Grassland Society of Southern Africa

www.grassland.org.za

Advancing Rangeland Ecology
and Pasture Management in Southern Africa

53rd ANNUAL CONGRESS

INCORPORATING THE

NINTH RESEARCH SKILLS WORKSHOP

AND A

POLICY AND PRACTICE WORKSHOP

ADVANCING RANGELAND ECOLOGY AND PASTURE MANAGEMENT IN AFRICA

ARC TRAINING CENTRE, PRETORIA DISTRICT, GAUTENG, SOUTH AFRICA

22 TO 27 JULY 2018

PROGRAMME COMPILED AND EDITED BY JANKE VAN DER COLF

Table of Contents

53rd Annual Congress of the Grassland Society of Southern Africa

Sunday, 22 July · 09:00 to 17:00

09:00-09:40	Registration for Research Skills Workshop	

Research Skills Workshop

09:40	Opening and welcome	*Clement Cupido*
10:00	Where we end up – choosing a career path	*Julius Tjelele*
10:30	The research question	*Wayne Twine*
11:00	How to plan and construct a thesis	*Abel Ramoelo*
11:30-12:00	**MORNING TEA**	
12:00	Data management – making it easier for you	*Victoria Goodall*
12:30	Overcoming the publishing obstacle	*Wayne Twine*
13:00-14:00	**LUNCH**	
14:00	Oral presentations: how to effectively give them using PowerPoint	*Adrian Shrader*
14:30	Ten tips for designing the perfect poster	*Adrian Shrader*
15:00-15:00	**AFTERNOON TEA**	
15:30	Networking, management and collaboration in research institutions	*Ntuthuko Mkhize/ Clement Cupido*
16:30	Practical: Organising and manipulating data in Excel	*Justin Du Toit*

Monday, 23 July · 08:30 to 19:15

Sicklebush Tour to Bela-Bela departs at 09:00

Research Skills Workshop

08:30	Writing for popular publications	*Amelia Genis*
10:00-10:30	**MORNING TEA**	
10:30	Practical: The research question (continued)	*Wayne Twine*
11:30	Managing finance and admin in the science world	*Freyni Du Toit*
12:00	Practical: Photography in the field	*Justin Du Toit*
13:00-14:00	**LUNCH**	
14:00	Sourcing research articles, referencing, and avoiding plagiarism	*Denise Nicholson*
15:00-15:30	**AFTERNOON TEA**	
15:30	Smartphones and android apps for fieldwork	*Clement Cupido*
16:30	Feedback session	

Opening of the 53rd Annual Congress of the Grassland Society of Southern Africa

	Welcome	*Julius Tjelele*
18:00	Presidential address	*Sigrun Ammann*
	Corteva AgriScience - solutions for bush encroachment	*Jaco Fouche*
	Opening address: A long term grazing capacity map for South Africa: used, misused and abused	*Paul Avenant*
19:15	**MEET AND GREET AT CONGRESS VENUE**	

Tuesday, 24 July   08:30 to

Plenary: Climate Change

08:30	Keynote: Bush encroachment on South Africa's grasslands - is it a form of land degradation?	*Barney Kgope*
09:15	Keynote: Practical agricultural approaches to building climate resilience in South African range and pasture systems	*Stephanie Midgley*

10:00-10:30   MORNING TEA

Parallel A: Climate Change

Parallel B: Rangeland Stewardship in Communal Farming Landscapes - Innovative Models for Policy and Planning

10:30	Keynote: Net primary production in South African grasslands: relationship to rainfall, soil type and history	*Bob Scholes*	10:30	Introduction	*Mahlodi Tau*
			10:35	Sustainable land management	*Lehman Lindeque*
			10:45	Meat naturally	*Nicky McLeod*
11:15	Effect of simulated drought on annual net primary productivity of semi-arid grassland	*Thabo Magandana*	11:00	Comments from DAFF	*Kedibone Chueu*
11:35	Plants and soil carbon-nitrogen sequestration and isotope ratios in relation to land management systems and seasons in Mopane savannah, Namibia	*Absalom Kahumba*	**Facilitated Discussion**		
			Cynics and believers?		
11:55	The effect of elevated temperatures on growth and defense of *Vachellia sieberiana* grown with or without grass	*Lusanda Ncisana*	Vision for communal rangelands in South Africa?		
			What can't we do alone exercise?		
12:15	Effects of high temperatures on emergence, growth, and forage quality of a perennial sorghum for supplementing dairy cows in	*Florence Nherera-Chokuda*	Way forward?		

12:35-13:35   LUNCH

Plenary: Climate Change

13:35	Keynote: Sustainable livestock production in the era of climate change through targeted interventions	*Michiel Scholtz*
14:20	High concentrate feeding level reduces enteric methane emissions of grazing dairy cows	*Josef Van Wyngaard*
14:40	Climate smart livestock management and feeding options for small-scale farmers: A review	*Unathi Gulwa*
15:00	The provision of shade alleviates heat stress of neonatal lambs but does not benefit growth or survival	*Anieka Muller*

15:20-15:50   AFTERNOON TEA

Plenary: Advances in Methodology

15:50	Measuring carbon and water fluxes in the Albany Thicket, Eastern Cape	*Anthony*
16:10	Multi-spectral, high resolution remote sensing imagery in agricultural management and -sciences	*Christiaan Harmse*
16:30	Predicting potential livestock distribution patterns in the communal rangelands of Cala, Eastern Cape, South Africa: A GIS approach	*Qawekazi Mkabile*

17:00	**ANNUAL GENERAL MEETING OF THE GRASSLAND SOCIETY OF SOUTHERN AFRICA**
19:00	**BRAAI AT THE GREEN OLIVE RESTAURANT**

Wednesday, 25 July   08:30 to 11:15

Parallel A: Rangeland Ecology and Management

Parallel B: Planted Pastures

Parallel A			Parallel B		
			08:35	Importance of the southern African members of tribe Phaseoleae (*Leguminosae*) in pasture development	*Letty Masemola*
08:30	Keynote: Karoo trajectories of change in the Anthropocene	*Joh Henschel*	08:55	Community composition and diversity of endophytic fungi associated with Brachiaria grass (*Brachiaria* spp.) during the dry season in Kenya	*Leah Gachao*
09:15	Understanding the resilience of the Karoo shrub, *Nenax microphylla*, to water availability and defoliation	*Paul Malan*	09:15	The effect of planting date on yield and botanical composition of forage herb and grass mixtures	*Sigrun Ammann*
09:35	Long-term interactions of grazing and rainfall on vegetation composition at Grootfontein in the eastern Karoo	*Justin Du Toit*	09:35	A new nitrogen fertilisation regime for minimum-tillage kikuyu-ryegrass pasture in the southern Cape	*Charné Viljoen*
09:55	The effect of human impact on habitat use of selected large herbivore species in the eastern Kalahari, South Africa	*Hanno Kilian*	09:55	The effect of different nitrogen application rates on the dry matter production and botanical composition of kikuyu over-sown with grass-legume mixtures	*Janke Van Der Colf*

10:15-11:15   MORNING TEA AND POSTER SESSION

Climate Change

Adaptation ranges under future bioclimatic conditions of *Indigofera* and *Lessertia* species prioritised for further evaluation as forage crops for water-limited agro-ecosystems	*Francuois Müller*
Browse plants as a protein source during the dry season in the Eastern Cape Province, South Africa	*Siza Mthi*

Bush Encroachment

Response of soil aggregate stability on different levels of bush encroachment at Honeydale Farm, Alice in Eastern Cape (Preliminary results)	*Tanki Thubela*
Evaluating the impact of bush encroachment on soil nutrient content at Sheshegu communal rangeland, Alice, South Africa	*Sive Tokozwayo*

Advances in Methodology

Performance of ratio-based, soil-adjusted and atmospheric-corrected multispectral vegetation indices in predicting herbaceous above ground biomass in a *Colophospermum* mopane tree-shrub savanna	*Abubeker Hassen*

Feeding Ecology

Bite sizes of goats in relation to condensed tannins, thorns and other plant characteristics	*Ngoako Letsoalo*
The behaviour and diet selection of extralimital giraffe in the Little Karoo, South Africa	*Jamie Paulse*

Socio-Ecological Studies

The knowledge and perception of small holder farmers concerning feeding sweet potato vines to goats	*Cynthia Fikile Luthuli*

Land Transformation and Rehabilitation

A maize pasture legume intercropping system for the abandoned lands of the Eastern Cape. How much nitrogen is available for the maize crop?	*Gideon Jordaan*
The effect of an accidental Spring fire on the survival rate of legumes sprayed with herbicide in a rehabilitated old land	*Craig Threthewey*

Livestock Impacts on Rangelands

Effect of high utilization grazing and controlled selective grazing on veld condition in the Sourish Mixed Bushveld	*Marsia Grobler*

Rangeland Ecology and Management

Species composition and diversity in protected areas and adjacent grazing lands in Gauteng Province, South Africa	*Moseketsi Mochesane*

Wednesday, 25 July

Parallel A: Rangeland Ecology and Management

Parallel B: Planted Pastures: Dedicated Poster Session

Time	Parallel A		Parallel B	
11:15	Herbaceous and woody vegetation response to land management practices and seasons in Mopane savannah, Namibia	*Absalom Kahumba*	Evaluation of dry matter yields and production trends of nine cultivars from four tropical grass species	*Msawenkosi Fano Msomi*
			The relative dry matter yield potential of various early-, medium- and late-flowering forage cereal cultivars	*Patrick Rakau*
11:35	Tree grass interactions across a topo-sequence in an African savanna	*John Mhlanga*	Climatic and edaphic tolerance of southern African species of I*ndigofera* (*Leguminosae*)	*Marike Trytsman*
			Oversowing Italian ryegrass (*Lolium multiflorum* var. Supreme Q) into irrigated kikuyu (*Pennisetum clandestinum*) for improved timing and quality of fodder production	*Donna Berjak*
11:55	Relative abundance of palatable and unpalatable herbaceous species on a conservation to communal savannah rangeland gradient	*Motlalepula Nchoe*	Does seed size, emergence rate and vigour relate to variation in productivity of winter cereals in relation drought in the Mpumalanga Highveld	*Norman Modau Magoro*
			High atmospheric drought exacerbates the effects of growth under moderate soil water content in Guinea grasses	*Solomon Mwendia*
12:15	Long term performance of Afrino sheep under different stocking densities within the Upper Karoo shrubland, South Africa	*Christiaan Harmse*	Effect of fibre content on the *in vitro* dry matter degradability of feedlot diets	*Sanele Jiyana*
			Effects of bio-digestate application on *Vigna unguiculata* and *Pennisetum purpureum* pastures on lignification rate of stem and leaf carbohydrate and structural protein fractions	*Florence Nherera-Chokuda*
12:35	Exploring the potential value of grazing lawns in rangeland ecosystems	*Gareth Hempson*	The impact on wool production yield of grazing Dohne Merino sheep on *Bidens pilosa* (Black jack) infested pastures in the Highveld	*Petros Khoza*
			Species composition and biomass production in two communal coastal rangelands of the Eastern Cape Province, South Africa	*Sinethemba Matshawule*
			Effect of fresh lucerne and concentrate supplementation on milk production of Jersey cows grazing Kikuyu pasture in spring	*Portia Mamothaladi Moshidi*

12:55-13:55   LUNCH

Plenary: Land Transformation and Rehabilitation

Time	Title	Author
13:55	Can ecosystems recover successfully without human intervention? Degraded vs natural grassland	*Nobuhle Mweli*
14:15	Working for Water prioritisation plan: Towards a strategy for management of invasive aliens for the Tsitsa River catchment, Eastern Cape	*Sukhmani Mantel*
14:35	The characteristics of the Matlabas Mire, Limpopo province: Implications for conservation management	*Antoinette Bootsma*
14:55	Seed mix type and planting method do affect restored grassland diversity	*Stuart Demmer*
15:15	Seedling growth of different grasses grown on mine soil from a disturbed area watered with solutions of varying salinity (NaCl)	*Mziwanda Mangwane*
15:35	Effect of vetiver grass competition and soil nutrient status on native grasses	*Lindokuhle Xolani Dlamini*

Wednesday, 25 July — 15:55 to 18:30

15:55-17:00 Research Proposal Session and Afternoon Tea

An ecological study of *Tarchonanthus camphoratus* (camphor bush) in the Northern Cape Province of South Africa	*Imke Jutta Stehn*
Assessing livestock grazing distribution on communal rangelands of Cata and Guquka, Eastern Cape, South Africa	*Thantaswa Zondani*
Determining the BCS (Body Condition Scoring) of giraffes (*Giraffa camelopardalis*) in different farming systems	*Amaria Janse van Rensburg*
Determining the status and development of a conservation plan for giraffe (*Giraffa camelopardalis giraffa*) in South Africa	*Cara-Anne van der Merwe*
Drought resistance and recovery of forage legumes in the genera *Medicago* and *Trifolium*	*Francuois Müller*
Effect of translocations on the faecal glucocorticoid metabolism levels of *Giraffa camelopardalis*	*Ciska P.J. Scheijen*
Exploitation of *Seriphium plumosum* woody plants and pasture-based feed ingredients for improvement of growth rate, carcass and meat quality of South African Free Range Beef	*Motswapo Phoko*
Lucerne cultivar evaluations under subtropical conditions	*Francuois Müller*
Management strategies to support sustainable production of lucerne in long-rotation cropping systems	*Christoff van der Westhuizen*
Objective calculation of a resilience score, using ungulates, plants and soils as indicators	*Wesley Black*
Mapping pattern and spatial distribution of *Seriphium plumosum* (Slangbos) invasive species using sentinel 2 imagery in Gauteng province, South Africa	*Mduduzi Ndlovu*
The diversity-stability debate: Do we know the underlying mechanisms?	*Stuart Demmer*
The evaluation of bush clearing at Melton LIC, North West province	*Ernest Mokua*
The use of remote sensing to predict *Seriphium plumosum* encroachment susceptibility	*Nonkwekhwezi Princess Myeki*

18:30 PIZZA & QUIZ AT CRAZY BUSHMAN RESTAURANT

Thursday, 26 July — 08:00 to 10:00

	Parallel A: Feeding Ecology		Parallel B: Feeds and Forage, with a Focus on the Forage Seed Value Chain	
08:00	The influence of phenology on browse availability for game species in a semi-arid environment of the Northern Cape province	*Marnus Smit*	Feeds and Forages in the Livestock CGIAR Research Program	*Michael Peters*
08:20	Leafhoppers associated with grasses and shrubs in South Africa	*Michael Stiller*	An update on the Global Strategy for the Conservation and Utilisation of Tropical and Subtropical Forage Genetic Resources	*Chris Jones*

Parallel A: Livestock Impacts on Rangelands

08:40	Distribution and botanical composition of grass species in relation to distance from the fence-line in six communal grazing lands located on three soil types	*Ayanda Kwaza*	Forage seed systems in eastern Africa: challenges and opportunities	*Solomon Mwendia*
09:00	Soil chemical and physical status in relation to distance from the fence-line in six semi-arid communal grazing lands and impact of exclosure	*Ayanda Kwaza*	Farmers' perception on the causes of feed shortage and the fear of cost of establishing leguminous pastures under small-scale farming system	*Nobuntu Matyholo-Mapeyi*
09:20	Communal livestock management for rehabilitation and livelihood outcomes: progress up to date	*Helen Fox*	Adoption of improved forage legume technologies by communal farmers in Zimbabwe	*Shirleen Fungisai Mushapaidze*

Parallel A: Bush Encroachment

09:40	Effects of *Seriphium plumosum* densification on grassland vegetation at Telperion, Mpumalanga, South Africa	*Susannah Cleo Patrocinio*	Value chain analysis of forage seed in smallholder systems of Zimbabwe	*Irenie Chakoma*

Thursday, 26 July
10:00 to 18:30

10:00-10:30 MORNING TEA

Parallel A: Fire Ecology			Parallel B: Feeds and Forage, with a Focus on the Forage Seed Value Chain	
10:30	Initial investigation of the effects of prescribed burning on the incidence of ticks in a moist savanna community in the Lowveld of South Africa	LD Van Essen	Breeding for late flowering and improved leaf and root yield in fodder radish	Patrick Rakau
10:50	Pyro-hydrological interactions in African savanna soils	Tercia Strydom	Brachiaria grass for livestock feed security in sub-Saharan Africa	Sita Ghimire
11:10	The effect of season, fire and slope position on Seriphium plumosum L. forage quality in South African grassland communities	Hosia Pule	Goat feeds and feeding systems in semi-arid smallholder farming system in Zimbabwe	Takudzwa Charambira

