought have resulted in many farmers abandoning crop farming, resulting in high livestock dependence. This has created large areas of previously cultivated lands, which are now used for livestock grazing along with undisturbed veld. Quantitative information on the impact of previous cultivation on soil and forage quality in grasslands is inadequate. Amongst the challenges of livestock production, the changes in seasonal quality of the natural vegetation are the most prominent, especially to emerging farmers. Insufficient knowledge of the nutritive status of forage in communal grazing areas results in continuous developments of un-informed livestock supplementation plans leading to unnecessary expenditure and/or poor winter feed supplementation. Amongst other things, low herd productivity is one of the most persistent problems in communal farming. Beef production is more than just livestock sales and profit gains in the communal areas of South Africa, therefore, with increasing environmental variability, it is important to improve farmers' knowledge of nutrient availability and grazing management of old cultivated lands. In particular, decisions on whether to graze previously cultivated lands in summer or in winter could impact significantly on animal performance as well as the secondary successional processes on the old lands. Experimental research was conducted at Mzongwana in Matatiele (Eastern Cape). Sampling was conducted in two sub-sites in the same area: old cultivated lands, and: continuously overgrazed, but not cultivated, veld. In both sub-sites, six 100m transects were laid out. Along each transect a 0.5m by 0.5m quadrat was placed at 2m intervals and grasses in the quadrat were identified and recorded for species frequency. For grass clipping, a quadrat was randomly placed 8 times along the transect and grasses in the quadrat were clipped at 5cm from ground level and analysed for crude protein, fibre, P, Mg and Ca content. For soil sampling, collection was at a depth of 15cm and was carried out at 25m intervals along each transect, and analysed for pH, acid saturation, nitrogen and phosphorus contents. This study will be conducted through the growing season (early, mid and late growing season). The study generally aims at comparing soil nutrient composition and availability to forage grasses between the sub-sites through the growing season. Results are projected to suggest that previous cultivation significantly influences nutrient composition and availability in grassland soils, and hence, species composition and forage quality. The results will be discussed, with the aim of improving grazing management, herd productivity and winter forage management and supplementation.



## RESEARCH PROPOSAL POSTER VIEWING

Wednesday, 27 July 2017, 15:40 - 17:00

**Meet promising young scientists as they present their ideas for exciting new research at the Research Proposals Sessions. Collect a bead from each author and stand a chance to win a prize at the Gala dinner on Thursday!**

### **RESEARCH PROPOSAL POSTER: THE EFFECT OF ARBUSCULAR MYCORRHIZAL FUNGI, RHIZOBIUM INOCULUM, AND PHOSPHORUS FERTILIZER ON SOIL PROPERTIES, BIOMASS YIELD AND NUTRIENT CONTENT OF THREE HERBACEOUS LEGUMES**

*Sanele Mpongwana\* and John Mupangwa*

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The Eastern Cape province of South Africa is a vast area with different soil types, vegetation and rainfall distribution. Most of those areas have low soil phosphorus availability and poor soil fertility, low soil microbes due to continuous cultivation of the same crop and lack of fertilization to replace the nutrients loss. Insufficient indigenous arbuscular mycorrhiza (AM) fungi in South African soils results in plants growing in these soils being susceptible to drought/water stress, having low resistance against pests, fungus diseases, root pathogens and having poor uptake of P and N. Biological nitrogen fixation processes are not possible in soils that have low phosphorus availability. The objective of this study will be to examine the adequate use of arbuscular mycorrhizal fungi, *Rhizobium* inoculum and phosphorus fertilizer on soil properties, biomass yield and nutrient content of three herbaceous legumes in Alice, South Africa. The study will be carried out at the University of Fort Hare greenhouse in Alice. The experimental design will be a split-split plot design with 3 x 2 x 5 arrangement. There will be three legume species (*Lablab*, Velvet bean and Cowpea) as the main factor, two arbuscular mycorrhizal fungi (AMF+ or AMF-) and five phosphorus fertilizer levels (0, 20, 40, 60 and 80) as sub factors. The soil will be sterilized in an autoclave machine and each treatment will be replicated four times resulting in a total of 120 pots. The seeds will be inoculated with *Rhizobium* inoculum (*Bradyrhizobium* strain) and placed at a depth of 4-6 cm. Mixtures of single phosphate fertilizers at either 20, 40, 60 or 80 kg/ha P<sub>2</sub>O<sub>5</sub> and Mycoroot™ Supreme will be applied at 7-8 cm soil depth in a sterilized plant pot (bottom 20 cm and top 30 cm) with 15 kg sterilized soil. The data will be collected at three growth stages for plant height, stem diameter, plant vigour, chlorophyll content and stomatal conductance. The forages will be harvested at the end of the experiment data for biomass production to be obtained. The harvested samples will be analysed for nutritive value and anti-nutrient components.

### **RESEARCH PROPOSAL POSTER: THE EFFECT OF APPLYING DIFFERENT PHOSPHOROUS FERTILISER LEVELS ON FOUR LEGUMINOUS PASTURES PLANTED AT DOHNE AND BATHURST NURSERIES IN THE EASTERN CAPE PROVINCE, SOUTH AFRICA**

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Phosphorous (P) is an essential component of the compounds that store energy in plant cells, and is critical for plant processes such as photosynthesis. It is important for enhancing root growth and development, and also plays a vital role in flowering, fruiting, seed formation, and crop maturation. It is a structural part of all cell membranes and many other cellular components. Therefore, a study aimed to determine the effect of applying different rates of P on the





general productivity and nutritive value of four leguminous pastures will be conducted. The studies will be located at Dohne Agricultural Development Institute and Bathurst research station nurseries. The research institutes are situated at 32°31'39.89"E and 27°26'38.62" S; 26°49'15.37"E and 33°30'49.56" S respectively. Sixteen plots measuring 2m x 2m per site will be planted to four legume species viz. *Trifolium repens*, *T. vesiculosum*, *Lotus corniculatus* and *Lespedeza cuneata*. All legume species will be grown under rain fed conditions. Treatments will be established in a randomised complete block design (RCBD) and replicated four times. Soil samples will be taken to a 20 cm depth at three random sampling points per plot and submitted to the laboratory for soil P content. Phosphorous in the form of superphosphate fertiliser will be applied at the rate of: Full P; ½ P; ¼ P and 0 P of the recommendation based on the initial analytical laboratory results. Plant growth determination will be done by measuring plant height on a fortnightly basis until harvesting (seasonally). Nodulation determination will be done by uprooting plants at random points per plot. Nodule counting, weighing and dissection will be done per season. Plant and soil sampling will be conducted in spring (November), summer (February), autumn (March) and winter (May) throughout the study period. All data will be analysed using two way analysis of variance (ANOVA) of the Generalised linear model of procedure of SAS (2001) statistical program. Treatment (P application rate), legume species and season will be the main factors, while plant, soil nutrient content, plant height and nodule numbers will be the dependent variables. The results of the study will provide information regarding the effect of P on nodulation, biomass production and the growth rate and the nutrient content of the four leguminous species.

**RESEARCH PROPOSAL POSTER: DETERMINING RAINWATER USE EFFICIENCY, DRY MATTER PRODUCTION AND SOIL NUTRIENT REPLENISHING POTENTIAL OF DRYLAND PASTURES PRODUCED IN THE OLD ARABLE LANDS OF KRWAKRWA COMMUNAL, EASTERN CAPE, SOUTH AFRICA**

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Rain Water Use Efficiency (RWUE) is defined as the ratio between net primary production (NPP), or aboveground NPP (ANPP), and rainfall. Rain use efficiency (RUE) is a measure of the productive use of rainfall, as it equates the amount of rainwater converted into agricultural products. Water use efficiency (WUE) is defined as the ratio between dry matter (DM) produced and total water used for growth or as DM accumulation against potential or measured evapotranspiration (ET). This can be done on a seasonal or annual scale, and is important for understanding the management of dryland pastures. A trial wherein a variety of forage legume species will be intercropped with grass will be established at Krwakrwa communal area in the Eastern Cape province of South Africa. Krwakrwa communal area is situated at 32°44'37"S; 26°54'34"E and falls under the Nkonkobe local municipality, about 15 km on the northeastern side of Alice. The vegetation in the trial site consists of two adjoining veld types, namely False Thornveld and the Dohne Sourveld that dominate the Amatola Mountains. The goal of the project will be to develop pasture systems that can bridge the seasonal fodder flow shortages, determine the water use efficiency of the various planted pastures and quantify the quality and quantity of dry matter produced by the different pasture legumes planted under rainfed conditions. An old land of about 6.51 ha will be used as the experimental site where three forage legumes, namely: *Lotus corniculatus* (birdsfoot trefoil), *Lespedeza cuneata* (sericea lespedeza) and *Trifolium repens* (white clover) will be intercropped with one grass species (*Eragrostis curvula*). A no-till planter will be used to plant seeds of both grass and legumes into the old land (at the same time as a mixture). Planting will be done in September 2017 (spring) and the experiment will be run until 2020. Based on the soil analysis results phosphorous (P) level will be corrected to the level of 20 mg P/kg by applying 50 kg superphosphate per hectare once-off at planting. The plots will be arranged in a randomised complete block design (RCBD) and replicated four times. Prior to planting, legume seeds will be mixed with the appropriate inoculant by hand. Seasonal herbage production will be measured by clipping a 0.25 m<sup>2</sup> quadrat in enclosure (2 m x 2 m) cages set out in all the experimental plots. All the plant samples will be cut using hand shears at approximately 5 cm above soil level. The following parameters will be measured and analysed: species composition; dry matter production; 15 N; plant mineral content; soil macronutrient content and organic carbon (OC); Rain Use Efficiency (RUE) and Water use Efficiency (WUE). Data collection will be done seasonally (i.e. spring, summer, autumn and winter) throughout the duration of the experiment. All soil and plant data analysis will be carried out using two-way analysis of variance (ANOVA) of the Generalised linear model procedure of SAS (2001) statistical program.