Parallel A: Conservation of Rangelands				
11:30	The Gauteng Biodiversity Stewardship Programme	Christina Seegers	Evaluation of dry season fodder supplements on the performance of goats grazed on natural veld in a semi-arid area of Zimbabwe	Tafadzwa Zvakumbirwa
11:50	The Greater Limpopo Transfrontier Conservation Area: implications for multiple land use objectives	Mike Peel	Value chain analysis of goats in Beitbridge district of Zimbabwe	Sikhalazo Dube
12:10	The use of Unmanned Aerial Vehicles in conservation	Debbie Jewitt	Qualitative and quantitative nutritional parameters of different feed sorghum cultivars for ruminants	Inge Neumann
12:30	The development of an alien and invasive taxa list for regulation in South Africa	Moleseng Moshobane		

Parallel A: Primary Production in Rangelands				
12:50	Effects of elevated ambient and soil temperature on above-ground productivity of high altitude grassland of South Africa	Thembeka Mvelase	**Facilitated discussion led by Session Chair**	
13:10	Grass species composition, distribution and biomass production potential in selected communal rangelands in Msukaligwa municipality	Thabile Joyce Mokgakane		

13:30-14:30 LUNCH

14:30 Mid-Congress Practical Sessions and Tours

Soil assessment and analysis		Cobus Botha	Grass and herbaceous species identification	Caroline Mashau
Tree measurements: VOLCALC workshop		Leslie Brown	Veld condition assessments	Tony Swemmer
Herbicide application		Jaco Fouche	Pasture measurement	Sigrun Ammann & Janke van der Colf
Practical parasite control on pastures: Famacha in small stock		Gareth Bath	Ecological Infrastructure tour: Colbyn Wetland	Mahlodi Tau & John Dini

18:30 GALA DINNER AT PUMULANI LODGE

Friday, 27 July	09:00 to 13:00

Policy and Practice Workshop: Ecological Infrastructure

SESSION OUTCOME: Understanding of the EI concept, its various types and functions and how they relate to the agriculture and rangeland sector, recommendations for policy and practice and research outcomes

09:00	Welcome and introductions	*Catherine Hughes*
09:10	Introduction to the ecological infrastructure concept and its evolution in South Africa	*Mahlodi Tau*
09:30	Investing in Ecological Infrastructure: Opportunities to influence agricultural planning and policy	*Dan'sile Cindi*
09:50	The value of spatial information for the agricultural sector	*Paul Avenant*
10:10	Supporting social change for improved water stewardship	*David Lindley*
10:30	Real world policy changes in the agriculture/water context	*Richard Meissner*
10:50	Introduction to the next session	*John Dini*
11:00 – 11:30	**MORNING TEA**	
11:30	Open discussion – coherent recommendations on EI policy and practice and research agenda from the various sectors. Areas of focus going forward.	
12:45	Closure and wrap-up	

Congress Organising Committee

Julius Tjelele	Agricultural Research Council
Rouxdene Deysel	Gauteng Department of Agriculture and Rural Development
Ntuthuko Mkhize	Agricultural Research Council
Lucas Letsoalo	Agricultural Research Council
Abel Ramoelo	Council for Scientific and Industrial Research (CSIR)
Gilbert Pule	Agricultural Research Council
Kedibone Chueu	DAFF - Animal Production
Florence Nherera-Chokuda	Agricultural Research Council
Claude Muya	Agricultural Research Council
Abubeker Hassen	University of Pretoria
Una-Lou Jordaan	Agricultural Research Council
Zelda King	Agricultural Research Council
Khanyisile Mbatha	UNISA
Mahlodi Tau	South African National Biodiversity Institute (SANBI)
Alan Short	Themeda Eco Consulting
Mduduzi Ndlovu	Gauteng Department of Agriculture and Rural Development
SCIENTIFIC COMMITTEE:	
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
Ralph Clark	Afromontane Research Unit / University of the Free State
Ntuthuko Mkhize	Agricultural Research Council
Rouxdene Deysel	Gauteng Department of Agriculture and Rural Development
Melvin Swarts	Agricultural Research Council
Abubeker Hassen	University of Pretoria
Pieter Swanpoel	Stellenbosch University
Wayne Twine	University of the Witwatersrand

Grassland Society of Southern Africa: 2017/18 Council

PRESIDENT	Sigrun Ammann
IMMEDIATE PAST PRESIDENT	Julius Tjelele
VICE PRESIDENT	Tony Swemmer
HONORARY SECRETARY	Heleen Els
HONORARY TREASURER	Linda Kleyn
SCIENTIFIC EDITOR	Pieter Swanepoel
PUBLICATIONS EDITOR	Josef van Wyngaard
WEBSITE EDITOR	Charné Viljoen
PUBLIC RELATIONS OFFICER	Janke van der Colf
ADDITIONAL MEMBER (ASSISTANT PUBLICATIONS EDITOR)	Malissa Murphy
ADDITIONAL MEMBER (ASSISTANT PUBLICATIONS EDITOR)	Christiaan Harmse
ADDITIONAL MEMBER (FUNDRAISING)	Justin du Toit
ADDITIONAL MEMBER (ASSISTANT WEBSITE EDITOR)	John Mupangwa
CHAIRPERSON OF TRUST	Rina Grant
CHAIRPERSON OF ORGANISING COMMITTEE	Julius Tjelele

Thank you to our sponsors

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.** Completed adjudication sheets should be collected by the session chair following the session and handed to the Congress administrator for data entry purposes.

Adjudicators give a value (1-10) 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 presenters. An example of an adjudication sheet follows on the next page.

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 should be judged both BEFORE the oral presentation begins, i.e. before the session starts, and during the oral presentation. Each poster presentation should be adjudicated by as many judges as possible, but session chairs should appoint **at least four judges per presentation**. Completed adjudication sheets should be collected by the session chair following the session and handed to the Congress administrator for data entry purposes.

Essentially a poster should convey its primary message concisely, preferably within a three minute reading time. Adjudicators give a value (1-10) to each of four questions relating to the physical poster and to one question relating to the oral presentation. 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.

NB: PLEASE NOTE THAT ADJUDICATION RESULTS ARE SENT TO PRESENTERS FOLLOWING THE END OF THE CONGRESS – SO POSITIVE AND CONSTRUCTIVE COMMENTS ARE ENCOURAGED!!

53rd Annual Congress of the Grassland Society of Southern Africa

GSSA ANNUAL CONGRESS PLATFORM PRESENTATION ADJUDICATION SHEET

Session Name:	
Presentation Title:	
Presenter Name:	

One	The speaker's interaction with the audience was (CIRCLE YOUR SCORE):	
A	Worse than I'd expect at this congress (no eye contact, stood with back to audience, did not speak audibly, etc)	1 / 2
B	Slightly below average – the speaker was not too bad, but needs to work on presentation skills.	3 / 4
C	Normal – I'd expect most presentations to be of this quality	5 / 6
D	Slightly above average – not a perfect presentation, but enjoyable	7 / 8
E	Better than I'd expect at this congress (the speaker had a very good rapport with the audience)	9 / 10

Two	The quality of the visual aids was (CIRCLE YOUR SCORE):	
A	Worse than I'd expect (too little/much information, too many/few, writing too small, pictures/graphs unclear, etc.)	1 / 2
B	Slightly below average – visual aids were not bad, but could use some work.	3 / 4
C	Normal – visual aids were understandable and supportive, and what I'd expect.	5 / 6
D	Slightly above average – visual aids on average were as I'd expect, but some of them stood out nicely	7 / 8
E	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)	9 / 10

Three	The supporting evidence (data, case studies, reviews, etc.) was (CIRCLE YOUR SCORE):	
A	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 / 2
B	Slightly below average – the evidence generally held together, but there were some problems	3 / 4
C	Normal – the conclusions were supported by evidence and I understood what was going on	5 / 6
D	Slightly above average - similar to most presentations, but some of the information was particularly valuable	7 / 8
E	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)	9 / 10

Four	The overall value to the congress of this presentation was (CIRCLE YOUR SCORE):	
A	Low (the talk did not contribute significantly to the session; perhaps should have been presented as a poster)	1 / 2
B	Slightly below average – valuable, but perhaps not to this audience, or the quality was a bit below average	3 / 4
C	Normal (this is the type of presentation I'd expect at this congress)	5 / 6
D	Slightly above average – similar to most other presentations, but more presentations should emulate this one	7 / 8
E	High (this contributed more than most other presentations)	9 / 10

Five	The subject of this presentation is (TICK ONE):	
A	Relatively foreign to me – many of the issues that are being discussed fall outside my experience and interests	
B	Relatively familiar to me – while I do not consider myself an expert in this field, I have an interest in the subject	
C	My area of direct interest – I am highly familiar with the subject, and I have direct experience in this field	

GENERAL COMMENTS RELATING TO THIS PLATFORM PRESENTATION:

GSSA ANNUAL CONGRESS POSTER PRESENTATION ADJUDICATION SHEET

Session Name:	
Presentation Title:	
Presenter Name:	

One	The length and detail of the poster were (TICK ONE):	
A	Too brief and lacking in detail	
B	Just right – I could read and understand it in 3 minutes or less	
C	Too busy, took too long to read and understand	

Two	Poster presentation, i.e. colours, font size, use of graphs and pictures, etc. was (CIRCLE YOUR SCORE 1 - 10):	
A	Terrible – this poster gave me a headache, and I could not work out what was going on	1 2
B	Below average – I could see what was going on, but some editing would really have improved things	3 4
C	Average – most of the posters at this congress have this quality presentation	5 6
D	Above average – fonts, colours, and pictures are well presented, and allow rapid appraisal and understanding	7 8
E	Spectacular - this should be used as an example of how to do a poster	9 10

Three	The scientific content of the poster (CIRCLE YOUR SCORE):	
A	Zero – the scientific content of this poster is totally unconvincing. Most information is wrong	1 2
B	Below average –too little information, faulty reasoning, statistics and/or results are flawed	3 4
C	Average – the information in this poster is what I would expect from this congress	5 6
D	Above average – the information here is interesting, exciting, and made me think	7 8
E	Fantastic – very interesting, publishable results	9 10

Four	The overall value to the congress of this presentation was (CIRCLE YOUR SCORE):	
A	Non-existent (no relevance to this type of congress)	1 2
B	Low (the poster did not contribute significantly to the session)	3 4
C	Acceptable (this is the type of poster I was expecting to see)	5 6
D	High (this contributed more than most other posters)	7 8
E	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)	9 10

Five	The quality of the oral presentation (CIRCLE YOUR SCORE):	
A	Awful – the speaker did not convey what the poster was about in the allocated time.	1 2
B	Below average – some information came across, but the speaker really should try harder	3 4
C	Average – what I was expecting, and most other presentation are like this	5 6
D	Above average – the speaker used the allocated time well, and the audience were left wanting more	7 8
E	Spectacular – this speaker held the audience enthralled – people will remember this talk for years to come	9 10

Six	The subject of this presentation is (TICK ONE):	
A	Relatively foreign to me – many of the issues that are being discussed fall outside my experience and interests	
B	Relatively familiar to me – while I do not consider myself an expert in this field, I have an interest in the subject	
C	My area of direct interest – I am highly familiar with the subject, and I have direct experience in this field	

GENERAL COMMENTS RELATING TO THIS POSTER PRESENTATION:

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 48th Annual Congress of the Grassland Society of Southern Africa. Nominations should be received by Thursday 26th July at 3pm. Hand them in at the registration desk.

Research Skills Workshop

Presented by the Grassland Society of Southern Africa

22 to 23 July 2018
Roodeplaat, Pretoria, Gauteng Province, South Africa

WHO SHOULD ATTEND?

The workshop will be of value to anyone involved directly or indirectly in biological, ecological, and agricultural research, including scientists, researchers, managers, technicians, teachers, mentors, and students.

DAY 1: RESEARCH SKILLS WORKSHOP

SESSION CHAIR: CLEMENT CUPIDO

Sunday 22 July 2018, 09:45 - 17:30

Venue: ARC Training Centre Main Room, Roodeplaat

WHERE WE END UP – CHOOSING A CAREER PATH

Julius Tjelele

Agricultural Research Council, email: jtjelele@arc.agric.za

A career in science faces challenges and opportunities, both at individual and institutional levels. An additional dilemma of whether to continue with research or move towards management often confronts young scientists, and decisions here can drastically alter careers in science.

Julius Tjelele holds a PhD (Botany) from the University of Kwazulu-Natal. He worked as a researcher for 10 years before he became a Research Team Manager at the Range and Forage Science section at the Agricultural Research Council. His research interest is in rangeland ecology and management, with a special focus on herbivores and their interaction with vegetation; and factors governing their foraging behaviour and seed dispersal of woody plant species. Dr Tjelele served as the Publication editor of Grassroots, a popular newsletter of the Grassland Society of Southern Africa (GSSA), president and currently the immediate past president of the GSSA. He is also serving on the advisory board of the Centre for African Conservation Ecology at Nelson Mandela Metropolitan University. Dr Tjelele is passionate about mentoring of young people.

THE RESEARCH QUESTION

Wayne Twine

University of the Witwatersrand, email: wayne.twine@wits.ac.za

The research question is central to research, providing a point from which literature is reviewed and experiments are developed. This pivotal aspect of research is often not given the attention it deserves, and many research questions are later found to be essentially unanswerable, uninteresting to the scientific community, or even already answered in other research. The objective of this presentation is to help researchers craft a clear, useful, and feasible research question to guide their study.

Wayne Twine is an associate professor in the School of Animal Plant and Environmental Sciences, University of the Witwatersrand. He has over 20 years of research experience, particularly in communal areas. He has been author or co-author of 43 peer-reviewed journal articles and 6 book chapters.

HOW TO PLAN AND CONSTRUCT A THESIS

Abel Ramoelo

Council for Scientific and Industrial Research (CSIR), email: aramoelo@csir.co.za

A thesis is known to be a long essay or dissertation, reporting on research written by a candidate for a University for a particular degree, for example; Masters or Doctorate. The planning and writing of a thesis is a critical stage during the studies of a candidate, and requires some careful thoughts. At the stage of construction and writing of the thesis, most of the candidates would have completed data analysis and interpretations of results. Therefore, there are two ways to construct a good thesis, and often this is institution dependent. Firstly, there is a conventional way which requires clear articulation of the components of the research process. Secondly, it can involve the compilation of scientific papers, with a general introduction and the last chapter as the Synthesis. The latter is favoured by many Universities these days, because candidates are encourage to publish scientific papers before they actually complete their studies. These two approaches for constructing a good thesis and additional tips for making a thesis more interesting shall be presented.

Dr Abel Ramoelo is a principal research scientist at the Earth Observation unit of the Council for Scientific and Industrial Research (CSIR). He completed his PhD in remote sensing from the University of Twente, Faculty of

Geoinformation Science and Earth Observation (ITC), the Netherlands. He also completed his MSc in Geoinformation Science and Earth Observation for Environmental Management and Modelling at four European Universities, Lund (Sweden), Southampton (UK), Warsaw (Poland) and ITC. His first degrees were completed at the University of Venda, Thohoyandou. His research focuses on developing and improving techniques for extracting information from remote sensing data, i.e. hyperspectral, Light Detection and Ranging (LiDAR) and multispectral for use in addressing issues related to natural resource and environment; e.g. rangeland or grass quality and quantity, tree species discrimination as well as water availability and quality assessment. He is also involved in projects focusing on land cover mapping and change detection as well as spatial modelling and analysis. His role involves among other activities, project management (local and international), research proposal writing and attracting research funding. He is NRF rated and professionally registered with SACNASP (Field: Geospatial Science). He is also an Associate Editor of the International Journal of Applied Earth Observation and Geoinformation and serves as Editorial Board member of several journals. He successfully supervised three PhD and over eight MSc students. He published over 45 scientific and conference proceeding papers.

DATA MANAGEMENT – MAKING IT EASIER FOR YOU

Victoria Goodall

VLG Statistical Services, email: victoriagoodall@gmail.com

Data management is a crucial component of the research cycle. This presentation introduces the concepts of data management and metadata standards. Various data management tools are discussed which will assist researchers with managing their own data. A number of data portals allow for data sharing and enable researchers to access a broad range of data that have already been collected.

Victoria Goodall completed her MSc (Mathematical Statistics) at Rhodes University in Grahamstown. Her PhD completed at the Department of Statistics, University of the Witwatersrand in Johannesburg, investigated the application of various statistical methods to the GPS locations obtained for sable antelope, buffalo and zebra in the Kruger National Park. Victoria began her working career with Volkswagen South Africa as a Customer Relationship Management Data Analyst. Her second job was as a statistician for Synovate (now Ipsos). Her working career then moved to Kirstenbosch in Cape Town, working as a Data Scientist for the South African Environmental Observation Network (SAEON) Fynbos Node. She then moved into the academic field, working as Senior Lecturer at Nelson Mandela University. She is currently a Research Associate affiliated with the Nelson Mandela University Department of Statistics and she is a member of the Centre for African Conservation Ecology and Institute for Coastal and Marine Research Centre at the university. Currently she is working as a consultant for VLG Statistical Services focusing on statistical consulting and training, and data management.

OVERCOMING THE PUBLISHING OBSTACLE

Wayne Twine

University of the Witwatersrand, email: wayne.twine@wits.ac.za

Peer-reviewed articles ('papers') are the accepted means of recording and communicating ideas and findings in science. However, the process of scientific writing, especially for beginner scientists, is an arduous one, and scathing reviews of submissions often permanently discourage promising students. This presentation provides some practical guidelines for writing a scientific paper and getting it published.

Wayne Twine is an associate professor in the School of Animal Plant and Environmental Sciences, University of the Witwatersrand. He has over 20 years of research experience, particularly in communal areas. He has been author or co-author of 43 peer-reviewed journal articles and 6 book chapters.

ORAL PRESENTATIONS: HOW TO EFFECTIVELY GIVE THEM USING POWERPOINT

Adrian Shrader

University of Pretoria, email: adrian.shrader@up.ac.za

One of the main ways in which we convey information in science is through oral presentations at conferences. Computers programs such as PowerPoint make these presentations more vivid and easy for the audience to follow. However, the misuse of PowerPoint can greatly blur your message and confuse the audience. Adrian will provide tips on how to best effectively use PowerPoint, and highlight some of the different types of oral presentations at conferences (Plenary, platform, speed).

Adrian is an Associate Professor of Mammalian Behavioural Ecology at the Mammal Research Institute at University of Pretoria. His research focuses primarily on the behavioural ecology of large mammalian herbivores, their interactions with vegetation, and the factors governing their foraging, habitat use, and movements. Secretly he believes that plants are nothing more than food for the cool herbivores he studies. Recently, Adrian has focused a portion of his research on how mammalian herbivores use olfactory cues from plants to make pre-ingestive foraging decisions. His research has been highlighted in the New York Times, The Washington Post, Los Angeles Times, BBC, National Geographic, Spiegel Online, Nature online, and the TV show QI. In addition to ecological research, Adrian has a particular interest in presenting complex scientific findings – be they in the written, poster, or oral forms – in a clear and understandable way.

TEN TIPS FOR DESIGNING THE PERFECT POSTER

Adrian Shrader

University of Pretoria, email: adrian.shrader@up.ac.za

Presenting posters at conferences is generally perceived to be second choice after giving a talk. However, if posters are put together well, you can get people to stop, look, and chat to you about your research. Moreover, these chats can last much longer, and thus you can gain more feedback, than if you were to give a talk. In this presentation, Adrian will provide 10 simple tips to improve you posters, and get people to spend more than 11 seconds looking at them.

Adrian is an Associate Professor of Mammalian Behavioural Ecology at the Mammal Research Institute at University of Pretoria. His research focuses primarily on the behavioural ecology of large mammalian herbivores, their interactions with vegetation, and the factors governing their foraging, habitat use, and movements. Secretly he believes that plants are nothing more than food for the cool herbivores he studies. Recently, Adrian has focused a portion of his research on how mammalian herbivores use olfactory cues from plants to make pre-ingestive foraging decisions. His research has been highlighted in the New York Times, The Washington Post, Los Angeles Times, BBC, National Geographic, Spiegel Online, Nature online, and the TV show QI. In addition to ecological research, Adrian has a particular interest in presenting complex scientific findings – be they in the written, poster, or oral forms

DAY 2: RESEARCH SKILLS WORKSHOP

SESSION CHAIR: CLEMENT CUPIDO

Monday 24 July 2018, 08:30 - 17:00

Venue: ARC Training Centre Main Room, Roodeplaat

WRITING POPULAR ARTICLES

Amelia Genis

Landbouweekblad, email: agenis@landbou.com

Scientists are in the best position to communicate their own research to the public, but they often lack the tools to write popular articles for the general press. This practical session will teach workshop attendants how to turn their research reports, theses and journal papers into reports that are jargon-free and easy to read for a wider audience without diminishing the value or gravity of their original work.

Dr. Amelia Genis is a specialist writer at Landbouweekblad where she writes about the grain industry, small stock farming, land reform, plant genetics and renosterveld and arid zone ecology. She is interested in rural change and innovation on the platteland. This year she began to organise veld days to bring together farmers, botanists and ecologists in the veld to talk about plants, insects, biological soil crusts, drought, heat, grazing methods, restoration and the importance of biodiversity.

THE RESEARCH QUESTION (CONTINUED)

Wayne Twine

University of the Witwatersrand, email: wayne.twine@wits.ac.za

The research question is central to research, providing a point from which literature is reviewed and experiments are developed. This pivotal aspect of research is often not given the attention it deserves, and many research questions are later found to be essentially unanswerable, uninteresting to the scientific community, or even already answered in other research. The objective of this presentation is to help researchers craft a clear, useful, and feasible research question to guide their study.

Wayne Twine is an associate professor in the School of Animal Plant and Environmental Sciences, University of the Witwatersrand. He has over 20 years of research experience, particularly in communal areas. He has been author or co-author of 43 peer-reviewed journal articles and 6 book chapters.

HOW TO PLAN AND CONSTRUCT A THESIS

Abel Ramoelo

Council for Scientific and Industrial Research (CSIR), email: aramoelo@csir.co.za

A thesis is known to be a long essay or dissertation, reporting on research written by a candidate for a University for a particular degree, for example; Masters or Doctorate. The planning and writing of a thesis is a critical stage during the studies of a candidate, and requires some careful thoughts. At the stage of construction and writing of the thesis, most of the candidates would have completed data analysis and interpretations of results. Therefore, there are two ways to construct a good thesis, and often this is institution dependent. Firstly, there is a conventional way which requires clear articulation of the components of the research process. Secondly, it can involve the compilation of scientific papers, with a general introduction and the last chapter as the Synthesis. The latter is favoured by many Universities these days, because candidates are encourage to publish scientific papers before they actually complete their studies. These two approaches for constructing a good thesis and additional tips for making a thesis more interesting shall be presented.

Dr. Abel Ramoelo is a principal research scientist at the Earth Observation unit of the Council for Scientific and Industrial Research (CSIR). He completed his PhD in remote sensing from the University of Twente, Faculty of

WRITING POPULAR ARTICLES

Amelia Genis

Landbouweekblad, email: agenis@landbou.com

Scientists are in the best position to communicate their own research to the public, but they often lack the tools to write popular articles for the general press. This practical session will teach workshop attendants how to turn their research reports, theses and journal papers into reports that are jargon-free and easy to read for a wider audience without diminishing the value or gravity of their original work.

Dr. Amelia Genis is a specialist writer at Landbouweekblad where she writes about the grain industry, small stock farming, land reform, plant genetics and renosterveld and arid zone ecology. She is interested in rural change and innovation on the platteland. This year she began to organise veld days to bring together farmers, botanists and ecologists in the veld to talk about plants, insects, biological soil crusts, drought, heat, grazing methods, restoration and the importance of biodiversity.

THE RESEARCH QUESTION (CONTINUED)

Wayne Twine

University of the Witwatersrand, email: wayne.twine@wits.ac.za

The research question is central to research, providing a point from which literature is reviewed and experiments are developed. This pivotal aspect of research is often not given the attention it deserves, and many research questions are later found to be essentially unanswerable, uninteresting to the scientific community, or even already answered in other research. The objective of this presentation is to help researchers craft a clear, useful, and feasible research question to guide their study.

Wayne Twine is an associate professor in the School of Animal Plant and Environmental Sciences, University of the Witwatersrand. He has over 20 years of research experience, particularly in communal areas. He has been author or co-author of 43 peer-reviewed journal articles and 6 book chapters.

PHOTOGRAPHY IN THE FIELD

Justin Du Toit

Scientist, DAFF - Grootfontein ADI , email: justindutoit@gmail.com

Ecologists can use photography for capturing information about organisms and their environment. This session focuses on how to maximise the amount of information a photograph provides, how to manage photograph collections, and using repeat photography as a monitoring tool. Included is a practical on repeat photography. (Please bring a camera / cellphone for the prac.)

Justin du Toit is a researcher for the Department of Agriculture, Forestry and Fisheries based at Grootfontein in the Karoo. His research interests include vegetation responses to grazing, rainfall, and fire; control of invasive species; and long-term monitoring using photography.

SOURCING OF ARTICLES, REFERENCING AND AVOIDING PLAGIARISM

Denise Nicholson

University of the Witwatersrand, email: denise.nicholson@wits.ac.za

During Information literacy awareness month in the USA, President Barack Obama (2012) confirms the importance of an information literate society. The correct use of information and information tools can be seen as a prerequisite for economic progress. According to the Association of College and Research Libraries it is more important than ever to use information wisely. Understanding the ethical and legal use of information can be seen as a performance indicator of an information literate individual. Using the right "package deal" for research purposes might be the pathway to academic progress.

SMARTPHONES TECHNOLOGY AND APPLICATIONS FOR RESEARCH

Clement Cupido

Agricultural Research Council, email: clementfcupido@gmail.com

Smartphone are becoming increasingly popular in our modern society and astronomic technological advances have been made to improve these devices over the past few years. Currently there are about 2.5 billion smartphones users worldwide and the rapid sales of these devices encouraged producers to pack them with high end sensors - some are hardly of any use to the common citizen. The most common built-in sensors are the accelerometer, gyroscope, magnetometer, GPS receiver, microphone and camera. Some higher-end models come equipped with for example gravity and rotational vector sensors, and environmental sensors such as barometers, photometers, thermometers and air humidity sensor. Combined with appropriate downloadable applications, this offers opportunities for researchers to perform tasks that could be more than useful during fieldwork and in the office. Various apps that can be potentially be used in research will be discussed and we will look at the possibilities of the GPS Essentials app in smartphone mapping.

Clement Cupido is a rangeland ecologist for the Agricultural Research Council. He works primarily in the Succulent Karoo biome in the Namaqualand Uplands and has a keen interest in the ecosystem services herding has to offer. He is based at the University of the Western Cape's Biodiversity and Conservation Biology Department where he supervises and co-supervises several post-graduate students who are working within the arid zone along the west coast region. He has a keen interest in outdoor and studio photography.

OPENING PLENARY SESSION: CLIMATE CHANGE

SESSION CHAIR: JULIUS TJELELE

Tuesday 24 July 2018, 08:30-10:00

Venue: ARC Training Centre Main Room, Roodeplaat

INVITED KEYNOTE ADDRESS: BUSH ENCROACHMENT ON SOUTH AFRICA'S GRASSLANDS– IS IT A FORM OF LAND DEGRADATION

Barney Kgope

Department of Environmental Affairs, email: bkgope@environment.gov.za

The planting of trees across the globe is punted as one of principal solutions to mitigate against climate change. However this notion negates the role of other equally important ecosystems e.g. grasslands and savannahs, in carbon sequestration whilst providing other crucial goods and services. Equally important is that this has potential to create tension across the three Rio Conventions, namely: United Nations Framework Convention on Climate Change (UNFCCC), United Nations Convention on Biological Diversity (UNCBD) and the United Nations Convention for Combating Desertification (UNCCD). In South Africa, the grassland and savannah biomes are already undergoing transformation through bush encroachment and woody thickening, respectively. Bush encroachment and woody thickening are global phenomena attributed to the increase in atmospheric CO_2, fire suppression and herbivory. A myopic interpretation of this transformation presents the risk of lending credence to the notion of bush encroachment and woody thickening as a phenomenon worth promoting at the expense of other important goods and services e.g. biodiversity and water reticulation. Ecosystem based Adaptation (EbA) is an emerging area of practise considered a comprehensive response to challenges presented by climate change. As a result, the contention here is that EbA is a smart 21st century practise that presents the opportunity for a balanced approach in addressing bush encroachment and woody thickening in South Africa.

INVITED KEYNOTE ADDRESS: PRACTICAL AGRICULTURAL APPROACHES TO BUILDING CLIMATE RESILIENCE IN SOUTH AFRICAN RANGE AND PASTURE SYSTEMS

Stephanie Midgley

Western Cape Department of Agriculture, email: stephanie.midgley@gmail.com

South African range and pasture systems make a significant contribution to the agricultural and wider economy. Their vulnerability to climate variability and climate change is highly context-specific, depending on local climate, soils, water resources, plant species composition, livestock species, and management practices. Changing risks associated with warming and altered rainfall patterns also vary across the country, across different spatial scales, and for different future timeframes. Nevertheless, research shows that a fundamental understanding of ecosystem services, and how these are impacted by climate risks together with management practices, can help to identify practices and technologies which can increase the resilience of these farming systems in the short to medium term. Provisioning, regulating and supporting ecosystem services (for example, relating to soil conservation, soil fertility, carbon sequestration and hydrology) within natural and semi-natural grazed landscapes support primary production of plants and animals. They also provide resilience to climate extremes such as droughts, floods and heat waves. Planted and intensively managed pastures display significantly altered abiotic and biotic characteristics and processes and climate vulnerability. In addition to impacts on the quantity and quality of grazing and fodder, climate change exerts direct impacts on the animals through heat, pests, diseases, nutritional stress and lack of water, manifested as changes in growth and fertility. However, the scale of impacts is highly differentiated between different livestock species and farming systems. This presentation will outline some of the complexities inherent in assessing climate risks at farm level, and then focus on some practical approaches to adaptation (with mitigation co-benefits) in South African contexts which can confer increased greater resilience. Key findings of the SmartAgri Project (Western Cape Climate Change Response Framework and Implementation Plan) and national and global scientific sources will be presented. The presentation will close with a summary of some research gaps and a discussion of the need for collaborative and strategic research partnerships which are cross-sectoral and inter-disciplinary.

PARALLEL A: CLIMATE CHANGE

SESSION CHAIR: TONY SWEMMER

Tuesday 24 July 2018, 10:30 - 12:35

Venue: ARC Training Centre Main Room, Roodeplaat

INVITED KEYNOTE ADRESS: NET PRIMARY PRODUCTION IN SOUTH AFRICAN GRASSLANDS: RELATIONSHIP TO RAINFALL, SOIL TYPE AND HISTORY

Bob Scholes[1]*, Catherine Van Den Hoof[2], Mtho Moyo[2] and Chantelle Howlett[3]

[1]WITS - Global Change Institute (GCI) [2]University of the Witwatersrand [3]Institute of Environmental Studies, University of the Free State, email: bob.scholes@wits.ac.za

The MISR-HR satellite sensor enabled us to construct an 18-year record of eight-daily fraction absorbed photosynthetic radiation (FAPAR) at 275 m resolution over the entire grassland domain. The seasonally-accumulated FAPAR is a good proxy for net primary production (NPP), a hypothesis we tested using independent data. We then selected 60 sites across the grassland rainfall range, in South Africa chosen to be in un-degraded condition, to establish a relationship between accumulated rainfall and seasonally-accumulated FAPAR. The relationship is strongly linear (r^2=0.805, p< 0.001) until around 700 mm, at which point it begins to level off. There is a strong association between soil types and rainfall, but the soil type itself has little effect on accumulated FAPAR. As found elsewhere, the within-site relationships to rainfall has a lower slope (rain use efficiency) than the between-site slope, an observation we attribute to biogeochemical constraints. The NPP in a given year has a strong relationship to NPP in the previous year, particularly below 600 mm (r^2 = 0.35-0.4), and even a relationship to two years previously (r^2~0.2). There are clear functional differences between the semi-arid and moist grasslands.