**RESEARCH PROPOSAL POSTER: ASSESSING RAINWATER USE EFFICIENCY OF DIFFERENT GRASS SPECIES, BIOMASS PRODUCTION AND BASAL COVER IN TWO VELD TYPES OF KRWAKRWA COMMUNAL RANGELANDS IN ALICE, EASTERN CAPE**

*Tanki Thubela<sup>1\*</sup>, Mfundo Macanda<sup>1</sup> and Mota Lesoli<sup>2</sup>*

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Rangeland management practices have been designed mainly for improving forage production, and secondarily soil and biodiversity conservation. While this was done, there was no emphasis on rangeland water dynamics. Forage production both in terms of quality and quantity is positively related with soil moisture, thus the higher the moisture the higher the production. Soil moisture in rangelands is influenced by ecosystem water recharge, storage and discharge. In the rangeland ecosystem, generally water recharge is more dependent on precipitation and run-off. The rangeland water capacity is influenced, among other factors, by soil physical properties, soil depth, vegetation cover and landscape morphology. Therefore, water discharge is influenced by run off, evaporation and infiltration rate, and these in turn influence vegetation, soil and landscape characteristics. Rangeland hydrology has been generally overlooked, whilst it is at the centre of productivity. It is therefore essential that rangeland ability to capture and store water be considered as an important factor in determining rangeland condition. This study will measure rangeland water dynamics in the form of recharge, storage and discharge in order to determine the potential of rangeland ecosystems to store water and to relate that potential to forage productivity. Rangeland ecosystem rain use efficiency (RUE) will be measured based on the water recharge, capacity to store and discharge rate. The major factors in this will be vegetation influence on rainfall interception and water storage, which will to a larger extent be influenced by species composition and vegetation cover. This will further be influenced by soil texture and landscape characteristics (shape, gradient and aspect). Water use efficiency (WUE) is more species specific and therefore allocation and categorisation of rangeland species into low, moderate and high water use efficiency will help in factoring water use efficiency in determining rangeland condition and rainwater efficiency. Morphological and phenological features of rangeland vegetation influence species water use efficiency. Different parts of the plants have different capacities to influence water use efficiency, which makes plants differ in efficiency of using water. Therefore, this project will further determine intrinsic water use efficiency (IWUE), which relates to the capacity of different parts of the plant. Exclosure cages of 9 m<sup>2</sup> will be systematically placed in line transects on the range with an interval of 200m in between cages, and transects will be laid along slope with top middle and bottom lines. Parameters will be measured inside and outside adjacent to each cage. These cage transects will be replicated in camps or aspects. The study will be applied on two veld types (Dohne Sourveld and Eastern Cape False Thornveld) that occur in the same communal rangeland. While climatic data (rainfall, temperature and evaporation) will be measured in the experimental sites, a full weather report will also be requested from ARC agromet for the length of the study.

**RESEARCH PROPOSAL POSTER: IMPACT OF DROUGHT AND ELEVATED CO<sub>2</sub> LEVEL ON SPECIES DIVERSITY, PRODUCTIVITY AND WATER USE EFFICIENCY OF KEY FORAGE SPECIES IN SEMI-ARID GRASSLAND IN GAUTENG PROVINCE, SOUTH AFRICA**

*Thabo Magandana<sup>1\*</sup>, Ayob Tesfamariam<sup>2</sup> and Abubeker Hassen<sup>1</sup>*

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Increased levels of greenhouse gases (including CO<sub>2</sub>) due to anthropogenic effects are responsible for global warming. South Africa is currently facing climate change which also has an impact on the occurrence of drought. Drought can be defined in general terms as the 50 percent shortfall of rainfall over a period of three months. The hazard level of drought is determined by its duration as the drought develops slowly and may last for many years. African countries have been identified as being drought vulnerable. Research shows that about 220 million people are exposed to drought annually with one third of African people living in areas that are prone to drought. South African semi-arid areas and neighboring countries experience periodic droughts during El Nino - Southern Oscillation events. It is argued that droughts occur every three to six years. Drought can lead to reduced rangeland (veld or pasture) productivity which will ultimately lead to reduced livestock and wildlife numbers. Under extensive systems, livestock farmers rely mainly on the natural veld for year-round grazing of their animals. However, drought may limit



the availability of forage for the grazing animals as it results in reduced growth or even death of plants and this in turn has a negative effect on livestock production. There are few studies that have focused on the influence of drought and CO<sup>2</sup> on grass and soil properties in South Africa. The proposed study examines how drought and elevated CO<sup>2</sup> influence vegetation diversity and structure as well as the soil organic carbon, soil nitrogen and other soil nutrients that are important for plant growth. This study will provide information about the negative impact of drought, and how elevated levels of CO<sup>2</sup> in the air affect vegetation dynamics (species composition and structure) and soil properties.

**RESEARCH PROPOSAL POSTER: TRANSPIRATION RATE OF *SENEGALIA MELLIFERA* IN RELATION TO DIURNAL PATTERN, SEASONAL PATTERN, RAINFALL, SIZE OF THE TREE, TREE DENSITY AND ENVIRONMENTAL FACTORS IN A SEMI-ARID NAMIBIAN THORNBUSH SAVANNA**

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Bush encroachment is the change in vegetation dominated by woody species which often results in overgrazing or invasion by alien species, (Archibold, 1995). Many studies have focused on the understanding of bush encroachment and its dynamics. However, little or no research has been done on diurnal, seasonal and/or environmental effects on transpiration rate in Namibia. Therefore there is a knowledge gap with regards to leaf transpiration and how much water is lost based on limited evidence. This specific study will focus on analysing the relative transpiration rate of *Senegalia mellifera* which is extensively spread in the highland savannah of Namibia (Curtis & Mannheimer, 2005). The aim of the study will be to give new information and it will draw conclusions from giving the true value of relative transpiration rate at a landscape scale and water use by trees. The objective of the study is to determine the transpiration rates of *Senegalia mellifera* and how it is affected by various factors in relation to diurnal pattern, time of season, rainfall, intra-and inter-specific competition, size of plants and soil water. The question to be addressed by the study will be "How is transpiration affected by various factors in relation to diurnal pattern, time of season, rainfall, intra-and inter-specific competition, size of plants and soil water?" The study is guided by two null hypotheses which are: "Transpiration rates are not affected by bush clearing."; "There is a strong negative correlation between transpiration rates and environmental changes such as temperature, light intensity, precipitation and seasonal change." Transpiration measurements will be conducted in cleared and encroached plots, on forty (40) trees of *Senegalia mellifera* of different tree sizes. Measurements will be conducted hourly for a week, every month during the growing season. Two porometers will be used to take measurements on the abaxial and adaxial side of the leaves (Decagon Devices Inc., 2015). Readings will be taken from sunrise to sunset. BECVOL estimation methods will be used to extrapolate measurements for the whole plant leaf biomass (Smit, 1996). Linear models will also be used to determine relationships between transpiration and other factors such as size of the tree, time of day and season, soil water related to days since last significant rainfall, encroached compared with cleared plots and competition.

**RESEARCH PROPOSAL POSTER: ASSESSING PARASITISM OF SMALL RUMINANTS IN ARID COMMUNAL RANGELANDS OF SOUTH AFRICA**

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Worldwide parasites pose a major constraint on livestock farming. Their impacts are represented as transmission of disease to humans and economic costs for prevention and treatment as well as loss in terms of mortality and lowered productivity (lowered milk/ meat yields). Although the impacts of parasitic loads can be decreased through proper management, extensive management systems are dependent on external factors such as rainfall and forage which affect malnutrition. The lack of proper nutrition with added stressors from an extensive management system (such as moving long distances for water, food and heat) allows for the success of parasites among sheep and goats. Thus the aims of this project are to investigate the parasitic loads of small ruminants in an arid communal rangeland which utilises an extensive management system, to determine and assess the pathogens these parasites harbour, and lastly, to make viable recommendations in terms of management and treatment of parasitic control. Research objectives include: (1) determining the density and diversity of tick loads of small ruminants through manual collection



and further identification to species level; (2) determining the density and diversity of internal parasitic worms found within faecal matter (collected from the recta) together with blood samples (collected from slaughtered animals), where the eggs will be identified using McMasters technique and through faecal cultures; (3) identification of any pathogens present using PCR (polymerase chain reaction) analysis from tick samples for the presence of diseases. To obtain these objectives, sampling will occur within the Steinkopf communal rangelands in the Northern Cape province of South Africa. Results of this study could provide insight into the future management and treatment of parasites.

### **RESEARCH PROPOSAL POSTER: ASSESSING THE RELATIONSHIP BETWEEN GENETIC DIVERSITY AND DIET SELECTION IN A SEMI-ARID COMMUNAL LIVESTOCK FARMING SYSTEM**

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South Africa is home to many indigenous, locally developed and introduced livestock breeds. In South Africa, adaptive traits have allowed indigenous sheep and goat breeds to co-evolve with their environment, including those occupying semi-arid ecosystems. These small-stock are characterised by their hardiness and adaptation to dry conditions and extensive ranges as well as extreme weather conditions. The introduction of commercialised breeds has allowed for more diverse genetic material within herds which can maximise meat quality as well as wool and milk production. However, a diverse genetic makeup is not the only determining factor that contributes to low productivity since the quality and quantity of available forage to livestock also play major roles. Small-stock are the most prominent livestock units in semi-arid areas and different breeds commonly co-graze due to their similar dietary needs. The aim of this study will be to evaluate feeding selection of different small-stock breeds in the semi-arid to arid Steinkopf communal rangeland in the Northern Cape province. This study will attempt to (i) assess the diet selection of herded sheep and goat breeds in a semi-arid region (ii) evaluate the niche breadth and overlap between the different livestock breeds (iii) assess whether genetic variability is linked to a more diverse forage intake of herded sheep and goat breeds in a semi-arid environment. Direct forage observations of small-stock will be conducted in the Steinkopf communal area. Diet selection, preferences and niche breadth and overlap will be calculated in the wet and dry seasons. Nutritive values of plant species selected will be calculated focussing on the crude protein levels within each plant. DNA analysis of livestock will be carried out for genetic diversity using microsatellite markers. Results of the DNA analysis will indicate variation in breeds as well as distinguish between breeds found in the study area. The forage selections identified for each breed will be compared to forage selections of these groups in controlled studies when commercial breeds were developed. Implications of this study are that it will improve our knowledge on forage selection of different breeds found in semi-arid rangelands.