PLATFORM PRESENTATION: EFFECT OF SIMULATED DROUGHT ON ANNUAL NET PRIMARY PRODUCTIVITY OF SEMI-ARID GRASSLAND

Thabo Magandana*, Abubeker Hassen and Eyob Tesfamariam

University of Pretoria, email: tmagandana@gmail.com

Drought can be defined in general terms as the 50 percent shortfall of rainfall over a period of three months. Drought leads to reduced rangeland productivity, which will ultimately lead to reduced livestock and wildlife production. The objective of this study was to determine the impact of drought, simulated with four different rainfall interception (RI) levels on grass annual net primary productivity (ANPP). The study was conducted at the University of Pretoria experimental farm, Hatfield, Pretoria. There were twenty 7 X 7m study plots on a natural grassland. The treatments consisted of 0, 15, 30 and 60% RI, each replicated five times. All the herbage in the plots was cut to ground level at the beginning of the experiment on the 1st of November 2016. A fixed 1 m^2 quadrat was marked at the centre of each plot and the biomass within the quadrats was harvested at the end of the year. Grasses were further separated into different species and the species were categorised into ecological statuses (increasers and decreasers). The ANPP under 60% RI was four times lower than that of the control plots (5482 kg ha^{-1}). Although there was no significant difference in the grass ANPP between the 0% (4582 kg ha^{-1}), 15% (4100 kg ha^{-1}) and 30% RI (3760 kg ha^{-1}), the herbage yield declined as the drought intensity increased. Forbs' ANPP was significantly lower (P<0.05) under 15% RI (30.5 kg ha^{-1}). *Digitaria eriantha*, *Themeda triandra* and *Heteropogon contortus* had a significantly lower ANPP (P<0.05) under 60% RI. However, *D. eriantha* attained a significantly higher (P<0.05) ANPP under 15% RI (3338 kg ha^{-1}). Decreasers produced a significantly higher ANPP (P<0.05) at the 0% RI (3432 kg ha^{-1}) while increasers were significantly higher (P<0.05) under 30% RI (2622 kg ha^{-1}) than 60% RI (283 kg ha^{-1}). Increasers used water more efficiently than decreasers. The results showed that drought has a significant negative effect on the ANPP. Herbage yield generally decreased with the increase in intensity of drought, however, the relative contribution of forbs increased with the increase in drought intensity while the opposite was true for grasses. This implies that drought (60% RI) can have severe effects on rangeland productivity, which can reduce livestock production.

PLATFORM PRESENTATION: PLANTS AND SOIL CARBON-NITROGEN SEQUESTRATION AND ISOTOPE RATIOS IN RELATION TO LAND MANAGEMENT SYSTEMS AND SEASONS IN MOPANE SAVANNAH, NAMIBIA

Absalom Kahumba[1]* and Solomon Tefera[2]

[1] University of Namibia, [2]University of Fort Hare, email: akahumba@unam.na

Land management systems may affect the amount of plant and soil carbon-nitrogen sequestrated in different seasons. This study investigated the differences in plant and soil carbon-nitrogen sequestration and C-N isotopes between three land management systems in summer and winter seasons. Three 250 m^2 belt transects were randomly laid out in each of the three camps per land management system. For herbaceous plant sampling, forages were harvested from five (0.25 m^2) quadrats laid out in each belt transect, bulked and samples oven-dried at 65 ^{o}C. For woody plant sampling, leaves and twigs of a dominant plant species (*Colophospermum mopane*) were harvested from five plants per belt transect, bulked and oven-dried at 65 ^{o}C. Three soil samples were collected per belt transect to a depth of 20 cm using a soil auger and a soil core sampler to determine soil bulk density. The total vegetation results showed that total organic carbon (TOC) (kg ha^{-1}) in plants (herbaceous and woody plants) was greater (P < 0.001) in the game reserve, followed by the ranch and lowest in the communal area, with a similar trend observed in both seasons. The total vegetation total nitrogen (TN) (kg ha^{-1}) sequestered in summer was greater (P < 0.001) in the game reserve and lowest in the communal area, while in winter the game reserve and ranch had similar results and greater (P < 0.001) TN (kg ha^{-1}) than the communal areas. The amount of vegetation TOC and TN (kg ha^{-1}) was greater in summer than winter season. Soil TOC (kg ha^{-1}) was greater (P < 0.001) in the game reserve than the ranch and communal land management systems. The TN (kg ha^{-1}) in soils was unaffected (P > 0.05) by land management systems. The herbaceous δ^{13}C and δ^{15}N levels were greatly (P < 0.05) affected by land management systems in different seasons. In summer, the game reserve and ranch land management systems recorded greater herbaceous (P < 0.001) δ^{13}C and lower δ^{15}N levels than the communal area, but in winter, the game reserve had a greater (P < 0.001) herbaceous δ^{13}C level than the ranch, though both the game reserve and ranch had similar (P > 0.001) δ^{15}N values. The woody foliar component had markedly greater (P < 0.001) δ^{13}C levels in summer in both the communal and ranch land management systems than the game reserve, but in winter the ranch had greater (P < 0.001) δ^{13}C level than the game reserve and communal areas. Woody foliar samples harvested from the ranch showed variation (P < 0.05) in δ^{15}N between seasons, being greater (P < 0.001) in summer than winter. Soil δ^{13}C level was slightly greater (P < 0.001) in both seasons in the communal land than the other two land management systems. The study concludes that the game reserve sequestered more TOC and TN (kg ha^{-1}) in the total vegetation than the other two land management systems during both summer and winter. The game reserve also stored more soil TOC (kg ha^{-1}) than the ranch and communal management systems. The study recommends more research to be conducted by including land management systems in different agro-ecologies, and for a prolonged period, to ascertain the impact of land use practices and seasonal dynamics of the measured variables.

PLATFORM PRESENTATION: THE EFFECT OF ELEVATED TEMPERATURES ON GROWTH AND DEFENSE OF *VACHELLIA SIEBERIANA* GROWN WITH OR WITHOUT GRASS

Lusanda Ncisana[1,2]*, Peter Scogings[1] and Ntuthuko Mkhize[2]

[1]University of KwaZulu-Natal, [2]Agricultural Research Council-Animal Production Institute, email: ncisanalusanda@gmail.com

The effects of rising temperature on grassland have been studied utilizing open top warming chambers (OTC), however little research has been done on the effect of warming on the performance of woody plants in savannas. The objective of the study was to test the effect of elevated temperatures on growth and defence of woody seedlings that have the potential to invade grassland. This was examined for *Vachellia sieberiana* seedlings at the Ukulinga Experimental Farm of the University of KwaZulu-Natal, Pietermaritzburg using OTC. Seeds of *V. sieberiana* were collected in 2016 around Pietermaritzburg and 200 seeds were germinated using agar, and then grown in pots with sandy soil in a greenhouse for a month. At a mean height and stem diameter of 13.5 cm and 2.16 mm, respectively, 120 seedlings were transplanted into field plots, that were either cleared of grass, or not, in October 2017. The remaining 80 seedlings were used to develop linear regression models of stem diameter and total dry mass (DM) to estimate initial biomass of seedlings. The experiment was a fully crossed randomized design with four treatments (warmed with grass, warmed without grass, not warmed with grass and not warmed without grass) replicated 5 times.

Plots were 2 x 2 m, with six seedlings in each plot. Open top warming chambers were used to raise air temperature by ~1°C. Stem length, plant height, stem diameter, thorn length, leaf dry matter, shoot dry matter, root dry matter and total dry matter (DM) were measured in January 2018. Warming significantly ($p < 0.05$) increased plant height, stem length, and stem diameter 1,3 to 1,4 fold and on average; and doubled leaf DM, shoot DM, root DM and total DM. The removal of grass cover significantly ($p < 0.05$) doubled shoot DM and total DM, on average, while warming in the absence of grass doubled thorn length compared to plots with grass. Temperature to a level expected in the next few decades clearly was more beneficial than grass removal for *V. sieberiana* seedlings growth. Our results suggest that, regardless of grass cover at the time of seedlings establishment, the rate of woody encroachment will increase as temperature rises.

PLATFORM PRESENTATION: EFFECTS OF HIGH TEMPERATURES ON EMERGENCE, GROWTH, AND FORAGE QUALITY OF A PERENNIAL SORGHUM FOR SUPPLEMENTING DAIRY COWS IN SEMI-ARID AREAS

Florence Nherera-Chokuda[1]*, Wisani Goodness Mushadu[2],Vincent Maphahla[2], Matlou Grace Makgobatlou[2], Ntuwiseni Mmbi[2] and Mukengela Claude Muya[1]

[1]Agricultural Research Council-Animal Production Institute, [2]Limpopo Department of Agriculture, email: nhereraf@arc.agric.za

Sorghum [*Sorghum bicolor* (*L) Moench*] is adapted to high temperatures and water stress, and plays a critical role as food in dry areas, with the stover also utilized as fodder. Temperatures above 30 °C promote faster emergence and better seedling establishment, but very high temperatures affect osmotic regulation. Optimum temperature for emergence is 20-30 °C. The objective of the study was to evaluate the effect of high temperatures experienced in the Limpopo region on the emergence of new perennial sorghum cultivars, and subsequently assess seedling and plant growth. Temperature effects were assessed at two sites in communal areas: Vhembe (Vh) district (Temperature Humidity index THI 72-83; mean maximum air temperatures of 38 °C, mean annual rainfall 410 mm) and Sekhukhune (SK) district (THI 75-87; 40 °C and mean annual rainfall of 380 mm). Experimental plots were established in January 2018 at sites characterised by a sandy loam soil type. Eight quadrats were randomly selected for assessment of germination, root length and mass and shoot growth (plant density, plant height, leaf numbers and length and stem diameter). Germination was assessed daily over 14 days, with weekly measurements on seedling growth undertaken thereafter on a weekly basis until eight weeks post emergence. At eight weeks whole plants were harvested for forage quality inference based on stem diameter. Germination percentage and seedling emergence was higher ($p < 0.05$) at Vh (86% and 79%, respectively) than at Sk (72%; 46%). Plant density was higher ($p < 0.001$) in Vh, ranging between 90 and-144, while it was < 40 plants/quadrat in Sk. At 4 weeks mean leaf numbers in Vh and Sk were 7 and 9, respectively, while mean leaf width was similar (1.8 cm) and plant height varied (23 vs 11 cm). Lateral root length was within the range 19-26 cm at Vh and 25-30 cm at Sk, although the latter had massive root system (40-60 lateral roots vs 38-46 in Vh). Positive, but non-linear, correlations were noted between lateral root length and shoot growth: ($R^2 = 0.66$ and 0.70; at Sk and Vh, respectively). Stem diameter ranged between 0.5-1.3 cm at four weeks, but did not differ at tasselling, averaging 2.3-cm. Better growth performance in Vh could be related to the greater initial rates of root and shoot growth, which allowed plants better adaptability to stress at temperatures below 40 °C. Sorghum sown at the warmer site (Sk) emerged, but plant density was lower, which affected yield. Thinner stems are less lignified and easily macerated during rumination; hence, the crop at Sk was of better quality irrespective of the crop yield being lower than at Vh. The perennial sorghum cultivar evaluated did not perform well in the warmer area, which is of great concern; given that, Sk has a high human and cattle population that is dependent on climate smart crops.

PARALLEL B: WORKSHOP ON RANGELAND STEWARDSHIP IN COMMUNAL LANDSCAPES: INNOVATIVE MODELS FOR POLICY AND PLANNING

SESSION CHAIR: MAHLODI TAU

Tuesday 24 July 2018, 10:30 - 12:35

Venue: ARC Training Centre Parallel Room, Roodeplaat

Rural livelihoods are an important component of the National Development Plan (NDP) Vision 2030. In supporting this vision, sustainable growth in the agricultural sector is identified as key to realising food security and improving rural livelihoods outlined in the NDP. However, achieving food security and improving rural livelihoods without compromising natural resources or vital ecosystem services remains a challenge in South Africa. This is a reality as the bulk of valuable ecological infrastructure and biodiversity assets are located in both the commercial agricultural production landscapes and the communal farming landscapes and the sector both depends on, and impacts, the supporting ecological systems. Communities residing in many of the rural areas across South Africa face livelihood challenges through lack of economic opportunity. Almost 50% of the national large livestock herd is also found in these communal tenure areas, but only 5% make it to the formal domestic beef market, indicating an enterprise opportunity. Many of these areas overlap Strategic Water Source Areas, which cover 10% of the land surface and generate over 50% of the nation's water supply. A participatory partnership between the communities and development practitioners in the upper north eastern uMzimvubu catchment near Matatiele led to the development of an innovative model for rangeland stewardship in communal farming landscapes, to address rural livelihoods and deterioration of ecological infrastructure, in communal rangelands. At the core of this emerging innovative model is the emphasis on meeting livelihood needs through good rangeland stewardship and cash returns. This also results in improved landscape resilience, rebuilding good governance and a better food and household security from the healthy ecological infrastructure. However a challenge remains for the upscale and uptake of the work within relevant national plans and policies related to rangeland stewardship in communal landscapes.

10:30 - 10:35	**Welcome and introductions**	*Mahlodi Tau (SANBI)*
10:35 - 10:45	**Sustainable land management**	*Lehman Lindeque*
10:45 - 11:00	**Meat naturally**	*Nicky McLeod (Environmental & Rural Solutions)*
11:00 - 11:05	**Comments from DAFF**	*Kedibone Chueu (DAFF - Animal Production)*

Facilitated Discussion

11:25	**Cynics and believers?**

This exercise will ask everyone in the room to pair up and one person will take on the role of a cynic (non believer) and one person will take on the role of a believer in relation to the concept presented by Nicky. They will be given 5 minutes to try and convince each other of the merits/pitfalls of the concept. We will ask them to capture their key inputs on cards. In plenary we will then get feedback on what the pro's and cons of the model are. The point of this exercise is to address the cynics in the room up front rather than letting them become disruptive during the session. It also gives everyone an opportunity to reflect on what is good about the model and what the potential pitfalls could be.

11:45 - 12:05	**Vision for communal rangelands in South Africa**

In small groups participants will be asked to write out their vision and some accompanying values for communal rangelands in South Africa. These visions will be captured on flip charts and we will do a ranking exercise to identify which vision speaks to the most people.

12:05 - 12:25	**What can't we do alone?**

Using a World Café facilitation approach, in small groups participants will be asked to identify what they can't do alone in relation to restoring communal rangelands. Groups will be given a chance to circulate to other groups. This is an opportunity to identify natural points of collaboration from stakeholders in the room.

12:25 - 12:45	**Way forward?**

Using a combination of individual commitments on cards (under themes emerging from "what can't we do alone" and plenary), we will map out a few key next steps.

CLIMATE CHANGE

SESSION CHAIR: FLORENCE NHERERA-CHOKUDA

TUESDAY 24 JULY 2018, 13:35 - 15:20

Venue: ARC Training Centre Main Room, Roodeplaat

KEYNOTE ADDRESS: SUSTAINABLE LIVESTOCK PRODUCTION IN THE ERA OF CLIMATE CHANGE THROUGH TARGETED INTERVENTIONS

Michiel Scholtz[1]*, Motshabi Mokolobate[1], Anette Theunissen[2], Mokgadi Seshoka[2], Georgette Pyoos[1] and Frikkie Neser[3]

[1]Agricultural Research Council - Animal Production Institute, [2]Northern Cape Department of Agricultural, Land Reform and Rural Development, [3]University of the Free State, email: gscholtz@arc.agric.za

The impact of global warming and continued uncontrolled release of greenhouse gases (GHG) has twofold implications for the livestock industry, and consequently food security. Firstly, the continuous increase in ambient temperature is predicted to have a direct effect on the animal, as well as indirect effects associated with feed sources, ecosystem changes and diseases. Secondly, the responsibility of livestock production is to limit the release of GHG or the carbon footprint, in order to ensure future sustainability. This presentation reviews the following targeted interventions: (1) The use of indigenous and adapted genotypes can be beneficial in the era of climate change. Matching of genotypes to production environment assumes that there are genotypes that could be matched more easily with the production environment. In this regard awareness of indigenous livestock is important; (2) Early warning systems should be developed. Projections of future changes in heat stress under climate change, as well as medium-range and seasonal prediction models for heat stress in cattle as an early warning system for farmers is important; (3) Alternative breeding objectives and biotechnology based breeding programs that will optimize climate smart beef production should be developed. An effective way to reduce the carbon and water footprint from livestock is to reduce the livestock numbers and increase the production per animal, thereby improving their productivity. In case of the Afrikaner breed, cow efficiency improved by 18% over a period of 33 years, which reduced the carbon footprint by 12%. A breeding objective that aims to improve the kg calf weaned per Large-Stock Unit (LSU) mated is thus being developed; (4) Alternative production systems (e.g. crossbreeding) to improve the production efficiency of beef cattle should be characterized. This can play a significant role in reducing the carbon footprint from beef production. Evidence will be presented that the kg calf weaned per LSU mated can be improved by almost 50% through structured crossbreeding, whereas 27% less feed is consumed between weaning and harvest; (5) Quantification of the effect of weather patterns on fertility and growth of beef cattle in warmer parts of the country is essential. It will be demonstrated that the severe drought and extreme heat of the 2015/2016 summer had a negative effect on the performance and fertility of continental sired genotypes; and (6) The impact of changes in livestock feed -grain availability and price is important. How long will we still have the luxury to feed grains to animals instead of people? No single organization can perform on its own. The combination of sources of excellence to conduct research and development in climate smart livestock production is therefore essential.

PLATFORM PRESENTATION: HIGH CONCENTRATE FEEDING LEVEL REDUCES ENTERIC METHANE EMISSIONS OF GRAZING DAIRY COWS

Josef Van Wyngaard[1]*, Robin Meeske[2] and Lourens Erasmus[3]

[1]Voermol, [2]Western Cape Department of Agriculture, [3]University of Pretoria, email: jdvvanwyngaard@gmail.com

Recently, increasing evidence for global warming has amplified the need to validate on-farm greenhouse gas (GHG) mitigation strategies. Ruminants have been identified as the single most important source of anthropogenic methane (CH_4) emissions, of which CH_4 is a potent GHG. Several CH_4 mitigation strategies have been proposed, but most lack the practicality to be adopted on farm level. Concentrate supplementation has been identified as a CH_4 mitigation strategy that is most likely to be adopted on farm level. The aim of this research was to determine the extent to which concentrate supplementation can reduce enteric CH_4 from dairy cows grazing pasture during late summer and early spring. Thirty-six multiparous Jersey cows were subjected to a complete randomised block design and allocated to one of three treatment groups. The treatments differed by means of concentrate feeding level: 0, 4

and 8 kg/d (as fed basis). A 14 d dietary adaptation period was implemented. Cows grazed perennial ryegrass (*Lolium perenne*) dominant pasture during early spring, and kikuyu *(Pennisetum clandestinum)* dominant pasture during late summer. Individual CH_4 emissions were measured using the sulphur hexafluoride tracer gas technique and pasture intake was estimated using TiO_2 as external marker and indigestible neutral detergent fibre as an internal marker. Pasture measurements and milk production parameters were also recorded. Milk yield, energy-corrected milk (ECM) yield, total dry matter intake (DMI) and milk lactose content increased linearly ($p < 0.05$), while pasture intake decreased linearly ($p < 0.05$) with increasing concentrate feeding level, irrespective of season. Methane production (mean of 294 g d^{-1}) and CH_4 yield (mean of 19.0 g kg^{-1} of DMI) were unaffected ($p > 0.05$) by treatment on ryegrass dominant pasture, but increased linearly ($p < 0.05$; 323 to 378 g d^{-1}) and decreased linearly ($p < 0.05$; 29.1 to 25.1 g kg^{-1} of DMI), respectively, with increasing concentrate feeding level on kikuyu-dominant pasture. Furthermore, CH_4 intensity (20.4 to 15.9 g of CH_4 kg^{-1} of milk yield) decreased linearly ($p < 0.05$) with increasing concentrate feeding level on ryegrass-dominant pasture, but decreased ($p < 0.05$; 35.5 to 21.1 g kg^{-1} of milk yield) even more on kikuyu-dominant pasture. Methane mitigation efficacy (40% vs 20%) of concentrate supplementation was more prominent on kikuyu-dominant pasture than ryegrass-dominant pasture. Kikuyu has an inherently higher fibre content than ryegrass, and the fermentation of fibre increases CH_4 emissions, hence providing more opportunity to reduce CH_4 emissions in kikuyu-dominant pasture systems.

PLATFORM PRESENTATION: CLIMATE SMART LIVESTOCK MANAGEMENT AND FEEDING OPTIONS FOR SMALL-SCALE FARMERS: A REVIEW

Unathi Gulwa*, Gideon Jordaan and Tanki Thubela

Eastern Cape Department of Rural Development and Agrarian Reform, email: ugulwa@yahoo.com

Climate change is a subject of global environmental concern. The increased production of greenhouse gas (GHG) emissions, particularly carbon dioxide, methane and nitrous oxide, is considered as an important cause of climate change. Although there is no single definition for climate change, it can be defined as the change that can be attributed directly or indirectly to human activity that alters the composition of the atmosphere and which is in addition to natural climate variability observed over comparable periods. Agriculture is immensely affected by climate change but it also contributes to climate change in various ways. The livestock sector is viewed as one of the major contributors to climate change mainly due to enteric fermentation emissions followed by, manure fermentation emissions (waste products) and emissions released from the production of feed and forage. Small scale farmers are the worst affected by changes in climate since they rely heavily on the natural resource base for their livelihoods. Therefore, there is a need to explore alternative options for the resource-deprived farmers. One such intervention is climate smart agriculture (CSA). This is agriculture that sustainably increases productivity, resilience (adaptation), mitigation efficacy of GHG emissions and enhances attainment of food security and development goals, while protecting the environment against degradation. Various climate smart options are recommended for sustainable livestock production. These include feed related interventions, livestock production management, environmental management and socio-political and financial interventions. This review will focus on feed related interventions and livestock production management (adaptation) options for reducing GHG emissions, increasing forage quantity and quality, and increasing livestock productivity.

PLATFORM PRESENTATION: THE PROVISION OF SHADE ALLEVIATES HEAT STRESS OF NEONATAL LAMBS BUT DOES NOT BENEFIT GROWTH OR SURVIVAL

Anieka Muller[1]*, Schalk Cloete[1,2], TS Brand[1,2], DA Van Der Merwe[1,2] and Annalie Kruger[2]

[1]Stellenbosch University, [2]Western Cape Department of Agriculture, email: aniekam@elsenburg.com

There is general consensus that the Western Cape is likely to become hotter and drier under the influence of climate change. Sheep are commonly reared in open extensive areas, devoid of shade cover, to maximize the grazing area. This predisposes sheep to direct solar radiation and excessive heat, which may compromise animal welfare. This study investigated the effect of availing shade offered by trees to neonatal lambs on common heat stress indicators (rectal temperature and respiration rate) as well as early lamb growth and survival. Groups consisting of 8-10 pregnant ewes of both the South African Mutton Merino (SAMM) and Dormer breeds were randomly allocated to 10 kikuyu (*Pennisetum clandestinum*) paddocks with natural shade from trees and nine comparable paddocks without shade. Heat stress indicators were recorded from noon on the day following the birth of individual lambs (i.e. within 24 h of birth, presumably at the time daily temperatures peaked), while the lambs were identified with their dams and

recorded for birth weight and birth status. Daily climate statistics were obtained from a nearby weather station. Linear models, including treatment (shade vs. no shade), breed (Dormer vs. SAMM), sex (ram vs. ewe), dam age (2-5 years) and birth status (single vs. multiple) were fitted as fixed effects. Climate data were included as regression variables and interacted with shade treatment and breed. There was an interaction ($p < 0.05$) between maximum daily temperature and shade treatments (access to shade or no access to shade) for both rectal temperature and respiration rate. The rectal temperature and respiration rate of lambs in shaded paddocks generally did not increase on days with an increased ambient temperature relative to cooler days. In contrast, the rectal temperature and respiration rates of lambs increased substantially in unshaded paddocks on hot days. Tailing weight and lamb survival to tailing were not influenced by providing shade when compared with the unshaded paddocks. Maximum temperature thus had the greatest ($p < 0.05$) impact on lambs without shade when exceeding 30 °C, as they were unable to maintain rectal temperatures and respiration rates at basal rates. In contrast, lambs in shaded paddocks could maintain their respiration rate and rectal temperatures at basal levels, even on hot days. In conclusion, lambs in unshaded paddocks were still able to accommodate the periods of excessive heat they were exposed to, by returning to their basal metabolic rate during the cooler nights and on cool days, since the provision of shade did not affect their production. However, the provision of shade had clear short-term animal welfare benefits by alleviating immediate heat stress resulting from high ambient temperatures on hot days.

ADVANCES IN METHODOLOGY

PLATFORM PRESENTATION: MEASURING CARBON AND WATER FLUXES IN THE ALBANY THICKET, EASTERN CAPE

Anthony Palmer[1]*, Onalenna Gwate[2] and Sukhmani Mantel[2]

[1]Agricultural Research Council - Animal Production Institute, [2]Rhodes University, email: palmert@arc.agric.za

The Albany Thicket (AT) has been over-grazed during recent times, with resultant transformation of large areas. Restoration is linked to its ability to store carbon (C) efficiently. To determine whether AT is a viable sink for atmospheric C, we established an eddy covariance system on the Ezulu Game Reserve. A Campbell Scientific eddy covariance system, comprising a CSAT sonic anemometer and an IRGASON infra-red gas analyzer were installed in October 2015. Associated instruments provide 30 min values for radiation, soil heat flux, soil moisture and soil temperature. An automatic weather station provided radiation, temperature, relative humidity and rainfall data. The system provided instantaneous fluxes for C and H_2O, which were corrected for site-specific parameters using EddyPro. The site has been free of domestic livestock for >30 years, and there are small populations of wild herbivores. There is visual evidence of the recovery of *Portulacaria afra*, where the mean clump height >1m, and clump density >2000 clumps ha^{-1}. The daily CO_2 fluxes of the site are comparable to those being experienced by other semi-arid regions in southern Africa, with maximum midday rates of 25-30 umols m^{-2} s^{-1}. These rates are sustained during a long growing season from October to May. Night-time respiration rates are low and subject to high reporting error due to low wind conditions at night. Appropriate gap-filling algorithms were used to generate these night-time respiration values. Results for two years of continuous recording indicate that the AT has been a net C sink, accumulating 0,52 (in 2016-17) and 0,59 (in 2015-2016) g C m^{-2} day^{-1}. Based on current daily accumulation, the annual C gain for this site will be 0.54-0.62 kg C m^{-2} year-1 (i.e. 5.4 - 6.2 tons C ha^{-1} year^{-1}). This still needs to be partitioned between above- and below-ground biomass using the ratio appropriate for this vegetation type. These results are compared with the MODIS net primary production product PsnNet(MOD17A2). MODIS PsnNet predicted 0,52 kg C m^{-2} year^{-1} in 2016-2017. The MODIS PsnNet data for 2015-16 had several periods of missing data due to satellite malfunction, but using gap-filling, we estimate that during 2015-2016, 0.69 kg C m^{-2} year^{-1}. The data provided in this summary reflect two relatively dry years (October 2015 - October 2017), when 238 mm and 252mm of rain were measured per 365 day period. Evapotranspiration (ET) was higher than precipitation in both years, being 278 mm and 324 mm respectively. The higher ET for the site is most likely attributable to a link between larger trees using groundwater, but this needs to be confirmed using isotope analysis. These results represent the first data-rich approximation of the sequestration rates in the AT using eddy covariance, and are the first conclusive evidence of the long-term sequestration ability of the AT. Our results concur largely with the findings of Mills and Cowling (0.42 kg C m^{-2} year^{-1} for healthy intact thicket at Krompoort), and the predictions of the MODIS 17A product.

PLATFORM PRESENTATION: MULTI-SPECTRAL, HIGH RESOLUTION REMOTE SENSING IMAGERY IN AGRICULTURAL MANAGEMENT AND -SCIENCES

Christiaan Harmse*, Annette Swanepoel and Hannes Gerber

Northern Cape Department of Agriculture, Land Reform and Rural Development, email: cjj.harmse@gmail.com

Considering the nature and scale of agriculture in general, remote sensing techniques offer the ideal tool for monitoring management inputs and response over time. As a result, current advancements in data collection and monitoring are frequently based on combining *in situ* measurements, airborne sensors and satellite observations. Simultaneously, remote sensing technologies are evolving at a rapid rate and together with increased number of earth observing satellites, high resolution remotely sensed imagery are more accessible than ever. Remotely sensed data are used to describe both small and large-scale processes, but each system has its unique spatiotemporal constraints. Ground based assessments are time consuming, labour intensive and very expensive. The main impediment to using remotely sensed data from satellites are the unavailability of cloud free, high spatial (0.3 m or better) and spectral resolution (multiple narrow bands) data. In recent times, the affordability and accessibility of

Remotely Piloted Aircrafts (RPA's) opened up new opportunities as transporters of remote sensing equipment. Currently, RPA-mounted sensors are in common use for bridging the gap between ground-based surveys and satellite-derived data. As a result, RPA's are commonly used to monitor an array of agricultural applications including; vegetation cover, plant health, crop condition, nutrient status, yield, productivity and many more. While most RPA's provide an accurate, geo-referenced platform which allows for instant results at regular intervals, it has its limitations with regard to flight time, adverse weather conditions and often it's sensing capacity. In order to correctly interpret the imagery derived in this manner, it is important to take cognisance of the capacity or capability of the particular sensor in use, as well as the reflection pattern which is derived from light that was absorbed and reflected from the electro-magnetic spectrum (EMS). The reflectance of vegetation differs throughout the EMS and is generally found to be very low in the blue and red regions of the EMS, slightly higher in the green region and high in the near infra-red region. This information can be used to determine stress levels in plants linked nitrogen status and correlated with chlorophyll concentration. This case study provides a first-hand account on the application of high resolution remote sensing imagery and illustrating the potential for this approach in Agricultural Management.

PLATFORM PRESENTATION: PREDICTING POTENTIAL LIVESTOCK DISTRIBUTION PATTERNS IN THE COMMUNAL RANGELANDS OF CALA, EASTERN CAPE, SOUTH AFRICA: A GIS APPROACH

Qawekazi Mkabile[1]*, Anthony Palmer[2], Sukhmani Mantel[1] and Carolyn Palmer[1]

[1]Institute for Water Research, Rhodes University, [2]Agricultural Research Council - Animal Production Institute,
email: qmkabile@gmail.com

Rangelands in communal lands, particularly in the former *Transkei* in the Eastern Cape, have been utilized for crop production and livestock farming for many years. Even though livestock farming has been practised for a long time, there have not been many studies addressing the distribution patterns of livestock in these rural areas. Geographic Information Systems (GIS) and remote sensing are tools that have been used to map land use and to monitor animal movement. In the South African context, the use of GIS combined with Global Positioning Systems (GPS) in domestic livestock needs to be given more attention. In this study we develop a predictive spatial model for domestic livestock using the ArcGIS Predictive Analysis Tool. We used a combination of a GPS collar dataset from tracked livestock during the dry and wet season and landscape variables that are expected to influence livestock distribution to predict potential distribution across the landscape. The selected landscape variables were (1) altitude (height above sea level), (2) slope (steepness) and (3) aspect (solar radiation intercepted by that surface), which were all generated from a Digital Elevation Model (DEM), (4) Normalized Difference Vegetation Index (NDVI) which is used to represent the presence of vegetation and lastly, (5) water sources. We addressed three research questions: (1) Where do livestock spend time? (2) Can we predict potential livestock distribution in other areas? (3) What management strategies can be implemented to overcome the under- and overutilization of resources available? The study was conducted in a village near Cala, Eastern Cape. Preliminary results show that core livestock distribution is located on grazing resources near homesteads and water sources, suggesting that these areas on the landscape are important in prediction models. The results also demonstrate that without adequate fencing and livestock management, livestock may over-utilize local grazing resources. With the decline in the use of herders within these communities, livestock are concentrated around human settlements. The research will benefit the local community members by emphasising the need for strategic herding and labour through the identification of areas that are potentially underused and overused. The research could also provide baseline information needed for rangeland strategies such as rotational grazing.

PARALLEL A: RANGELAND ECOLOGY AND MANAGEMENT

SESSION CHAIR: LESLIE BROWN

Wednesday 25 July 2018, 08:30 - 10:15

Venue: ARC Training Centre Main Room, Roodeplaat

KEYNOTE ADDRESS: KAROO TRAJECTORIES OF CHANGE IN THE ANTHROPOCENE

Joh R. Henschel[1]*, Cherryl Walker[2] and Timm Hoffman[3]

[1]South African Environmental Observation Network (SAEON), [2]Stellenbosch University, [3]University of Cape Town,
email: henschel@saeon.ac.za

The Karoo is often regarded as South Africa's best-kept secret, an arid remote Outback to be left untouched by new developments lest it loses its special character. Covering a good third of South Africa, the Succulent- and Nama-Karoo, however, now face many changes from internal and external factors. It is time to take stock of current knowledge and challenges concerning the Karoo's ecological and social dimensions. Accordingly, the GSSA has planned to publish a Karoo Special Issue in the African Journal of Range and Forage Science. This Issue boasts an impressive array of information. An overarching lead article is followed by six sections, each with several articles, concerning the following themes: Climate in the Anthropocene, Gharo across History, Long-term Trends and Processes, Dynamics of Current Developments, Farming Impacts, Ecosystem Processes and Rehabilitation, and ends with a Synthesis. Ironically, Karoo ecology has received more scientific attention than its people, and the Karoo Special Issue therefore sets out to merge different disciplines, if not in individual papers bar the transdisciplinary Lead Article, then at least by the arrangement of different articles. The Karoo Special Issue will be published by the end of 2018.