### **RESEARCH PROPOSAL POSTER: ASSESSING THE RELATIONSHIP BETWEEN LANDSCAPE FUNCTIONALITY AND SMALL MAMMAL ASSEMBLAGES IN THE ARID COMMUNAL DRYLANDS OF STEINKOPF, NORTHERN CAPE**

*Laetitia Piers<sup>1,2\*</sup>, Adriaan Engebrecht<sup>1</sup>, Igshaan Samuels<sup>2</sup> and Mmoto Masubelele<sup>3</sup>*

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Rangeland ecology is a broad subject but most published research in the field focuses on animal production. Thus, few studies have explored rangeland ecology from a landscape functionality perspective. Rangeland functionality in relation to pastoralism is important to allow for optimum fodder production, sustainable use of resources and subsequently improved livelihoods. The arid and semi-arid ecosystems in Steinkopf are not managed differently even though they have different rainfall regimes and hence the question arises: how does management affect landscape functionality? Functionality also impacts on small mammals, which are very important since they assist in various system functions: their feeding, excretory and fossorial habits allow for enhancement of nutrient cycling, water infiltration and soil stability. Their populations can decline due to a reduction in functionality and habitats for them to survive. To fill this knowledge gap, the following research approach will be explored in the communal area of Steinkopf. Nine sites will be selected to perform a Landscape Functional Analysis, Point Centered Quadrat and Soil Surface Assessment using the methodology of Tongway & Hindley (2005). Three sites will be selected in each area



(Desert biome, the ecotone, Succulent Karoo biome) in a linear sequence. Three replicates of each site will be done resulting in 27 sites being selected for statistical reliability. The small mammals will be trapped using Sherman live traps in one site of each area which will be a representative of each area. The data will be analyzed using appropriate statistical tests. To compare the small mammal assemblages and body condition with landscape functionality data a MANOVA will be used. This study will assist in improving management strategies of communal rangelands to ensure their health and functionality, and the conservation of the small mammal assemblages in arid areas.

## **RESEARCH PROPOSAL POSTER: ASSESSMENT OF BUSH CLEARING ON GRASS PRODUCTION, WOODY STRUCTURE AND PLANT DIVERSITY IN A SEMI-ARID SAVANNA, CENTRAL NAMIBIA**

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Bush thickening is one of the major challenges facing rangelands and the agricultural sector in Namibia. The affected areas are mainly within the semi-arid savannas with rainfall varying from 300 mm in the west to about 500 mm in the north-eastern parts of the country. Bush thickening severely affects about 12 million ha which is mainly the north and central parts of Namibia, resulting in loss of land productivity, and hence a significant decline in carrying capacity and biodiversity. Mismanagement of rangelands together with overgrazing and limited livestock movement has been partially believed to be the main cause of bush thickening in Namibia. Other contributing factors such as soils, rainfall, altered fire regime, browsing pressure etc. also play major roles in determining interactions between the woody and herbaceous components. Some commercial farmers with the aid of funded projects have implemented projects on bush clearing which aim at improving rangeland productivity. Previous studies on the effects of bush clearing in Namibia mainly focused on the economic issues such as production, whereas the ecological and biodiversity effects are not well understood. Therefore this project aims at understanding the effects of bush clearing on grass production, woody structure, and plant diversity in a semi-arid savanna in central Namibia.

## **RESEARCH PROPOSAL POSTER: INVESTIGATING ACTIVE VELD RESTORATION BY MEANS OF ALTERNATIVE FERTILISATION PRACTICES IN THE NORTH WEST PROVINCE**

*Yvette Brits*

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Veld degradation is an enormous problem in our agricultural landscape. Depending on the severity of the degradation as well as the soils and environment, either passive or active restoration can be implemented. The fertilisation of veld resonates with the latter. Nitrogen (N) and phosphate (P) are deemed to be of primary importance, with soil moisture and status not to be forgotten. The advantages of the fertilisation of veld include increases in productivity, crude protein content and phosphate in the grasses as well as improvement in the palatability of grasses of the sour veld regions. The downside to this practice is that it can result in poorer species composition with a higher production of the less desirable species. Only with strategic fertilisation, where the "rest camps" are only partially fertilised, were positive results obtained in sour veld areas. The traditional granular fertilisers can also cause salination of soils causing more problems. Liquid fertilisers are also not a new concept, but as they are similar to the granular fertilisers, the effect will be the same. However, a new type of liquid fertiliser has been introduced to the NW Department READ, of which the phosphates are in the orthophosphate form and nitrogen can be included as needed. It is sprayed directly onto the leaf and it is claimed that the effect is quicker and more effective than normal granular fertilisers. As it is absorbed and utilised by the leaves, it improves the plants ability to photosynthesise, which may result in excess energy available to be transported to the root, aiding in better root development, resulting in more effective moisture uptake and in the end a stronger plant. The aim of the study is to evaluate the effectiveness of the new product and to determine if it might be of value in the restoration of veld. A pilot study on the application and effectiveness thereof in veld will therefore take place. The trial area will be on the experimental farm of NW READ, Potchefstroom. An exclusion plot, in a veld camp, of 80 m x 80 m, divided into 12 (20 m x 20 m) blocks, with a 5 m border around each block, will serve as the trial area. The trial consists of three (3) treatments, i.e. new liquid fertiliser product, traditional granular fertiliser as well as a zero treatment, replicated three (3) times. The treatments will be randomly allocated to a block and applied by hand. Soil analysis will be carried out in each of the



12 blocks, before and during the trial period. Plant composition, density, and biomass production as well root development for each treatment will make up the physical surveys. Leaf, root and soil analysis will take place to give an indication of the nutrient status in the various areas. The results will be analysed and compared to conclude whether or not the product can be effectively used to restore bigger areas of veld.

**RESEARCH PROPOSAL POSTER: CONTROL OF BUSH ENCROACHMENT ON *LOPHOLAENA CORRIFOLIA* SHRUB AND SOIL PROPERTIES AROUND MIXED BUSHVELD REGION OF THEMBISILE HANI - MPUMALANGA PROVINCE**

*Oupa Keromecwe\**, *Norman Magoro* and *Collen Rabothata*

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Many species which have become troublesome invaders in other parts of the country and which by law must be eradicated or controlled are still largely confined to cultivation in the mixed bush veld. Indigenous bush encroachment is the increase in density, cover and biomass of indigenous woody species in relation to herbaceous species. Vegetation structure and species composition are closely related to soil types in the mixed bush-veld region. The study will be comparing the different soil characteristics, biomass and production associated with bush encroachment on *Lopholaena corrifolia*. The objectives of this study are to determine species composition, plant growth on vegetation, soil physico-chemical properties along the bush encroached area, measuring the biomass and production. Sampling will be separated by species and dried in the oven at the temperature of 60°C and weighed. In conclusion the results of these studies will not be conclusively linked to soil properties to bush encroachment on *Lopholaena corrifolia* species.

**RESEARCH PROPOSAL POSTER: THE IMPACTS OF ALIEN INFESTATIONS ON VELD GRAZING CAPACITY**

*Ayanda Mnikathi\**, *Kevin Kirkman* and *Mbulisa Sibanda*

University of KwaZulu-Natal, School of Life Sciences, email: [apmnikathi@gmail.com](mailto:apmnikathi@gmail.com)

An increasingly important focus of ecologists, conservationists and resource managers are invasive alien species. This focus is mainly due to their rapid spread, damage to ecosystems and threats to biodiversity. Approximately 70% of the earth's vegetation cover is rangelands, and alien invasive species pose a threat to the structure and functioning of these rangelands. The attributes of RS technology are beneficial to detecting, mapping and monitoring invasive species in pastures, rangelands and forests. The impacts of three alien invasive species (*Rubus cuneifolius*, *Lantana camara* and *Acacia mearnsii*), which are currently a problem in KZN rangelands, will be investigated. Three study areas (Ukulinga Research Farm, Wakefield and Matatiele) were selected for this study due to the prevailing occurrence of alien invasions in these sites. To evaluate the impact of alien infestations on veld grazing capacity, Landsat 08 OLI satellite images will be used to classify alien invasive species from other land cover types. Rangeland productivity, as well as grass species composition, will be measured using a dry-weight technique for estimating grazing capacity. For this research study, it is predicted that alien invasive species will decrease the veld grazing capacity of rangelands. This is an ongoing Master's project at the University of KwaZulu-Natal.