PLATFORM PRESENTATION: UNDERSTANDING THE RESILIENCE OF THE KAROO SHRUB, *NENAX MICROPHYLLA*, TO WATER AVAILABILITY AND DEFOLIATION

Paul Malan and Hennie Snyman

University of the Free State, email: snymanha@ufs.ac.za

In general Karoo vegetation is known for its resilience. This so-called resilience was up to date not yet quantified. During the past decade, annual rainfall in South Africa varied a lot, with a downward trend in certain areas. The question was therefore asked, how are individual Karoo shrub species reacting to variable water availability while also exposed to different frequencies and intensities of defoliation? A greenhouse trial was conducted where *Nenax microphylla*, a widely distributed Karoo shrub, was exposed to 36 water and defoliation treatment combinations over a period of 12 months. These treatments included a water deficit gradient of four water treatments, three defoliation intensities and three defoliation frequencies. Amongst other measurements, above- and belowground phytomass production, as well as water-use efficiency (WUE) were determined. A lot of data were obtained, which are summarized in this presentation to highlight the most valuable research findings. Water availability proved to be the single most important factor influencing both above- and belowground productivity and accounted for most of the variation in phytomass production data, much more so than the defoliation treatments. Increased water availability resulted in exponentially higher productivity, which could be ascribed to the expression of a compensatory growth ability by *N. microphylla*. An increased water deficit resulted in increased root:shoot ratios. This is one of the few studies known where root:shoot ratios for specific shrubs was calculated. Although water deficit decreased root growth, the decrease was less than that observed for the aboveground phytomass production. Defoliation intensity had the lowest impact on productivity, while the impact of defoliation frequency was markedly higher on both above- and below-ground phytomass production. Although defoliation intensity accounted for the least variation in data, it might, however, still impact on the physiological functioning of the plant. Infrequent defoliation resulted in shrubs being less sensitive to defoliation intensity. Water use tended to be uneconomical when water is abundantly available, resulting in a low WUE. As soil water becomes limited, the plants were expressing awareness to the water deficit by increasing their WUE for improved survival rather than improved phytomass production. Inclusion of belowground phytomass production in WUE calculations increased the WUE by 30%. *Nenax microphylla* showed

increased WUE under increased defoliation stress, regardless of the watering treatment. This indicates how the plant defends itself, by increased WUE, against the factor that is causing the most harm to its survival at a given time. It was clear that water had the greatest impact on phytomass production of *N. microphylla*. Unfortunately, land users do not have control over the rainfall, and therefore the water available to Karoo shrubs. On the contrary, two of the most manageable variables that influence plant response to grazing are frequency and intensity of grazing, which the land manager has full control over. Rainfall interacts strongly with the impact of defoliation and it is therefore more detrimental to graze Karoo shrubs when soil-water conditions are unfavourable.

PLATFORM PRESENTATION: LONG-TERM INTERACTIONS OF GRAZING AND RAINFALL ON VEGETATION COMPOSITION AT GROOTFONTEIN IN THE EASTERN KAROO

Justin Du Toit[1]* and Tim O'Connor[2]

[1]Department of Agriculture, Forestry and Fisheries - Grootfontein ADI, [2]South African Environmental Observation Network (SAEON), email: justindutoit@gmail.com

Rainfall and grazing are primary drivers of vegetation composition in the Nama-Karoo. Increased rainfall is directly related to the abundance of perennial grasses, to where Nama-Karoo transitions to grassland. Severe grazing treatments, (e.g. continuous or summer-only), generally result in an increase in grazing-tolerant dwarf shrubs and annual grasses, and a decrease in perennial grasses. Grootfontein lies in the ecotone between the Nama-Karoo and the grassland biomes, and is home to grazing trials that were stocked from 1934 to 2009, and from 1941 to 1985. The area has experienced higher than average rainfall in recent decades. Plant basal cover data collected in the 1960's and 2010's on the two trials allow several hypotheses to be tested: 1) Historical severe grazing (until 1985) limits subsequent grassiness (Grazing Legacy Effect); 2) Severe grazing precludes increases in grassiness, independent of rainfall (Herbivore Trap Effect); and 3) Historically leniently-grazed sites will transition to grassland with increased rainfall (Biome Shift Effect). Results show that rainfall was lower in the ten years before surveys in the 1960's (350 mm) than before the 2010's (490 mm). The Grazing Legacy hypothesis was supported, in that historically severely-grazed sites differed compositionally from historically leniently-grazed sites, despite all sites becoming much grassier. The Grazing Trap hypothesis was not supported, because previously and currently severely-grazed treatments shifted similarly to a grass-dominated stage. The Biome Shift hypothesis was partly supported in that a shift to grassland did occur, but not always, and severity of grazing appeared to have no influence. Results suggest that increasing rainfall has prompted a shift to much increased grassiness and decreased abundance of dwarf shrubs, and that grazing had a smaller secondary effect. This implies that established veld management principles may not apply to the same degree, and that the effects of rainfall, and drought in particular, will be different from what they were in the past.

PLATFORM PRESENTATION: THE EFFECT OF HUMAN IMPACT ON HABITAT USE OF SELECTED LARGE HERBIVORE SPECIES IN THE EASTERN KALAHARI, SOUTH AFRICA

Hanno Kilian

Khamab Kalahari Reserve, email: ecologist@khamab.co.za

Habitat heterogeneity is a key driver of herbivore spatial distribution in natural ecosystems. In managed environments the occurrence of herbivore species may be affected by vegetation cover, availability of surface water, as well as human disturbance factors. Understanding the way that animals use available habitat is essential in understanding the ecology of the landscape, therefore essential for sustainable wildlife conservation planning and management. Large areas of the vegetation on Khamab Kalahari Reserve are heavily impacted by human actions before the establishment of the reserve. Broad-scale applications of arboricides (Molopo) transformed large areas of the vegetation layer from closed woodland to open woodland. This study is the first part of a broader study which aims to determine the impact of bush encroachment on the ecosystem and focusses on the way that large herbivores utilise the different habitat types of the reserve. This will provide insight into future impacts of bush encroachment on herbivore populations, and whether management actions like bush clearing can provide suitable habitat to the herbivore populations. Between the years 2014 to 2017, 25 monthly road strip counts were conducted on a predetermined route to establish the distribution of herbivores. Their distribution was plotted on a habitat type map of the reserve. To determine habitat type selection, it was necessary to determine a habitat visibility factor (fh) for each herbivore species. This gave an estimation of the visibility of each herbivores species in the various habitat types. A species visibility area (sv) was also calculated for each herbivores species, which is effectively the surface

area of each habitat type along the survey route in which each herbivore species was still visible. The results were analysed using chi-square analysis which calculated the habitat type selection of the selected herbivore species. The results of the analysis indicated distinct differences in the way that different species utilised the different habitat types. Old cattle posts and open woodland on depressions were the most favoured habitat type on the reserve, while dense and closed woodlands on sandy soils were the most disfavoured habitat types. The results also indicated that blue wildebeest, springbok and zebra were the most selective species, while warthog, giraffe and white rhino were least selective about which habitat types they preferred. The avoidance of closed and dense woodland habitat types by most species suggests that expected increases of woody vegetation in the future will have a negative impact on the populations of species like blue wildebeest and springbok. The general avoidance of habitat types on sandy soils further suggests that nutrients likely also play a role, which warrants further investigation. We can conclude that management actions on the reserve should focus on maintaining suitable open habitat if the long-term perseverance of herbivore species is important. Management actions that focus on preventing bush encroachment will be critical for the productivity of the herbivore populations on the reserve.

PARALLEL B: PLANTED PASTURE

SESSION CHAIR: YVETTE BRITS

Wednesday 25 July 2018, 08:35 - 10:15

Venue: ARC Training Parallel Room, Roodeplaat

PLATFORM PRESENTATION: IMPORTANCE OF THE SOUTHERN AFRICAN MEMBERS OF TRIBE PHASEOLEAE (*LEGUMINOSAE*) IN PASTURE DEVELOPMENT

Letty Masemola[1], Marike Trytsman[1], Francuois Müller[1] and Braam Van Wyk[2]*

[1]Agricultural Research Council - Animal Production Institute, [2]University of Pretoria, email: mullerf@arc.agric.za

Phaseoleae is the largest tribe in the *Leguminosae* family, indigenous to southern Africa. It contains 22 genera, namely *Alistilus*, *Bolusafra*, *Canavalia*, *Decorsea*, *Dipogon*, *Dolichos*, *Dumasia*, *Eriosema*, *Erythrina*, *Flemingia*, *Galactia*, *Lablab, Macrotyloma, Mucuna, Neonotonia, Neorautanenia, Ophrestia, Otoptera, Rhynchosia, Sphenostylis, Teramnus* and *Vigna*. Many species within these genera are known for their high forage value. These species include, but are not limited to *Lablab purpureus*, *Neonotonia wightii* and *Vigna unguiculata*. Therefore, the Phaseoleae tribe may hold potential in developing more new forage species. To describe the 180 species within this tribe in terms of their adaptation or range of tolerance to rainfall, mean annual rainfall and mean annual minimum and maximum temperature, soil pH and phosphorus levels, a discriminant analysis was performed to determine which predictor contributed mostly to species distribution as recorded by PRECIS (2008). *Eriosema* and *Rhynchosia* contains large species numbers (46 and 59 respectively) and were analysed separately from the other 75 remaining species. The section of the data for *Eriosema*, *Rhynchosia* and *Vigna* spp. will be discussed. Mean annual rainfall, mean annual minimum temperatures and soil phosphorus (P) content were the main drivers for the distribution of *Eriosema* into three groups. Most species were grouped in Group 1, i.e. high annual rainfall, intermediate minimum temperature and soil P, indicating a limited distribution range. The main drivers for the separation of *Rhynchosia* species into four groups are mean annual rainfall, soil pH and mean annual minimum temperature. Many of the *Rhynchosia* spp. were recorded in all four groups, suggesting a high tolerance to these given independent variables. The remaining species, with *Vigna* the largest group (20 spp.), were driven by mean annual rainfall and soil pH. The majority of *Vigna* spp. were grouped in Group 3, recorded in high annual rainfall and intermediate soil pH regions. Results show that discriminant analyses can be used to group species in the tribe Phaseoleae in terms of measured variables to determine, firstly, their range of tolerance and secondly, to use this as a selection tool for further screenings to select indigenous legume species with desirable attributes.

PLATFORM PRESENTATION: COMMUNITY COMPOSITION AND DIVERSITY OF ENDOPHYTIC FUNGI ASSOCIATED WITH BRACHIARIA GRASS (*BRACHIARIA* SPP.) DURING THE DRY SEASON IN KENYA

Leah Gachao, Joyce Njuguna and Sita Ghimire,

International Livestock Research Institute (ILRI), email: L.Kago@cgiar.org

Endophytes are all micro-organisms that live inside host plants, partly or wholly, throughout their life cycle without causing any apparent harm or disease, but may form beneficial associations with the host. A study was conducted to understand endophytic fungal communities inhabiting the aerial and root tissues of local Brachiaria grass ecotypes grown in natural habitat after a four-month dry spell in early 2018 from a grazing field of the International Livestock Research Institute's Headquarters in Nairobi, Kenya. A total of 20 whole plant samples of Brachiaria grass were collected. Fungal endophytes were isolated from surface disinfected, asymptomatic leaf, leaf sheath, and root tissues of Brachiaria grass on Potato Dextrose Agar amended with an antibiotics cocktail. Fungal DNA was extracted using MagAttract 96 DNA plant core kit and fungi were identified to the lowest possible taxonomic unit using ITS rDNA sequence analysis. Our previous study on the fungal endophytes of local Brachiaria grass in the year with normal weather conditions isolated 354 fungi representing 84 different fungal taxa. The current study characterizes the fungal community of Brachiaria grass during the dry weather conditions, estimates species diversity and elucidates the potential role of these microbes in growth and development of Brachiaria grass, including the adaptation to drought and low fertility soils. Moreover, we will compare the results obtained from current and previous study that differ in terms of weather conditions.

PLATFORM PRESENTATION: THE EFFECT OF PLANTING DATE ON YIELD AND BOTANICAL COMPOSITION OF FORAGE HERB AND GRASS MIXTURES

Sigrun Ammann

Western Cape Department of Agriculture, email: sigruna@elsenburg.com

Forage chicory (*Cichorium intybus*) and Plantain (*Plantago lanceolata*), collectively known as forage herbs, have recently become regular components of mainly dairy pastures. On most farms the forage herbs are planted in a mixture with grasses and often clover species are added as a minor component. Trials were conducted at Outeniqua Research Farm on mixtures of forage herbs with grass, compared with pure stands planted in spring (5/10/2016) and autumn (15/3/2017) using a 4x4 balanced lattice design. Dry matter (DM) yield and botanical composition on a biomass basis, were determined. The spring-planted trial had a substantial weed component of 37% to 65% at the first harvest, dependent on the treatment. By January 2017 the weeds decreased to a mean of 28% for the herb treatments and 84% for the grass only treatments. The autumn-planted trial had a mean of 13% weeds at the first harvest, decreasing from there onwards. During the first summer the grass component was outcompeted by the forage herbs, while the forage herb pure stands had the highest yields ($p < 0.05$), with chicory yielding best with 8.0 t DM ha^{-1}. From autumn 2017 onwards, all treatments with plantain, pure and mixed, out yielded ($p < 0.05$) the chicory treatments and pure grass treatments, including the second summer. The chicory treatments were higher yielding ($p < 0.05$) than the grass treatments. For the grass/herb mixtures the herb component dominated with 71% to 97%, depending on the mixture. At 38.7 t DM ha^{-1}, plantain had the highest DM yield over the 17-month period. The highest chicory yield was 32.1 t DM ha^{-1} and was lower ($p < 0.05$) than the plantain. The pure grass treatments were lower ($p < 0.05$) than all other treatments with a mean of with 20.6 t DM ha^{-1}. In the autumn-planted trial the perennial ryegrass component dominated and out-yielded in both the pure stands and in a mixture with forage herbs until the end of winter. During spring the forage herb treatments were higher yielding ($p < 0.05$) than perennial ryegrass, while during summer the pure plantain treatments yielded a mean of 8.4 t DM ha^{-1}, which was higher than all other treatments. The same was true for the total DM yield, with plantain sown at 10 kg ha^{-1} producing 22.0 t DM ha^{-1} during a 12-month period and perennial ryegrass at 15.3 t DM ha^{-1}. In the autumn-planted mixtures the grass-component was smallest at the end of January with 5%. The pure stands of forage herbs yielded significantly better than the mixtures. In terms of pasture systems and how forage herbs can best be used, these results indicate that there could be merit in rather planting a pure forage herb sward and a grass pasture separately, where both are grazed alternatively during the same day to ensure sufficient fibre from the grass pasture to counter the low DM content and high carbohydrate content of the forage herbs.