**RESEARCH PROPOSAL POSTER: THE ROLE OF BIODIVERSITY IN PROVIDING ECOSYSTEM GOODS AND SERVICES IN AGRICULTURAL LANDSCAPES**

*Keletso Mopipi<sup>1</sup>*, *Sizwe Tikwayo<sup>1\*</sup>* and *Thabiso Mokotjomela<sup>2</sup>*

<sup>1</sup>University of Fort Hare, Department of Livestock & Pasture Science, <sup>2</sup>Eastern Cape Parks & Tourism Agency, Coastal and Marine Cluster, email: [stikwayo@ufh.ac.za](mailto:stikwayo@ufh.ac.za)

It has been predicted that climate warming will have profound negative impacts on human wellbeing through reduced agricultural food productivity, and devastate biodiversity which provides important sustenance for many rural communities across the world. In South Africa, the Eastern Cape province has high levels of rural poverty due to its under-developed state. The province also possesses unique biodiversity which is, however, threatened by loss of natural habitat to infrastructural developments and agricultural land use. There is a paucity of knowledge on ecological processes that maintain the remaining biodiversity in the heavily transformed agricultural landscapes. This gap requires urgent attention in order to understand and sustainably manage ecological processes and their complex relationships with the social structures. The objectives of this study are: to assess the role of biodiversity in providing



goods and services in agricultural landscapes; to assess potential success associated with the wildlife economy in the Eastern Cape province; to determine how smallholder farmers adapt the food production systems to the on-going climate change, and to investigate the local ecological regime shift imparted by elements of global change, such as plant invasion and implications for biodiversity conservation. The role of biodiversity in agricultural landscapes will be assessed using observational and experimental methods in the field documenting interactions of the biodiversity with anthropogenic structures. To assess the potential success of the wildlife economy in South Africa, a comparative assessment will be conducted focusing policy documentation review, observational surveys of land uses, species diversity and game management laws in Namibia and Botswana as two neighbouring countries that have successfully implemented wildlife economy. Farmers' knowledge of climate change adaptation mechanisms in the Eastern Cape province will be assessed using ethnographic methods (i.e. focus groups, questionnaires and interviews). In addition, historical temperature and rainfall records will be analysed to detect if there have been significant changes in local climate. These will be complemented by analyses of historical local vegetation cover changes. The local ecological regime shifts will be evaluated using GIS and Remote Sensing techniques combined with ground-truthing from analyses of soil chemistry and physical properties and the historical land use practices. The results of this study are expected to increase communal farmers' awareness about the role of biodiversity in providing goods and services in agricultural landscapes and educate smallholder farmers about adaptation of their food production systems to the on-going climate change. Also, the study will address how game farming generates rural socio-economic development opportunities in the Eastern Cape. It will also address implications of the local ecological regime shift imparted by elements of global change such as plant invasion on biodiversity conservation in transformed agricultural landscapes.

## RESEARCH PROPOSAL POSTER: ANALYSING COMPETITION STRATEGIES FOR INVASION SUCCESS OF *SOLANUM MAURITIANUM* (BUGWEED) IN EASTERN CAPE PROVINCE, SOUTH AFRICA

Thando Ntutha<sup>1</sup>, Keletso Mopipi<sup>1\*</sup>, Thabiso Mokotjomela<sup>2</sup>

<sup>1</sup>University of Fort Hare, Department of Livestock and Pasture Science, <sup>2</sup>Eastern Cape Parks & Tourism Agency, Coastal and Marine Cluster, email: [kmopipi@ufh.ac.za](mailto:kmopipi@ufh.ac.za)

Invasive alien plants and climate changes are major threats biodiversity and human well-being in the world. In South Africa, the invasive species pose economic threats and reduce agricultural food productivity. *Solanum mauritianum* (bugweed) is one of the invasive woody plant South Africa and it has invaded extensive areas in the Eastern Cape province. Whereas existing studies were conducted in the Western Cape and Mpumalanga provinces, there are no previous studies that have investigated competition strategies leading invasion success of bugweed and its potential impacts on the natural environment in the Eastern Cape province. Urgent attention is required to fill this gap in order to advise the alien plant managers and conservation authorities on how to contain the problem.

The objectives of this study will be to investigate the chemical ecology of *S. mauritianum* and its allelopathic effects on natural veld; to determine how the invasion of bugweed influence the edaphic environment; to investigate the role of reproductive output in invasion of bugweed and its population recruitment; and to investigate seedling performance in different environmental conditions (e.g. rainfall and temperature) in order to predict the areas vulnerable to invasion by bugweed in Eastern Cape.

The relationship between bugweed abundance and allelopathic effects on the natural veld will be investigated in different densities of invasion using field and laboratory experiments. Field observations of plants of different age and their under-canopy composition of indigenous species will be used to assess the age at which bugweed starts having allelopathic effects. To assess the influence of bugweed invasion on the edaphic environment, the comparative experimental methods will be used to study soil chemistry and physical properties in an invaded and non-invaded areas. To investigate the role of reproductive output in the invasion of bugweed, the seed production, dispersal and germination viability will be explored. Lastly, to investigate seedling performance and to predict spatial spread, field experiments with seedlings from the greenhouse will be used. Seeds from different plants and areas will be harvested to produce seedlings in the greenhouse and transplant them to various climatic conditions (e.g. rainfall and temperature) and have their growth monitored.

The study will provide critical information pertaining the invasion success strategies of bugweed and its impacts on the natural veld, and thereof make management recommendations of this species in the Eastern Cape province.



## RESEARCH PROPOSAL POSTER: EFFECTS OF LONG-TERM FIRE EXCLUSION ON GRASS SPECIES COMPOSITION, TUFT DENSITY AND SOIL PHYSICAL PROPERTIES IN THE DOHNE SOURVELD

*Nolonwabo Jokani\* and Tanki Thubela*

Eastern Cape Department of Rural Development and Agrarian Reform, email: [njokani@gmail.com](mailto:njokani@gmail.com)

The effects of fire and fire use has much been explored in rangelands research around the globe; however more research mainly focused on fire use, frequency and its effects thus leaving less known on the long term impact of fire exclusion on rangelands management. Fire is considered an important rangeland management tool on Dohne Sourveld rangelands and this veld type is known to be fire climax grassland. Therefore in total absence of fire use, its vegetation succession climax is expected to be forest. Fire climax grasslands in potential of forest areas which are at low levels are said to may have no trees or interspersed among forest patches or bush clumps while in the high lying areas have most tufted grasses and provide high basal cover compared to arid or savannah regions. These areas are said to be stable and their degeneration is associated with change in species composition rather than with a loss in basal cover. However in the case of long term fire exclusion where these grasslands has a potential of forest climax, mainly where succession forms bush or shrubs clumps it is not known whether the tuft density, basal cover and species composition remain the same or what happen to soil stability. Therefore, further investigation of the fire exclusion on the mentioned parameters is essential in learning the importance of fire use in such vegetation types. On the study, three small camps (paddocks) of different use will be used to measure soil physical properties (Organic matter, structure, aggregate stability and texture), species composition, tuft density and basal cover. The camps are currently used for different purpose, one is for grazing animals and burning is practised, the other camp is used as a trial to measure different times/ or season of burning and is burnt annually, and the last camp is said to have never experienced burning since 1938 and was burnt down only in 2014 and is used as a control for the burning trial adjacent to it. Square quadrants of on  $1\text{m}^2$  will be used to randomly select 10 sites per camp where all the mentioned parameters will be measured. The study will be carried over one year period to measure variations. Physical properties of soil such as compaction, texture, aggregate stability and moisture will be measured. Data will be analysed using general linear model (GLM) procedure of the SAS 2002 and results will be compared from different treatments and seasons to identify any significance related to hypothesis of the study





## **PARALLEL SESSION A: BIODIVERSITY INITIATIVES AND CONSERVATION PLANNING**

**SESSION CHAIR: LISA JOUBERT-VAN DER MERWE**

*Thursday, 27 July 2017, 08:00 - 09:30*

**Venue:** Mhelembe (Rhino) Hall

### **PLATFORM PRESENTATION: PLANNING FOR THE MAINTENANCE OF FLORISTIC DIVERSITY UNDER GLOBAL CHANGE**

*Debbie Jewitt<sup>1,2\*</sup>, Peter Goodman<sup>1</sup>, Barend Erasmus<sup>1</sup>, Tim O'Connor<sup>1,3</sup> and Ed Witkowski<sup>1</sup>*

<sup>1</sup>Ezemvelo KZN Wildlife, <sup>2</sup>University of Witwatersrand, <sup>3</sup>South African Environmental Observation Network (SAEON), email: [debbie.jewitt@kznwildlife.com](mailto:debbie.jewitt@kznwildlife.com)

Habitat loss and climate change are driving biodiversity loss globally. Species will need to track changing environmental conditions but this will be difficult in fragmented and anthropogenically transformed landscapes. An important tool for maintaining resilience to global change is to ensure landscape connectivity. We present a coarse-grained connectivity map between protected areas to facilitate decision-making in the face of land cover and climate change in KwaZulu-Natal. A biological underpinning is used to prioritise the spatial location of the corridors including the major climatic gradients correlated to floristic composition, high beta diversity areas, important plant areas and climate refugia. Linkage Mapper was used to develop the corridors. Land cover categories were used to develop the resistance layer. Resistance values were informed by research related to the impact of land cover and land use on plant diversity. Natural habitats were discounted based on their contribution towards meeting the biological objectives. Various corridor options are presented based on minimum corridor requirements, meeting landscape targets and creating linkages in highly transformed areas. The importance of different protected areas in maintaining landscape connectivity are discussed and pinchpoints that could compromise landscape connectivity are identified. This framework is suggested as a way to conserve floristic diversity in future. However, a lack of implementation of the corridors will lead to further habitat loss and fragmentation resulting in major risks to plant diversity in the province.

### **PLATFORM PRESENTATION: THE GAUTENG BIODIVERSITY STEWARDSHIP PROGRAMME**

*Emily Taylor*

Endangered Wildlife Trust, email: [emilyt@ewt.org.za](mailto:emilyt@ewt.org.za)

The Gauteng province has committed to expanding the number of hectares of land under formal protection by 30,000 ha by 2019, and Biodiversity Stewardship has been identified as an effective mechanism with which to achieve this. The Gauteng Biodiversity Stewardship Programme (GBSP) is a collaboration between the Gauteng Department of Agriculture and Rural Development (GDARD), the Endangered Wildlife Trust (EWT) and the World Wide Fund For Nature (WWF) Nedbank Green Trust. The Programme was formed to catalyse the implementation of Biodiversity Stewardship in Gauteng grasslands through the development of capacity to support stewardship processes at all levels. This public-private partnership aims to capacitate existing stakeholders as well as to support strong and relevant institutional structures for long-term impact and sustainability. The measurable target for this project is to publish the intent to declare 5,000 hectares of privately owned land under Biodiversity Stewardship within three years. The first year of the project involved the identification of project targets, the development of a plan of operation to meet these targets, the enhancement of understanding of the conservation landscape in Gauteng and the development of institutional processes to ensure effective implementation of stewardship in the province going forward. Subsequently, the team has finalised the adaptation of selection and assessment procedures for the Gauteng landscape and implemented these procedures in a number of sites; conducting desktop assessments of the sites, following up on these on the ground with the assistance of the GDARD's Scientific Services unit, taking the site assessments through the review panel process, and putting in place the institutional steps required for the formal proposal of the appropriate Protected Area category to landowners. The team is now taking the first steps into the declaration phase for one site through extensive engagement with the landowner, the surveying and mapping of areas to be declared, and the development, in negotiation with the landowner, of an Environmental Management Plan for the first Private Nature Reserve declared under the National Environmental Management: Protected Areas Act (NEM: PAA) in the Gauteng province.



## PLATFORM PRESENTATION: CARBON TAX AND THE NEED FOR CARBON SEQUESTRATION AND OFFSET

*Josef van Wyngaard<sup>1,2\*</sup> and Robin Meeske<sup>2</sup>*

<sup>1</sup>University of Pretoria, <sup>2</sup>Western Cape Department of Agriculture, Outeniqua Research Farm, email: [josefvw@elsenburg.com](mailto:josefvw@elsenburg.com)

It is well known that greenhouse gasses (GHG) accumulate in the ozone layer which brings forth global warming or climate change per se. The ripple effect includes the increased risk for drought, fire, floods and heat-related animal and plant diseases and stresses. This transforms and threatens the sustainability of current and future global natural resources; hence questioning the sustainability of current agricultural enterprises. Furthermore, it is scheduled that agricultural carbon tax will be implemented in South Africa by the end of 2020. Currently, carbon is protected or increased in significant quantities in various ways, but may not be enough. These carbon offset strategies include no or minimum tillage practices, veld or pasture biomass and ecosystem protection, planting of trees and shrubs, and precision farming (fertilization and animal feed). Other practices include biogas (bio-digesters), solar and wind power, saving on fuel and various other known measures. The cost of carbon offset or GHG mitigation strategies cannot be avoided and should rather be seen as an incentive for tax relief. Climate change is a common term for all natural and agricultural science disciplines and in reality it should be addressed mutually. This paper gives an overview on GHG as global warming instigators and builds up to the proposed South African carbon tax and ultimately aims to trigger plaited cooperation among different disciplines to discover new or improve current practical carbon offset and GHG mitigation strategies.

## PLATFORM PRESENTATION: STRENGTHENING RANGELAND STEWARDSHIP AND RESTORATION THROUGH RESEARCH, DEVELOPMENT AND INNOVATION (RDI) LEARNING PLATFORMS

*Dan'sile Cindi<sup>1\*</sup>, Kennedy Nmutamvuni<sup>1</sup> and Nicky Macleod<sup>2</sup>*

<sup>1</sup>South African National Biodiversity Institute (SANBI), <sup>2</sup>Environmental & Rural Solutions, email: [d.cindi@sanbi.org.za](mailto:d.cindi@sanbi.org.za)

There are several factors contributing to the overall loss of biodiversity in communal rangelands including alien invasive species, poor land management, climate change, and history of tenure systems. These factors further contribute to poor livestock production, increased risk of drought and/or floods, damage to built infrastructure and reduced water security and the overall impact on the livelihood of the people who depend on the production capacity of these landscapes. South Africa has a strong research base addressing some of these problems both in the academic and applied context. However, this research is not applied or taken up in policy development or recommendations do not get implemented due to lack of information-sharing between researchers and practitioners. To respond to this the South African National Biodiversity Institute (SANBI) is undertaking a project funded by the Department of Science and Technology (DST) and Department of Environmental Affairs (DEA) to establish research, development and innovation (RDI) platforms for ecological infrastructure in two river catchments namely uMzimvubu and the Berg and Breede. Ecological infrastructure is defined for the purpose of this project as naturally functioning ecosystems that deliver valuable services to people (SANBI 2013). The intention of these platforms is to deepen and expand relationships, to establish a community of practise, improve coordination, sharing and cross-pollination of research within these strategic river catchments. These learning platforms are built on the existing initiatives instead of starting a parallel process. One useful learning platform is embracing the success of the rangeland restoration stewardship model, linked with the Meat Naturally Initiative. The concept is based on the idea that proper livestock management can reverse land degradation and the desired impacts, including the recharge of water resources and an increase in biodiversity resources, can be achieved. The model played a critical role in changing the mind-set of landowners around governance, that overgrazing is a function of time, not animal numbers. A core restoration strategy in the catchment is an incentivized rangeland stewardship model, linking with the Meat Naturally Initiative, driven by Conservation South Africa (CSA), in partnership with ERS through WWF Nedbank Green Trust support. The model is the result of collaborative efforts by UCPP partners, and demonstrates the results of an effective community of practice. Through the RDI support, communities from different catchments in KwaZulu-Natal, Lesotho and other parts of the Eastern Cape convened in Matatiele to share their current initiatives for managing rangelands as well as their contributions to livelihoods. These lessons are going to be documented and be shared in the bigger RDI National learning Event due mid-2018. By focusing on improved livelihoods from sound livestock production as the outcome, we can promote sustainable rangeland restoration and water security, poverty reduction and improved governance in communal landscapes. Effective learning platforms can support a shift in practise and governance mind-sets, replicating the benefits and sustainability of this model into other catchment areas.



## PARALLEL SESSION B: COMMUNAL LIVESTOCK FARMING SYSTEMS

**SESSION CHAIR: WAYNE TWINE**

Thursday, 27 July 2017, 08:00 - 09:30

**Venue:** Hongonyi (Wildebeest) and Xidzidzi (Honey Badger) Rooms

### PLATFORM PRESENTATION: CLIMATE CHANGE ADAPTATION STRATEGIES IN THE COMMUNAL AREAS OF NAMIBIA AND SOUTH AFRICA

*Igshaan Samuels<sup>1\*</sup>, Khululiwe Ntombela<sup>1,2</sup>, Angula Margaret<sup>3</sup> and Melvin Swarts<sup>1,2</sup>*

<sup>1</sup>Agricultural Research Council -Animal Production Institute, <sup>2</sup>University of the Western Cape, <sup>3</sup> University of Namibia, email: [isamuels@uwc.ac.za](mailto:isamuels@uwc.ac.za)

Climate change impacts have been experienced in almost all sectors of the world but more so in developing countries. In the communal livestock farming sector, adapting to climate change is crucial to prohibit large scale animal mortalities or even risk losing one's entire herd. This study assessed adaptation strategies of eight livestock farming communities along an aridity gradient from South Africa and Namibia. A qualitative research approach was adopted using triangulation methods that included focus group discussions, semi-structured interviews and field observations to validate the data. Communal farmers said that due to climate change, they have been exposed to increased drought frequencies, temperature extremes which resulted in hotter summers and colder winters as well as a general decrease in rainfall. These climate hazards have resulted in numerous shocks and stresses that include forage limitations, poor animal health and loss of income. By using a capital assets approach to examine adaptation responses to shocks and stresses, results show that in the three South Africa communal areas, farmers relied largely on natural and human capitals and accessed few social and physical capitals. Financial capital was mostly accessed in the four Namibian study areas except in the north where mostly human capitals were used. In general, human capitals were largely changes in grazing management and some farmers responded similarly to certain shocks and stresses albeit being in different regions. Natural capitals included accessing the diversity of plant species and landscapes of the Succulent Karoo for animal fodder and grazing sites during drought. Financial capitals included using state grants, remittances and other forms of income to supplement livestock farming. Communal farmers have the knowledge and experience to adapt to a changing climate, however, they have to overcome a hierarchy of climate and non-climate related barriers in order to continue their way of life or farm profitably.

### PLATFORM PRESENTATION: THE FUTURE OF COMMUNAL LIVESTOCK FARMING IN SEMI-ARID NAMAQUALAND

*Khululiwe Ntombela<sup>1,2\*</sup>, Melvin Swarts<sup>1,2</sup>, Igshaan Samuels<sup>2</sup> and Clement Cupido<sup>2</sup>*

<sup>1</sup>University of the Western Cape, <sup>2</sup>Agricultural Research Council -Animal Production Institute, email: [ntombelak@arc.agric.za](mailto:ntombelak@arc.agric.za)

In vast parts of Africa where cultivation is not possible, agriculture is primarily based on raising livestock in arid and semi-arid rangelands. Pastoralism, which is practiced largely by impoverished communities living in remote drylands, is threatened by the rapid rate of climate change, socio-economic, environmental and political factors. This study examines Namaqualand pastoralists' perceptions on the future of pastoralism in the region, by using semi-structured interviews. The majority of the respondents from both sites perceived that there would be fewer pastoralists, as well as less livestock in their respective areas in the next 20 years. The main reasons for the reduction of pastoralists were attributed to a combination of the current poor condition of the veld due to overgrazing, increase in rainfall variability which increases drought incidences and the type of breeds farmers keep. The endeavoured move away from subsistence to a more commercially driven production system in Steinkopf has resulted in the farmers growing their herds and farming with a market-dictated breed which might not be suitable for their drought-prone region. This could negatively affect the community's resilience to climate change. Another important aspect that resurfaced throughout the interviews in both sites was that the future of pastoralism relies heavily on the involvement of the youth in farming, as most farmers have reached old age and have health problems. The youth were in general described by these farmers as being ill-disciplined, vandalistic, abusing alcohol and drugs and just plain lazy. However, there are few youth in their early 30s who are continuing with the pastoral tradition, but even they reported that they require more training, financial investment, and support from more experienced farmers and government. The future of pastoralism in Namaqualand is complex, but profoundly dependent on how the current farmers utilize the veld and the farming interests of the youth to take over from their parents.