PLATFORM PRESENTATION: A NEW NITROGEN FERTILISATION REGIME FOR MINIMUM-TILLAGE KIKUYU-RYEGRASS PASTURE IN THE SOUTHERN CAPE

Charné Viljoen[1,2]*, Janke Van Der Colf[1], Pieter Swanepoel[2],

[1]Western Cape Department of Agriculture, [2]Stellenbosch University, email: charnea@elsenburg.com

The sustainability of current nitrogen (N) fertilisation regimes for minimum-tillage kikuyu-ryegrass (*Pennisetum clandestinum*, *Lolium multiflorum*) pastures in the southern Cape are under scrutiny. The reason is that these guidelines were developed for conventional tillage and non-grazing systems. Thus, the aim was to determine effects of N fertilisation rates on soil and pasture characteristics. Nitrogen treatments were applied to a kikuyu-annual ryegrass trial site (four replicates, 225 m^2 plots) at the Outeniqua Research Farm for two years. Nitrogen fertiliser was applied after each grazing cycle (28 to 35 days) at five fixed rates namely 0, 20, 40, 60 and 80 kg N ha^{-1} (N_0, N_{20}, N_{40}, N_{60} and N_{80}). Prior to each grazing cycle by dairy cows, soil and pasture production characteristics were determined, while botanical composition was determined seasonally. Response of total mineral N in soil to N treatments varied ($p < 0.05$) between grazing cycles. Total mineral N in the 0–100 mm soil depth increased ($p < 0.05$) over time in high N treatments (N_{60} and N_{80}) compared to N_0, for which it remained relatively constant throughout the trial period. This was also evident for the 100–200 mm and 200–300 mm depths. These findings indicate a build-up of N in soil to a point beyond what can be utilised by pasture, and an increased risk of leaching when N is applied at ≥60 kg ha^{-1} grazing cycle^{-1}. Pasture production response to N fertilisation was similar ($p ≥ 0.05$) for all grazing cycles. Treatment N_{60} and N_{80} had, on average, a greater ($p < 0.05$) pasture production compared to the N_0 treatment; however, this was not the case during all seasons. Pasture production was most negatively affected ($p < 0.05$) during winter and autumn season. The ryegrass component was greatest ($p < 0.05$) during winter

and spring. All N-containing treatments had a greater (p <0.05) ryegrass component than the N_0 treatment. Season and treatment affected (p < 0.05) the pasture crude protein (CP) content, where high N treatments was greater (p < 0.05) relative to low N treatments. Results suggest that N fertilisation rates should be adjusted according to season. Furthermore, in order to prevent N losses through leaching, while maintaining a high pasture production and quality, it is advisable to apply no more than N_{40} after each grazing during winter and spring. Interestingly, applying N_{20} after each grazing during summer and autumn will result in a similar pasture production as when applying N_{80}. In addition N_{20} will ensure more acceptable pasture CP content for grazing dairy cows and induce a mineral N content in the soil that is less likely to result in N leaching. Lower N rates during summer might be due to the kikuyu component, which was greater (p < 0.05) during summer and autumn, regardless of the N application. This may indicate sufficient soil N for pasture growth and is supported by a volunteer legumes component that was present in low N treatments, particularly in spring and summer. This, together with a potential to mineralise N (15-70 kg ha^{-1} grazing cycle^{-1}) could have contributed to adequate N amounts for pasture growth during summer.

PLATFORM PRESENTATION: THE EFFECT OF DIFFERENT NITROGEN APPLICATION RATES ON THE DRY MATTER PRODUCTION AND BOTANICAL COMPOSITION OF KIKUYU OVER-SOWN WITH GRASS-LEGUME MIXTURES

Janke Van Der Colf

Western Cape Department of Agriculture, email: jankevdc@elsenburg.com

A limitation to the uptake of kikuyu-temperate grass-legume pastures in the southern Cape is the reported 60 % decline in total annual pasture dry matter (DM) yield compared with kikuyu-ryegrass pastures. Strategic nitrogen (N) fertilisation, based on applying nitrogen at lower rates or during specific times, could address this shortcoming. The aim of this study was to determine the effect of N application rates on the pasture production potential of irrigated kikuyu when over-sown with different grass/legume mixtures over a 3-year period. The four mixtures consisted of red clover (*Trifolium pratense*), white clover (*T. repens*) and one of four temperate grasses viz. Italian ryegrass (IC; *Lolium multiflorum*), perennial ryegrass (PC; *L. perenne*), Tall Fescue (FC; *Festuca arundinacea*) or cocksfoot (CC; *Dactylis glomerata*). The experiment was a randomised complete block design, with treatments randomly allocated within each block. Pastures were over-sown on an annual basis using a mulcher and Aitcheson seeder. Nitrogen was applied at 0, 20 and 40 kg of N ha^{-1} (N_0, N_{20}, N_{40}, respectively) after each grazing. Pasture yield (kg DM ha^{-1}) was determined every 28 to 35 days by cutting four 0.25 m^2 quadrats to a height of 50 mm per plot before grazing. The mixture over-sown did not affect total annual DM production at the respective fertilisation rates during the three years. The IC mixture was the only mixture where fertilisation rate had an impact on total annual DM production, with the yield of the N_0 treatment lower than N_{20} and N_{40} for year 1 only. Mean annual N efficiency (kg of DM kg^{-1} of N applied) was greater (p < 0.05) for N_{20} than N_{40} for all mixtures over the 3-year period. Agronomic nitrogen efficiency (kg of DM relative to N_0 kg^{-1} N applied) however, did not differ. With the exception the N_0 treatments and the N_{20} treatment of FC during Spring of year 2, clover content was below 30 % (recommended to obtain a benefit from legume content) for all seasons during the study. The only notable effect on sown grass content (%) was the greater (p < 0.05) ryegrass content of the N_{20} and N_{40} treatments than that of N_0 in the IC mixture during winter and spring. The sown grass content in FC was lower (p < 0.05) than for other mixtures, irrespective of N rate and season. This mixture also had a higher (p > 0.05) "weedy" volunteer grass content (*Bromus* spp. during winter and *Paspalum notatum* during summer and autumn) than other treatments, particularly during winter and spring. This component increased for all treatments from winter to autumn, being particularly high during summer and autumn (40 - 83%). With the exception of year 1, the kikuyu content in pastures remained below 15% from winter to summer for all treatments, and below 20% during autumn. These results indicate that previously kikuyu based pastures have been replaced by pastures dominated by volunteer or weedy grasses. This is likely to have confounded N treatment and mixture effects. To obtain the full benefit from temperate grasses and clover, these systems will have to undergo complete renovation/re-establishment to remove competition from volunteer and weedy grasses. Where over-sowing is the only option, IC is recommended.

POSTER SESSION

CLIMATE CHANGE

POSTER: ADAPTATION RANGES UNDER FUTURE BIOCLIMATIC CONDITIONS OF *INDIGOFERA* AND *LESSERTIA SPECIES* PRIORITISED FOR FURTHER EVALUATION AS FORAGE CROPS FOR WATER-LIMITED AGRO-ECOSYSTEMS

Francuois Müller[1]*, Marike Trytsman[1], Lincoln Raitt[2], Igshaan Samuels[1], Clement Cupido[1], Stephen Boatwright[2], and Samson Chimphango[3]

[1]Agricultural Research Council-Animal Production Institute, [2]University of the Western Cape, Department of Biodiversity and Conservation Biology, [3]University of Cape Town, email: mullerf@arc.agric.za

Currently there are only a limited number of introduced forage species suitable for dryland farming under water-limited agro-ecosystems. The projected climate change scenarios for South Africa (SA), however, indicate a general trend of becoming hotter and drier. Recently, a number of indigenous *Indigofera* and *Lessertia* species were prioritised for further evaluation as forage crops within these water-limited agro-ecosystems. It is important, however, to determine how future bioclimatic conditions could influence the distribution of these species. This in turn, will influence prioritisation of germplasm collections which, in turn, could influence the agronomic potential of these species. The DOMAIN model in DivaGIS was used to determine the climate adaptation, as well as the most limiting bioclimatic factors, limiting the distribution of the selected legume species, using the 19 bioclimatic variables of the Worldclim climate database version 1.4 at the resolution of 2.5 ARC minutes. The adaptation zones were overlaid onto the different general soil classes of SA, and clipped to contain only soils on which the legumes occur. The remaining areas were then calculated as the adaptation zones and changes in distribution of each legume species between current and future bioclimatic scenarios were determined. *I. heterotricha* and *I. meyeriana,* as well as all *Lessertia* species, showed an overall increase, while *I. alternans* and *I. nigromontana* showed an overall decrease in their total predicted adaptation ranges throughout SA. All species, however, displayed decreases or no changes in their highly adapted ranges from current to future bioclimatic conditions. Under the projected future bioclimatic conditions of SA, the distribution of *I. meyeriana*, *L. diffusa* and *L. excisa* were found to be limited primarily by precipitation variables. The distributions of all other *Indigofera* species as well as *L. pauciflora* and *L. frutescence* were found to be limited primarily by temperature variables, while the distributions of *L. depressa* and *L. inflata* are equally influenced by temperature and precipitation variables. Due to the variation in bioclimatic variables limiting the potential distributions and suitability of the different legume species, germplasm collections should include collections over a wide range of bioclimatic conditions in order to obtain a large variation of accessions, adapted to different agro-ecological conditions. These genetic resources will be the raw materials needed for breeding accessions and cultivars of *Indigofera* and *Lessertia* species suitable for specific agro-ecological conditions.

POSTER: BROWSE PLANTS AS A PROTEIN SOURCE DURING THE DRY SEASON IN THE EASTERN CAPE PROVINCE, SOUTH AFRICA

Siza Mthi[1]* and Jean Rust[2]

[1]Eastern Cape Department of Rural Development and Agrarian Reform, [2]Eastern Cape Department of Agriculture, email: siza.mthi@drdar.gov.za

Veld and crop residues are a main source of ruminant livestock feed in rural Africa. Veld grasses have a low forage quality during the winter season and do not meet the nutrient requirements for livestock year-round. Commercial feed is too costly and unpopular in resource poor livestock production system. Therefore the use of browse plants to supplement protein during the dry season to grazing livestock in small-scale farming systems is worthy of consideration. The study evaluated the crude protein (CP) content of browse plants as protein source for ruminants in the Eastern Cape. Nineteen browse plants (*Vachellia karoo, Calpurnia aurea, Oleaeuropaea subsp. Africana, Schotia latifolia, Grewia occidentalis, Rhus pyroides, Cordia rudis, Salanum mauritianum, Diospyros dichrophylla, Vepris lanceolata, Prunus persica, Ziziphus mucronata, Zanthaxylum capense, Mimusops obovata, Cussonia*

spicata and Diosporus lyciodis) were collected from Goso Administrative area under the Ngquza Hill Local Municipality in June 2014 and brought to Dohne Agricultural Development Institute. Leaf fractions were oven dried at 400 °C for 48 hours and later ground in a Willey mill to pass through a 1 mm sieve prior to chemical analysis to determine their respective protein contents. The CP was analysed using the procedures as outlined by the Association of Analytical Chemistry (AOAC, 2002). The CP content on dry matter basis of the leaf fraction ranged from 6 to 48 %. There was 21 % of the leaf fraction that had a CP content of < 7% (*Vachellia karoo, Grewia occidentalis, Mimusops obovata, Cordia rudis),* 73.7% of browse plants had CP within the range of 7.25 to 20 %, and 5.3 % had a CP content of above 20 %. These findings indicate that the leaf fraction is the most suitable part of the plant to use as protein source to address the low nutritive value of veld in winter. It is noteworthy that the leaf of *Salanum mauritianum* had the highest CP content at above 20 %. Further research is necessary to determine the tannin content, acceptability and digestibility of the browse plants and its protein. Effect of browse plants' leaves on animal performance as protein supplement warrants further study.

BUSH ENCROACHMENT

POSTER: RESPONSE OF SOIL AGGREGATE STABILITY ON DIFFERENT LEVELS OF BUSH ENCROACHMENT AT HONEYDALE FARM, ALICE IN EASTERN CAPE (PRELIMINARY RESULTS)

Tanki Thubela[1] and Solomon Tefera[2]*

[1]Eastern Cape Department of Rural Development and Agrarian Reform, [2]University of Fort Hare, email: thubelat@gmail.com

Bush encroachment is a form of land degradation that is noticeable globally, and predominantly in semi-arid areas. Bush encroachment in savannas can alter carbon (C) and nitrogen (N) levels over the long-term, which could have environmental implications. The impacts of bush encroachment on soil organic carbon (SOC), soil total nitrogen and soil aggregate stability were assessed at simulated different levels (12% 25%, 50%, 75% and 100%) of encroachment at Honeydale farm in Alice, Eastern Cape Province. Soil samples were collected at three depths (20-40 cm, 41-60 cm and 61-80 cm) in all treatments and were separated into two for chemical analysis and for aggregate stability, respectively. Samples for aggregate stability were air dried and passed through a 5-mm sieve. Visible organic materials and debris were discarded. Aggregate stability was measured according to Le Bissonnais (1996). Thereafter, three replicate soil samples were immersed in 50 mL deionized water and the material was gently transferred to a 50 μm sieve that immersed in ethanol to separate it into 50 μm fragments. The remaining >50 μm fraction was oven dried and sifted on a stack of sieves of 2000, 1000, 500, 250 and 50 μm pore size. The weight of each fraction was then measured, and soil fraction <50 μm was calculated and expressed as the mean weight diameter (MWD). The results indicated no consistency and less signs of soil aggregate instability, however treatments with less bush density had higher figures of mean weight diameter. Soils from all treatments had an acidic reaction at all sampled depths range. The exchangeable Ca^{2+}, which is said to promote aggregation, dominated the exchange complexes of the soils. Soil organic carbon (SOC) content was less than 2% in all samples and decreased with depth. The average SOC content for the soil at the site ranged from 0.32 to 1.17 % and it is suggested that when SOC is at 2% is considered to be in a critical level, below which soil structural stability will suffer a significant decline. Bush density had slight influence on soil aggregate stability.

POSTER: EVALUATING THE IMPACT OF BUSH ENCROACHMENT ON SOIL NUTRIENT CONTENT IN SHESHEGU COMMUNAL RANGELAND, ALICE, SOUTH AFRICA

Sive Tokozwayo[1], Keletso Mopipi[2] and Eric Timpong-Jones[3]*

[1]Eastern Cape Department of Rural Development and Agrarian Reform, [2]University of Fort Hare, [3]University of Ghana
email: furaluke@gmail.com

Soil nutrients play a vital role in tree-grass interactions within an ecosystem. Soil pH, macro and micro elements are determinants of vegetation productivity. Encroachment of woody plants in an ecosystem tends to outcompete grasses. Competition between of grasses and woody plants impact the soil and a deficiency of soil minerals, can lead to deficiency in the forages and subsequently of the livestock. The effect of bush encroachment on soil nutrient content is well documented, but there is limited data available that clarifies the impact of bush encroachment on soil properties such as soil pH, and macro and micro elements in communal grazing lands. The objective of the study was to assess the effects of bush encroachment on soil nutrient content at Sheshegu communal rangeland. The data was collected from four different bush densities: Scattered (15%), Moderate (30%), Mixed (45%) and Dense (60%)

with these densities replicated three times. A plot of 100 m x 50 m was demarcated in each replicate. Two soil samples per bush density were sampled randomly using soil auger to a depth of 30cm. A total of 12 soil samples were collected, oven dried for 48 hours at 60°c, and analysed for N, P, K, organic Carbon (OC), Cu, Fe, Mn, Zn and soil pH. Inductively Coupled Plasma (ICP) was used to determine the concentration of P, Mg, P, Zn, Mn, Fe and Cu using 1% of critic acid and 0.02M DI-ammonium Ethylene-diamine-tetra-acetic acid. The standard Kjeldahl method was used to determine N concentration. The Walkley-black technique was used to determine OC. Soil pH was determined in 1M potassium chloride 2.5 KCL: 1 soil. The Dense treatment (60%) indicated high nitrogen content compared to the Scattered (15%), Moderate (30%) and Mixed (45%) treatments, respectively. There was a low concentration of OC at the Mixed (45%) treatment, but the concentration of OC revealed no significant difference (p > 0.05) between the Scattered (15%), Moderate (30%) and Dense (60%) treatments. These findings showed that the concentration of P and Fe in the soil decreases with an increase in bush density. Soil pH indicated a positive relationship with increase in bush density. This implies that an increase in bush encroachment could have an impact on soil nutrient content, particularly, P, soil pH and OC. Proper veld management practices are recommended to mitigate bush encroachment, in order to improve rangeland condition in Sheshegu communal rangeland.

ADVANCES IN METHODOLOGY

POSTER: PERFORMANCE OF RATIO-BASED, SOIL-ADJUSTED AND ATMOSPHERIC-CORRECTED MULTISPECTRAL VEGETATION INDICES IN PREDICTING HERBACEOUS ABOVE GROUND BIOMASS IN A *COLOPHOSPERMUM MOPANE* TREE-SHRUB SAVANNA

Abubeker Hassen[1], Walter Svinurai[1]*, Eyob Tesfamariam[1] and Abel Ramoelo[2]

[1]University of Pretoria, [2]Council for Scientific and Industrial Research (CSIR), email: wsvinurai@gmail.com

Accurate and near-real time estimation of herbaceous aboveground biomass (AGB) at farm level is crucial for monitoring utilisation of pasture and proactive management of stock in semi-arid rangelands. Despite its importance, remote sensing has rarely been used by range ecologists and managers in Zimbabwe. This study aimed to assess the performance of classical multispectral vegetation indices (MVIs) when either singly regressed with measured herbaceous AGB or combined with other visible spectral bands in predicting herbaceous AGB in a *Colophospermum mopane* tree-shrub savanna. Field herbaceous AGB and corresponding Landsat 8 Operational Land Imager (OLI) visible spectral data were collected during the 2016-17 rainy season. Relationships between measured AGB and classical MVIs and extended models of MVIs combined with other visible spectral bands were analysed using bootstrapped simple and stepwise multiple linear regression functions. When MVIs were singly regressed with measured AGB, ratio-based indices yielded the highest r^2 value of 0.64 followed by soil-adjusted indices (r^2 = 0.61) whilst atmospheric-corrected MVIs showed the lowest r^2 of 0.58 (p = 0.00). A significant improvement in herbaceous AGB estimation was obtained by using a combination of classical MVIs and other visible spectral bands. Soil-adjusted MVIs showed the greatest increase (44 - 46%) in r^2 whilst atmospheric-corrected and ratio-based MVIs poorly improved (less than 5%). The findings demonstrate that combining MVIs with Landsat 8 optical spectral bands, especially green band provides the best models for estimating AGB in *C. mopane* savanna rangelands. These findings emphasise the importance of testing band-MVI combinations when developing models for estimating herbaceous AGB.