## PLATFORM PRESENTATION: USING THE SOCIO-ECOLOGICAL SYSTEM IN UNDERSTANDING THE CHALLENGES IN COLLECTIVE MANAGEMENT OF COMMUNAL RANGELANDS IN THE RURAL EASTERN CAPE

*Andiswa Finca<sup>1\*</sup>, David Getty<sup>2</sup>, Jill Slinger<sup>3</sup>, Suzanne Linnane<sup>4</sup> and Tony Palmer<sup>1</sup>*

<sup>1</sup>Agricultural Research Council -Animal Production Institute, <sup>2</sup>Dundalk Institute of Technology, Department of Humanities, <sup>3</sup>Delft University of Technology, Faculty of Technology, Policy and Management, <sup>4</sup>Dundalk Institute of Technology, Freshwater and Environmental Studies, email: [fincaa@arc.agric.za](mailto:fincaa@arc.agric.za)

Livestock is described as a key commodity of human well-being and provides social benefits such as food, income, nutrients, employment, traction and others. It plays an important but complex role in people's lives economically, socially and environmentally. These roles have previously been addressed independently making it difficult to find sustainable solutions especially in rural areas where people use common resources. Using the socio-ecological systems approach, the present study is aimed at understanding the social and ecological challenges associated with livestock production faced by communal farmers in rural areas of the Eastern Cape. In order to achieve this, a mixed method approach was undertaken using a combination of participatory geographic information system (PGIS), structured interviews and a focus group discussion. PGIS was conducted with six participants who were asked to draw maps to establish their spatial indigenous knowledge of the rangeland and arable land boundaries, temporal changes in the rangeland condition and locations of the water points. This was followed by structured interviews, conducted with 21 participants with questions framed around social, spiritual and economic significance of livestock, rangeland management strategies and access to government services. To gain a deeper insight into matters arising from the structured interviews, a focus group discussion was conducted with 21 participants. Digital Map layouts were created from the community's hand drawn maps using ArcGIS 10.1 software and data collected from both the structured interviews and focus group discussion were analysed using a thematic analysis method. The results obtained from the three methods shared one ecological challenge - the decreasing quality of the rangeland condition, evidenced by the increase in erosion dongas, short grasses, and encroachment of *Vachellia karroo*. This decrease in rangeland quality was linked to the absence of fenced camps and control over the grazing patterns of livestock. The impact of this on livestock performance and mortality was also recognised. Some of the social challenges that arose from the thematic maps that were generated for the structured interviews and focus group discussion included (i) land access and livestock number restrictions which were associated with the Apartheid era forced removals that later led to vandalism of the camp fence (ii) the lack of youth involvement in livestock matters (iii) limited access to government services from the extension office (iv) absence of community rules over livestock and rangeland management. These results showed that people are aware of the changes in grazing quality and the effects these have on the quality of their livestock. Additionally, the desire for the camp fence restoration and community rules also showed that they understood the importance of a management strategy in order to improve the current condition. Moreover, these results showed that there are strong linkages between the ecological and social challenges faced by communal farmers and addressing them through a socio-ecological systems approach can open doors for sustainable development.

## PLATFORM PRESENTATION: ADDRESSING CONSTRAINTS TO INCREASE LIVESTOCK PRODUCTION IN TALENI AND SHWENI COMMUNITIES, CHRIS HANI DISTRICT MUNICIPALITY, SOUTH AFRICA

*Nobuntu Matyholo-Mapeyi\*, Mzubane Ntengento, Gcotyelwa Nkohla and Nonzaliseko Mlahlwa*

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Livestock contributes to rural livelihoods and the economy of the country. Statistics of livestock production at provincial level are scant because not all farmers dip their livestock where records are kept. Communal livestock farmers are different to the commercial farmers, therefore a different approach to assist the non-commercial sector was initiated. Farmers do not keep records of numbers and income generated through livestock products and sales. This sector needs technical support in improving product quality, nutritional and health management. This study addresses production level numbers, problems experienced by farmers and identified opportunities through a diagnostic survey. The study covered 6 communities in 2009/10 and was conducted in Ntsika Yethu Local municipality in Jowweni, New Mine, Mangubomvu, Mangunkone, Taleni and Shweni communities under Chris Hani District municipality. Two communities were selected from the 6 communities, Taleni and Shweni villages.



Participants either owned cattle and sheep; or cattle, sheep and goats or sheep and goats only or sheep or goats only. Livestock were kept in the kraals at night before the survey until the research team arrived to count and observe livestock. Kraal visits occurred at 8:00 a.m. and latest at 9:00 a.m. All livestock in 27 homesteads were observed and counted in 2 consecutive days. As information was gathered, solutions to the problems were shared with the farmers. Farmers also shared knowledge and referral to experts was made. Indigenous technical knowledge was being transferred through farmer to farmer information sharing sessions such as meetings and Information days twice a year. Trust was built between the stakeholders. Lamb survival rate increased from 40 to 70%, calving percentage increased from 50 to 65%, starvation reduced from 40 to 20%, awareness to keep treatment drugs was from 30-60%. Out of 27 only one farmer planted maize and also planted green forage. Both communities have small stock dipping tanks built by individual farmers which also benefited all. A sheep shearing shed was donated by the department. In all meetings farmers were encouraged to shear sheep as an association.

**STANDARD POSTER VIEWING SESSION**

Thursday, 27 July 2017, 09:30 -10:00

**BIODIVERSITY INITIATIVES AND CONSERVATION PLANNING****POSTER PRESENTATION: RESPONSE OF MIGRATORY *FALCO AMURENSIS* TO COMMON GRASSLAND ROOST SITES AFTER SHORT-TERM DROUGHT**

Norman Magoro

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The roosting periods of migratory raptor *Falco amurensis* were investigated by visually quantifying the roost abundance on different sites of Mpumalanga province grassland prior to recent reoccurring drought. Recently Mpumalanga province grassland vegetation units have received a flagship of being named a Twin-treasure conservancy area, implying the splendid two structural landscapes (wetland and undulating grassland hills) with birds to be a rich scenic environment. Regardless of noticeable fragmentation like forestry, mining and agriculture, grasslands have the largest natural biodiversity ranging from plants, insects and birds. In the view of migratory raptors, grasslands have several roosting sites of migratory raptor *Falco amurensis* and making grassland one of most important habitats for the survival of this taxa. Their specific overwintering preference on grassland can be linked to habitat's rich insect diversity and abundance during good seasons. Taking into consideration the drought experienced in most parts of South Africa from the 2012 to 2016 growing seasons, the response of these raptors on their roosting areas was closely monitored. Hundreds to thousands of roost sites can be identified at different localities including business area centres and margins of forestry belts. Three sites were identified and roost density was visually monitored annually (November-February) to quantify the abundance of falcons roosting throughout five seasons from 2010-2015. The three roost sites were Nooitgedacht ADC, Ermelo Town and Breyten Roadside (R36). Observation indicated that the 2016-2017 growing season received experienced a lower roost density than previous seasons from 2010, while Nooitgedacht ADC received zero roost density by mid-March 2017 as compared to previous seasons. Observation and use of migratory raptors as indicators can be of an utmost importance when monitoring longterm grassland state of health. Keywords: *Falco amurensis*, grassland, roost sites, insect diversity, roost density.

**POSTER PRESENTATION: RANGELAND BIODIVERSITY RESEARCH IN SUB-SAHARAN AFRICA LACKS ATTENTION TO SPATIAL, TEMPORAL SCALE OF DISTURBANCE**Devan McGranahan<sup>1\*</sup> and Kevin Kirkman<sup>2</sup><sup>1</sup>North Dakota State University Range Science Program, <sup>2</sup>University of KwaZulu-Natal, School of Life Sciences, email: [devan.mcgranahan@gmail.com](mailto:devan.mcgranahan@gmail.com)

Sub-Saharan Africa has extraordinary rangeland biodiversity. As ecological disturbances, fire and grazing contributed to the evolution of many African rangelands, current regimes are shaped by humans and global change. While considerable research documents negative effects of altered disturbance regimes and land-use change on Africa's biodiversity, less work describes fire and grazing management that reconcile biodiversity conservation and human land-use. Heterogeneity is important to conservation management worldwide. Research from the U.S. Great Plains, specifically, demonstrates how spatially-discrete fires drive grazing patterns that enhance biodiversity via spatially-heterogeneous landscapes in which contrasting patches of vegetation structure provide multiple ecological niches for wildlife. Calls for heterogeneity-based management for conservation of biological diversity in Africa raise the question, what is the state of science on African wildlife community responses to spatial heterogeneity? We address this question with a review of literature on fire and grazing impacts on non-game wildlife in sub-Saharan Africa, including invertebrates, herptofauna, small mammals, and birds. Specifically, we focus on the paucity of research attention to spatial and temporal scales of disturbance. We conducted a systematic review of literature available on the Web of Science and Google Scholar. Inclusion was limited to peer-reviewed studies presenting original data on non-game wildlife species, populations, or communities in sub-Saharan rangelands. From each study we collected data on: experimental design and analytical approach; type of disturbance, treatment, or management studied; whether there was an explicit spatial or temporal heterogeneity component; as well as reported effect of disturbance or management on species richness, diversity, abundance, behaviour, or community composition. Finally, studies were scored by the strength of their community analysis and assessed for whether an effect of heterogeneity was determined or "if authors did not test for such an effect" whether a community-based,



multivariate approach might elucidate a heterogeneity effect were such an analysis to be applied. We reviewed 117 peer-review studies on non-game wildlife in sub-Saharan Africa. Although research was conducted throughout the region, the majority of studies (65%) were reported from South Africa. Reported taxa included invertebrates (39%), small mammals (34%), birds (20%), and herpetofauna (7%). Grazing and fire were the most-frequently studied disturbances (37% and 32%, respectively) but only 8% of studies considered them together. Heterogeneity was explicitly studied in just 6% of papers while another 27% implied heterogeneity but did not present their study or results as such. Community-level analyses such as multivariate statistics were rare and conventional univariate analyses were often misapplied in pseudoreplicated (42%) or unreplicated (21%) studies. We suggest considerations for future work on biodiversity in Sub-Saharan grasslands and savannas, including 1) quantification of fire and grazing as regimes comprised of intensity and frequency, rather than qualitative categories of occurrence; 2) community-level sampling and analysis; 3) consideration of the spatial and temporal patterns of fire and grazing, with particular attention to heterogeneity and patch contrast; and 4) consideration of the interactive effects of fire and grazing, particularly at patch- and landscape-level effects on wildlife communities and habitat structure.

### POSTER PRESENTATION: RAILWAY SIDE MAPPING OF ALIEN PLANT DISTRIBUTION IN MPUMALANGA, SOUTH AFRICA

*Ndifelani Mararakanye<sup>1</sup>, Norman Magoro<sup>1</sup>, Nomakhazi Matshaya<sup>2</sup>, Collen Rabothata<sup>1\*</sup> and Sthembele Ncobeni<sup>2</sup>*

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Alien plant invasions are among the major threats to natural and semi-natural ecosystems in South Africa. Earlier studies show that in South Africa, between 10 million and 20 million hectares are invaded by various taxa of alien plants. Much of the available data is not suitable for planning of local scale management because it is presented at a quarter degree grid square scale which makes accurate location and estimation of invaded areas difficult. The aim was to identify the dominant alien plant species and quantify their areal extent along a 479 km railway corridor in the Mpumalanga province. The extent of the invaded area was obtained by manual digitising of alien plant distribution and density from a Satellite Pour l'Observation de la Terre (SPOT) 5 imagery and by further applying an Iterative Self-Organising Data Analysis (ISODATA) technique of the unsupervised classification method of identifying and classifying features from the satellite images. Species' occurrence were located and identified in the field with the use of the Global Positioning System (GPS) and subsequently linked to the infested area identified using SPOT 5 imagery. The most dominant invaders in terms of the number of individual polygons and the infested area were *Eucalyptus* spp. L'Hér., *Acacia* spp. Mill., *Populus alba* L., *Pinus patula* Schltl & Cham., *Salix babylonica* L. and *Caesalpinia decapetala* (Roth) Alston. These species have also been previously classified as major invaders, although the Conservation of Agricultural Resources Act (CARA) regulations permit their planting provided spreading to adjacent areas is avoided except for *Caesalpinia decapetala* which must be cleared under all circumstances. Knowledge of the species occurrence and extent will assist landowners and relevant authorities in their efforts to control the spread of alien plants which impact on rail safety, agricultural production, water availability and biodiversity.

## COMMUNAL LIVESTOCK FARMING SYSTEMS

### POSTER PRESENTATION: PERFORMANCE OF LIVESTOCK PRODUCTION IN NORTH EASTERN CAPE COMMUNAL AREAS: A STOCHASTIC FRONTIER ANALYSIS

*Bukho Gusha\* and Tony Palmer*

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The livestock sector is a fast-growing agricultural sub-sector worldwide. Approximately 37% and 25% of the gross value of the agricultural sector in East and Southern Africa respectively is contributed to livestock production. Livestock supply many various products and services, making a significant contribution to rural livelihoods and to a variety of social and economic roles for the world's poor. Studies have shown that the levels of technical inefficiency indicate the inability of an individual to attain the highest possible outputs in the given inputs used. Technical efficiency analysis has mostly been used in integrated farming with limited focus on livestock production. Therefore, a study assessing the performance of total household livestock production in communal farmers was conducted with



the aim of understanding the variation of efficiency in different households. A structured questionnaire was developed to gather information pertaining to livestock contribution to rural livelihoods. The results were analysed using a stochastic frontier analysis to test the maximum likelihood estimate and technical production efficiency for each household. The mean likelihood estimates results showed that the coefficients for productive factor (capital) are positive except for labour. Labour had a negative coefficient, which suggests that its increase would increase the outputs derived from livestock. The mean level of technical efficiency for the sampled households ( $n = 120$ ) suggests that they could only achieve about 49% of the potential maximum outputs from a given number of production inputs (labour and capital). The results also revealed that 26 % of the household had abandoned livestock farming ( $n = 32$ ). In conclusion, there is a potential for increased contribution of livestock production in improving rural livelihoods in the north-Eastern cape. This can be achieved through provision of knowledge or information about livestock and market so that we can reduce the livestock water footprint in the village.





## Special Session: Grasses as Invasive Aliens

**SESSION CHAIR: SEBATAOLO RAHLAO**

Thursday, 27 July 2017, 08:00 - 09:30

Venue: Mhelembe (Rhino) Hall

### PLATFORM PRESENTATION: GRASSES AS INVASIVE PLANTS IN SOUTH AFRICA

Vernon Visser<sup>1\*</sup>, Kim Canavan<sup>2</sup>, Susan Canavan<sup>3</sup> and Lyn Fish<sup>4</sup>

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In many countries around the world the most damaging invasive plant species are grasses. However, the group has received little attention in South Africa. In response to this information deficiency on a group with high invasion potential we established a National Working Group on Alien Grasses in 2013. One of the main goals of the group so far has been to provide a baseline understanding of alien grasses in South Africa, focussing on their known distributions, pathways of introduction and management options. Here we present the results of our findings, which suggest that at least 256 alien grass species are in the country, and 37 of these have become invasive. We discuss whether invasive grasses are likely to be a major problem in South Africa in light of our findings, and with reference to grass invasions elsewhere in the world. This talk also serves to invite delegates to participate in the Working Group and to help us identify any emerging alien grass problems.

### PLATFORM PRESENTATION: GLOBAL IMPACT ASSESSMENT OF ALIEN GRASSES OCCURRING IN SOUTH AFRICA

Khensani Nkuna<sup>1,3\*</sup>, Vernon Visser<sup>2</sup>, John Wilson<sup>1,3</sup> and Sabrina Kumschick<sup>1,3</sup>

<sup>1</sup>South African National Biodiversity Institute (SANBI), Invasive Species Programme, <sup>2</sup>University of Cape Town, Centre for Statistics in Ecology, the Environment and Conservation (SEEC), <sup>3</sup>Stellenbosch University, email: [khensani.vulani@gmail.com](mailto:khensani.vulani@gmail.com)

Grasses have been introduced around the world. They are found in most habitats as invasives and are recorded as causing impacts on other taxa, ecosystems and the economy of the area in which they occur. In South Africa, there are relatively few invasive grasses, but many alien grasses have not yet become invasive. The aim of this study was to investigate, compile and assess the globally recorded environmental and socio-economic impacts of selected alien grasses found in South Africa. Two impact quantifying schemes, namely, the Environmental Impact Classification of Alien Taxa (EICAT) and the Generic Impact Scoring System (GISS), were used to assess the recorded impacts of 61 alien grass species using published literature and credible databases. *Cortaderia selloana* and *Sorghum halepense* obtained the highest impact scores in GISS, while *Arundo donax* and *Phalaris aquaticus* scored the highest in the EICAT assessment. For GISS, the environmental impact had the most records, with impact through competition being the strongest mechanism; under socio-economic impacts, alien grasses had the strongest impact on agricultural production. In the EICAT assessment, impact through competition was the strongest mechanism. Our results indicate that plantations are the land-use most affected by alien grasses, followed by grasslands and pasturelands. We could not assess some alien grasses due to data deficiency. This indicates a knowledge gap with regards to the impacts of alien grasses. However, the two impact quantifying schemes were able to rank alien grasses based on their impacts, as well as provide an indication of the habitats impacted, thereby providing an indication of possible impacts in South Africa. This should help for prioritisation of resources and management purposes.



**PLATFORM PRESENTATION: ARE INVASIVE GRASSES (POACEAE) SUITABLE TARGETS FOR BIOLOGICAL CONTROL? A CASE STUDY OF TWO AFRICAN *SPOROBOLUS* SPP INVADING AUSTRALIA**

Guy Sutton<sup>1\*</sup>, Kim Canavan<sup>2</sup> and Iain Paterson<sup>1</sup>

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Historically, there have been very few invasive grasses (Poaceae) targeted for classical biological control, despite the abundance, extent, and serious negative environmental and economic consequences of grass invaders. Grasses are often considered poor targets for biological control, as they are perceived to lack suitably host-specific herbivores and because arthropod herbivores are unlikely to be sufficiently damaging to control the target weed due to the tolerance of grasses to large, mammalian herbivory. However, recent advances in the field of grass biological control suggest that invasive grasses may indeed be suitable targets for biological control, with several target weeds supporting large herbivore assemblages in their native ranges, and two control agents demonstrating measurable impacts on *Arundo donax* L. in the USA. As such, the aim of this research is to evaluate whether two African *Sporobolus* spp. grasses (*S. pyramidalis* and *S. natalensis*), which have become serious weeds in Australia, are suitable targets for biological control. Suitable targets should have phytophagous herbivores that are both host-specific and sufficiently damaging. Identifying potential agents will involve conducting quantitative native-range phytophagous faunal surveys across southern Africa, focused monthly surveys at six sites (from a climatically-suitable survey region) and detailed field host-range surveys. The study will also involve conducting a fully-factorial manipulative field experiment, with treatments including: exclusion of invertebrate herbivores, exclusion of fungal pathogens, and nutrient additions, to derive co-efficients to parameterise an integral projection model (IPM). The IPM model will be employed to identify key contributing factors to *Sporobolus* spp. population dynamics and subsequently determine the “Achilles’ Heel” in the weed life-cycle. The IPM will also help prioritise candidates that are most likely to be damaging and thus determine whether these grasses are likely to be good targets for biological control.

**PLATFORM PRESENTATION: COMPETITIVE ABILITY OF VETIVER GRASS: DOES VETIVER ALLOW GERMINATION AND ESTABLISHMENT OF NATIVE GRASSES?**

Lindokuhle Dlamini\*, Michelle Tedder and Kevin Kirkman

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Vetiver grass (*Chrysopogon zizanioides*) is a perennial C4 grass that originates from central India but occurs in many tropical regions, including tropical Africa. This grass is used worldwide for soil (e.g. erosion control) and water conservation (e.g. wetland and river rehabilitation) because of its unique morphological and physiological features. Vetiver is a fast growing tufted grass with a deep root system that extends down to 3 meters depending on the soil depth, forming a wall-like structure that binds soil particles together. It is a very hardy grass, allowing it to withstand environmental hazards such as drought, frost, and floods. The most commonly used cultivars produce infertile seeds or no seeds at all, hence it reproduces vegetatively. Mature grass plants sometimes inhibit germination and establishment of other grasses through creating an unfavorable microclimate (competition for space and available resources). Seedlings are more sensitive to stress than adult plants but their establishment is crucial for successful grassland restoration and biodiversity maintenance. To our knowledge, no study has focused on the competitive ability of vetiver grass. Most studies consider its application and use in water and soil conservation. This study aims to determine the competitive ability of vetiver grass. Pot trials were used to address two questions: (1) Does vetiver grass inhibit or facilitate seed germination and seedling establishment of two native grasses (*Eragrostis curvula* and *Panicum maximum*)? And: (2) Do seeds of these native grasses germinate best when buried, unburied or when mixed with a hydro-seeding gel? These two native grasses were chosen because they have contrasting traits but are both used for rehabilitation. For example, *E. curvula* is a more pioneer type grass, producing large numbers of seed with a high germination percentage, while *P. maximum* is a late seral grass, producing less seed with lower viability. One hundred seeds of each native grass species were planted alone, around one vetiver grass tuft and between two vetiver grass tufts planted fifteen centimeters apart. These seeds of native grasses were laid on top of the soil (unburied), buried, and hydro-seeded. Percentage of germinated seeds, seedling survival (%) and seedling growth (number of tillers and leaves) was recorded. The establishment potential of native grasses in areas restored/rehabilitated using vetiver grass, and predictions on the potential for vetiver grass to become invasive, will be discussed.



## PLATFORM PRESENTATION: DEVELOPING MANAGEMENT GUIDELINES FOR THE CULTIVATION OF ALIEN BAMBOOS IN SOUTH AFRICA

*Susan Canavan<sup>1,2\*</sup>, John Wilson<sup>1,2</sup>, David Richardson<sup>2</sup> and Jaco le Roux<sup>2</sup>*

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Woody grass species such as bamboo can provide an alternative source of biomass and timber compared to traditional tree species. In recent years there have been efforts to cultivate various species of bamboo across Africa. Particularly in South Africa, a number of large plantations have been established with non-native Asian species in rangelands to meet this growing demand. These projects have the potential to provide a good source of fast-growing biomass, as well as offering social benefits for local communities. However, with improper management of populations, there may be environmental risks to neighbouring grassland communities. Here we discuss the current status of bamboos in South Africa and provide suggestions for managing large populations in order to minimise the risk of spread and impacts.



Grassland Society of Southern Africa



Advancing Rangeland Ecology  
and Pasture Management in Southern Africa

**52nd Annual Congress:**

**Mid-Congress Tours**

***27 July 2017***



# The challenges of managing protected areas in the Lowveld Savannas: perspectives from national parks, provincial parks and private reserves



GSSA 52, Mid-congress Tour, 27 July 2017



The savannas of the Lowveld support a huge eco-tourism industry, which is the largest employer in the region. The various protected areas involved also contain one of the few remaining intact African savanna ecosystems, including the full complement of indigenous herbivores and predators. While much of the overall protected area falls within the iconic Kruger National Park (KNP), the conglomeration of provincial and private reserves to the west protect an almost equal area, and include some ecosystem types not present or well-represented within KNP. These three types of protected area – national park (KNP), provincial reserve (Manyeleti) and private reserve (Timbavati/Sandringham) – all face

similar threats to the biodiversity they contain, but the resources and approaches used to manage these threats vary considerably. This tour will involve driving through selected sections of the protected area network, with discussions on management issues and solutions by a warden from of each. Multiple stops will be included to highlight examples of management issues, including areas of bush encroachment, bush clearing, altered fire management and artificial water provision. The tour will end with a short drive through the rural areas to the west, to highlight management issues arising from rapid development.





# Herding 4 Health: Rangeland management in a FMD area

GSSA 52, Mid-congress Tour, 27 July 2017



The Mnisi Rangeland project has been a partnership between Sanparks BSP (K2C), University of Pretoria, Buffelshoek Trust and Conservation South Africa. This partnership is in the Mnisi Tribal Authority area. The initial action item was identified as the bush clearing project under the K2C. This project, entailing bush thinning, alien removal and rangeland restoration through brush packing, was a catalyst in the villages to start to manage the rangeland holistically and under planned grazing.

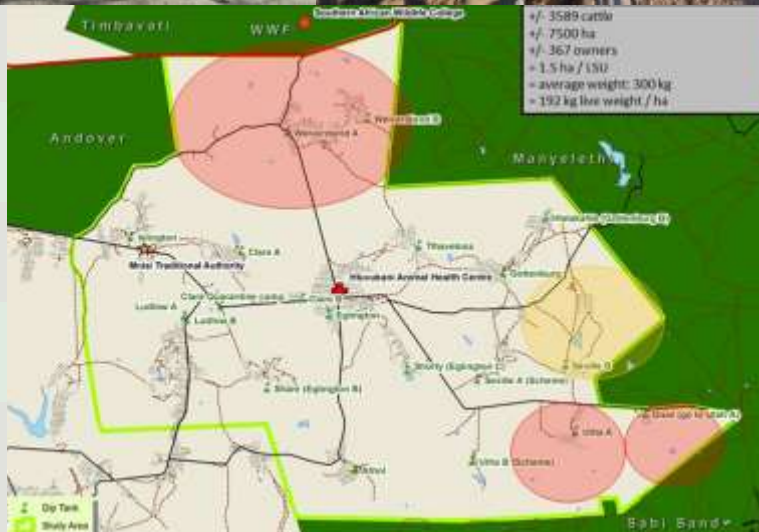
This project as a whole is about raising awareness about the importance of proper ecosystem management and the role of conservation areas in the local economy. This

results from building skills and capacity of communities to manage sustainable businesses and participate in the Wildlife Economy supply chain (including but not limited to rangelands). But most importantly building trust with communities that rangeland restoration and conservation related projects are adding value to villages therefore creating the platform on which to build rapid progress in the rangelands as soon as the droughts have passed.

Much of the work done directly on the rangeland to date, was to restore the rangelands grass cover with brush packing. The initial goal was to provide above average grass cover so as to have a buffer for when the planned grazing process was started.



- 13:00** Mobile abattoir demonstration (video or live viewing)
- 13:30** Visit Clinic with EM's
- 14.30** Visit dip tank engage with herd monitors
- 15:00** Fence line walk with Andover
- 16:00** Visit a current clearing site in Morgenzon where pruning has taken place





# Wits Rural Facility:

## Savanna ecology field experiments

GSSA 52, Mid-congress Tour, 27 July 2017

UNIVERSITY OF THE  
WITWATERSRAND  
JOHANNESBURG



Grassland Society of  
Southern Africa

The Wits Rural Facility (WRF) is a multidisciplinary research campus of the University of the Witwatersrand, located on a 350 hectare bushveld estate on the border of Limpopo and Mpumalanga provinces. While much of the research conducted from the facility is situated in the rural communities of nearby Bushbuckridge, a number of interesting ecological experiments are underway on the WRF property. The aim of this research is to gain insight into various aspects of savanna ecology, with management implications. This mid-congress tour will visit these ecological experiments on the facility. Some of the sites are an easy 15 minute walk from the conference centre, providing participants with the opportunity to stretch their legs and get out into the bush. Other sites are a short drive. Experiments that will be visited include those investigating: 1) The effects of various post-harvest treatments on resprouting of felled *Dichrostachys cinerea* and *Terminalia sericea* trees; 2) The resilience of tree seedlings of different ages and species to fire and simulated herbivory; 3) How tree and grass species differ in their responses to variation in timing, duration, and depth of soil moisture; and 4) The contribution of termites to herbivory and decomposition, and the role of predatory ant populations in regulating invertebrate herbivory.

13:00	Walk to first site
13:15	Coppice experiment 1
13:35	Seedling fire experiment
13:50	Walk to second site
14:05	Tree/grass irrigation experiment
14:25	Walk to Bushcamp
14:35	Packed lunch at Bushcamp dining area
15:00	Walk back to conference centre
15:15	Drive to third site
15:25	Termite and ant suppression experiment
15:45	Drive to fourth site
15:55	Seedling herbivory experiment
16:15	Drive to fifth site
16:20	Coppice experiment 2
16:40	Drive back to conference centre





# INVASIVE ALIEN PLANT CONTROL AND BIOMONITORING: ECOSYSTEM RESTORATION FROM GRASSLANDS TO RIVERS

GSSA 52, Mid-Congress Tour: 27 July 2017



Biomonitoring is a key citizen science technique for strengthening stewardship and custodianship in water resources management. Supporting capacity development in Biomonitoring and restoration of degraded ecosystems has been a key focus of AWARD’s work in the highly diverse Blyde & Klaserie Catchments, in order to sustain biodiversity and long-term ecosystem services in this high priority area. The objective of this tour is

to highlight the development of collective action amongst ecosystem restoration practitioners and managers involved in restorative invasive alien plant (IAP) control in the Upper Blyde & Klaserie Catchments, and the linkages with the river custodianship programme amongst conservation managers and communities. The tour is also aimed at stimulating discussions amongst congress delegates on the need for development of



13:00	Brief overview of projects and areas to be visited
13:15	Depart for site 1 (eat lunch on the go)
15:00	Stop at Klaserie river Bio-monitoring site (with talk of work undertaken there and Q&A)
15:45	Stop at Mariepskop restoration site (with talk of work undertaken there and Q&A)
17:00	Arrive back at Wits Rural

*Please remember to bring along camera, comfortable shoes, a hat and warm jacket. This will be an outdoor tour, and the weather at Mariepskop can be very unpredictable and cold during this time of the year. You are also advised to bring along binoculars in order to view inaccessible sites of interest from a distance.*



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