FEEDING ECOLOGY

POSTER: BITE SIZES OF GOATS IN RELATION TO CONDENSED TANNINS, THORNS AND OTHER PLANT CHARACTERISTICS

Ngoako Letsoalo[1]*, Ntuthuko Mkhize[1], Dorian Van Dalen[2], Ignas Heitkonig[2] and Fred De Boer[2]

[1]Agricultural Research Council - Animal Production Institute, [2]Resource Ecology Group, Wageningen University

email: letsoalonl@arc.agric.za

The optimal utilization of woody plants in savannas depends on a better understanding of plant-animal interactions. Morphological structures of plants (e.g. spines, thorns and prickles) are reported to act as plant defences against herbivory and have been shown to affect the foraging efficiency of mammalian herbivores. Moreover, condensed tannins (CTs) have proved to mediate forage intake and energy uptake by browsers, due to their digestibility reducing effects. In two short-term pen experiments (18 days and 6 days long), we investigated the effects of plant

morphological characteristics (i.e., thorn presence/absence, spine length, amount of leaves per branch) and leaf chemistry (i.e. nitrogen and CT content) on the bite sizes of indigenous goats. We hypothesised that bite size would be higher for spineless plants and will increase along with CT intake. We expected spine length to negatively affect bite size, and the amount of leaves to have a positive effect on bite sizes. Nitrogen content was predicted to increase bite sizes while CTs were expected to have an opposite relationship. For the first experiment, we orally dosed 9 goats with (i) 20 g of condensed tannins extract dissolved in 50 mL of water (high tannin exposure), another 9 goats (ii) with 20 g of polyethylene glycol dissolved in 50 mL of water, and the last group of 9 goats (iii) with 50 mL of water (control) before offering forage species. Goats were offered branches of *Vachellia nilotica, V. tortilis*, and *V. Karroo* and their foraging behaviour was recorded. These branches were cut into pieces of approximately 50 cm that all had more or less the same size and structure, and the exact weight was determined using a scale with a precision of 0.01 g. All goats were fed *ad libitum* Lucerne hay (*Medicago sativa*). The second experiment using the same goats involved removal of thorns from branches and comparing bite sizes between branches within species. Goats were conditioned for a week prior to the feeding trial to re-adapt to the diets. Feeding time, number of bites taken, and weight loss of the branches was measured, in order to calculate bite size and bite rate. Bite size [g bite^{-1}] of the goats was calculated. As predicted, CT contents of the plants and proportion of leaves per branch were found to positively affect bite size (Pearson: R > 0.6, N = 453, p < 0.001), and nitrogen content of the leaves and length of the spines were negatively correlated to bite size (Pearson: R < -0.2, N = 453, p < 0.001). The main conclusions were that (1) spine-absence is effective in reducing leaf loss to goats and, (2) supplemental treatment with CT did not affect bite size, which indicated that bite size was not affected by total CT intake in the short term. This study extends our understanding of browse-browser interactions, which represent important input to goat production and range forage species management.

POSTER: THE BEHAVIOUR AND DIET SELECTION OF EXTRALIMITAL GIRAFFE IN THE LITTLE KAROO, SOUTH AFRICA

Jamie Paulse[1]*, Vanessa Couldridge[1],Clement Cupido[2] and Francois Deacon[1]

[1]University of the Free State, [2]Agricultural Research Council-Animal Production Institute, email: jpaulse363@gmail.com

Due to their popularity for tourism, giraffes are being introduced outside their historical distributions into Thicket areas within the Little Karoo region of the Western Cape. However, information regarding the activity budgets and diet selection of these giraffes is lacking. Therefore, this study aimed to achieve three objectives; to determine the diurnal activity budget, diet composition and browsing levels, and the estimated browsing capacities of extralimital giraffe. The study was conducted on two privately owned farms, namely Kareesbos Private Game Reserve and Tsumkwe Private Game Reserves. Observations were completed on both study sites using the interval scan method, whereby observations were conducted on all visible individuals from 6 am – 6 pm for four days every 3 months (winter, spring, summer and autumn). Observations found browsing to be the most dominant activity displayed by both populations, with walking and rumination being the second and third most dominant activity. Females browsed more than males at both study sites. Dietary selection showed to be contrary to that found within their natural ranges where *Vachellia* and *Senegalia spp.* are prominent. Four species (*Pappea capensis*, *Portulacaria afra*, *Euclea undulata* and *Searsia longispina*) and five species (*Searsia longispina*, *Euclea undulata*, *Pappea capensis*, *Vachellia karroo* and *Grewia robusta*) comprised approximately 90% and 80% of the giraffes' diet in Kareesbos and Tsumkwe, respectively. The importance of flower bearing species (*Lycium spp.* and *Rhigozhum obovatum*) increased during the spring and summer seasons at both study sites. In addition to the diet selection, browsing by both giraffe populations was shown to occur mostly below 2 m. Estimated browsing capacities for Kareesbos and Tsumkwe were 25 and 21, and 107 and 88 ha per giraffe, respectively, for the respective browse height strata of less than two metres and five metres. It is suggested that browsing capacities of less than two metres be considered when stocking giraffe and the number of individuals adjusted accordingly on each farm, due to the continuous low browsing of giraffe at less than two metres. Furthermore, results indicate that these giraffes have adapted to take advantage of forage available in ecosystems outside their natural ranges. Low foraging heights suggests possible niche overlap with other browsers, which may result in increased competition for food when it becomes limited. Long term ecological monitoring of extralimital populations and appropriate management procedures are therefore required to avoid the displacement and degradation of indigenous fauna and flora within the Little Karoo.

SOCIO-ECOLOGICAL STUDIES

POSTER: THE KNOWLEDGE AND PERCEPTION OF SMALL HOLDING FARMERS CONCERNING FEEDING SWEET POTATO VINES TO GOATS

Cynthia Fikile Luthuli[1]*, Fabian Nde Fon[2] and Nokothula Winfred Kunene[2]

[1]KwaZulu-Natal Department of Agriculture and Rural Development, [2]University of Zululand, email : fikile.luthuli@kzndard.gov.za

Goats are raised in conditions which do not allow them to achieve their maximum performance, nor express their genetic potential. They are raised on poor quality feeds, with low energy and protein content. For goats to perform to their full potential as small ruminants, it requires highly nutritious feed, especially during high producing periods. However, supplementation can be done using fresh green feeds, protein blocks or vitamin supplements as well as traditional food crops residues. This study outlines the knowledge and perceptions of goat farmers concerning feeding sweet potato vines to goats. This study was conducted at KwaMthethwa community area, KwaMbonambi local Municipality, KwaZulu-Natal, which consist of seven wards. Surveys were administered through structured questionnaires and 15 households were interviewed per ward, making a sample size of 105 participants. Participants were randomly selected at their willingness to participate in an interview. Data was analysed using frequency procedure of SPSS 2015. Results of this study showed that 56.2% of the respondents were males and 43.8% were female, demonstrating that male dominion in the farming sector, still exists. The results also revealed that 71% of households keep goats for socio-cultural purposes such as lobola, traditional functions and status, whereas 15% and 9% is kept for income generating purposes and consumption, respectively. The majority of farmers (71.4%) were aware of, and do, practice some sort of supplementary feeding. The source of feed being bought was 34%, of which 26.7% was sourced from food crop residues and 9% from the branches of indigenous trees. Farmers (72.4%) cultivate sweet potatoes for different uses such as generating income (53.3%) or for consumption (27.5%). A further 8% use it for both consumption and income, whilst 16% do not cultivate sweet potatoes. Sweet potato vines were being discarded as waste or burnt (32.4%), left on the field as green manure (25.7%), conserved as propagation material (8.6%), and fed to livestock by 7.6% respondents, respectively. However most of the participants (78.1%) rejected the use of sweet potato vines as feed to livestock. Their assumption behind rejecting sweet potato vines needs to be studied further, since they believe that the vines cause fatal diarrhoea to goats. Domination of males in livestock production sector is still high and the findings concur with previous studies that indicate that small holding farmers keep livestock for socio-economic purposes. Most farmers seem to know about supplementation, however they have little understanding concerning the concept of supplementation, since most were giving maize to goats every afternoon for goats to come back for kraaling in the afternoons without herder. Government still has a major role to play to ensure more women partake in agricultural sector. Furthermore, there is a need to develop farmers in goat farming through training and workshops concerning supplementary feeding, for farmers to be able to supplement in a profitable manner.

LAND TRANSFORMATION AND REHABILITATION

POSTER: A MAIZE PASTURE LEGUME INTERCROPPING SYSTEM FOR THE ABANDONED LANDS OF THE EASTERN CAPE. HOW MUCH NITROGEN IS AVAILABLE FOR THE MAIZE CROP?

Gideon Jordaan[1]*, John Botha[2] and Solomon Tefera[3]

[1]Eastern Cape Department of Agriculture, Rural Development and Agrarian Reform , [2]Agricultural Research Council , [3]University of Fort Hare, email : gideon.jordaan01@gmail.com

Old lands in the Eastern Cape Province suffer from low pasture productivity, brought about by a lack of diversity in the forage species available. Previous trial work identified a suite of annual and perennial legume pastures to fill the winter feed gap and significantly increase in animal production. However, to ensure long term sustainability these pastures, need a good seeding rest every three years. For the temperate species, this is typically during the summer season when maize is grown. The aim is to develop an intercropping system that could utilize any excess nitrogen produced by the pasture legumes for maize production, while affording the legumes an opportunity to set seed. At

two communities (Sinqumeni and Kubedlana) each, a plot (15 m X 80 m) with an even stand of legumes was selected in an existing grass and legume pasture. Herbage production was determined by cutting 1 m² quadrats during November and May of each year. A 250 g grab sample was collected per plot for quality analysis purposes. To determine soil nitrate-N levels, five soil sample cores were collected at random at 4 weekly intervals commencing in November 2016. The samples were pooled per plot for analysis purposes. Both the herbage and the soil data indicate that there was no excess Nitrogen available for the maize crop. From the soil data, a calculated 9 kg N ha^{-1} was available while the calculation of plant available nitrogen based on herbage data show that there was no nitrogen available for the planted maize crop. There are a number of factors that can contribute to this, but in our opinion the utilization of the pasture during the winter is the biggest factor. High quality forage is grazed by animals and the nitrogen is then deposited in urine and dung in other areas such as kraals and around water points.

POSTER: THE EFFECT OF AN ACCIDENTAL SPRING FIRE ON THE SURVIVAL RATE OF LEGUMES SPRAYED WITH HERBICIDE IN A REHABILITATED OLD LAND

Gideon Jordaan*, Craig Trethewey and Unathi Gulwa

Eastern Cape Department of Agriculture, Rural Development and Agrarian Reform, email: gideon.jordaan01@gmail.com

Old lands in the Eastern Cape Province suffer from low pasture productivity, due to low diversity in forage species. The ECCAL project identified a suite of pasture legumes to fill the winter feed gap and significantly increase animal production. However, to ensure long term sustainability these legumes, need a seeding rest every three years. For the temperate species, this is typically during the summer season when maize is grown. This created an opportunity to develop a system that could utilize any excess nitrogen produced by the pasture legumes for maize production, while affording the legumes an opportunity to set seed. The cover on these rehabilitated old lands consist of a mixture of grass and legumes which could have a negative influence on the germination and establishment of maize seedlings. A herbicide trial was therefore designed with the aim of supressing grass and legume growth but allowing the legumes to survive. A plot (15 m X 80 m) with an even stand of legumes was selected in a rehabilitated old land. In November 2016 eight different herbicide treatments were applied in a randomized block design with four replications. Species composition and stand density was determined by conducting a frequency count annually during November and May. During the last week of October 2017 the entire plot was burnt down by a runaway veld fire. This afforded us the opportunity to assess the effect that a late winter or spring burn will have on the survival rate of the different legumes in a rehabilitated old land. Data collected in November 2017 (3 weeks after the fire) indicated a reduction in legume numbers ranging from 42% in Arrowleaf clover (*Trifolium vesiculosum*) to 23% in Lespedeza (*Lespedeza cuneata*) plants, compared ton the May 2017 count. It can be concluded that legumes have the ability to survive a late winter or spring fire regardless of the application of herbicides during the previous spring.

LIVESTOCK IMPACTS ON RANGELANDS

POSTER: EFFECT OF HIGH UTILIZATION GRAZING AND CONTROLLED SELECTIVE GRAZING ON VELD CONDITION IN THE SOURISH MIXED BUSHVELD

Marsia Grobler[1]*, Michiel Scholtz[1], Frikkie Neser[2], Liesl Morey[1] and Frikkie Calitz[1]

[1]Agricultural Research Council - Animal Production Institute, [2]University of the Free State, email: mgrobler@arc.agric.za

Natural veld has long been acknowledged to play an important role in the South African beef industry. According to the Department of Agriculture, approximately 80% of the South African agricultural land is only suitable for extensive grazing. Therefore, grazing of beef cattle in these areas, is a practical method of meat production. The aim of the study was to evaluate the effect of high utilization grazing (HUG) and controlled selective grazing (CSG) systems over a four-year period (2011/2012 – 2014/2015) on veld condition in the Sourish Mixed Bushveld. The experimental herd consisted of 92 Bonsmara cows, divided into four sub-herds consisting of 23 cows each. With the CSG treatment, animals were moved from one camp to the next when approximately 30% of available grass dry matter was utilized whereas with the HUG treatment, animals were moved when approximately 60% of available grass dry matter was utilized. Veld evaluation was done during each consecutive growing season (October/November). Both the area-based method and point-based method were used to determine: Basal cover percentage; Total canopy cover percentage; Proportional canopy cover percentage of grasses; Standing biomass (kg/ha); Decreaser grass

species contribution (%); and Veld condition score (number out of 1000). The data was subjected to an appropriate factorial analysis of variance (ANOVA) using the repeated measurements as a Sub-Plot Factor. The Shapiro-Wilk's test was performed on the standardized residuals to test for deviations from normality. In cases where significant deviation from normality was due to skewness, outliers were removed, until normal or symmetrically distributed. The student's t-Least significant difference (LSD) was calculated at a 5% significance level to compare means of significant source effects. All the above data analyses were performed using SAS version 9.3 statistical software. The basal cover percentage of the HUG treatment decreased significantly from 2011/2012 to 2014/2015 and the basal cover for the CSG treatment decreased slightly, although not significantly. The reason for the significant decrease in grass plant basal size for the high utilization grazing treatment may be due to the higher defoliation of grass leaves. The average standing biomass for the HUG treatment varied from 2394 kg ha^{-1} in 2012/2013 to 2994 kg ha^{-1} in 2014/2015 and for the CSG treatment from 2514 kg ha^{-1} in 2012/2013 to 3044 kg ha^{-1} in 2014/2015. Over the four-year period, a significant difference was found between HUG and CSG (p = 0.001) mean veld condition scores, but the differences over years was not significant (p = 0.51). The decreaser grass species increased slightly from the first evaluation in 2011/2012 to the last evaluation in 2014/2015, for both treatments. These results indicate that neither the HUG nor CSG had a negative impact on the veld in relation to the decreaser grass species composition. It is also an indication that the veld was not under grazed or overgrazed. Note: This research is financially supported by Red Meat Research and Development South Africa (RMRD SA) and THRIP.

POSTER: SPECIES COMPOSITION AND DIVERSITY IN PROTECTED AREAS AND ADJACENT GRAZING LANDS IN GAUTENG PROVINCE, SOUTH AFRICA

Moseketsi Mochesane* and Mamokete Dingaan

University of South Africa (UNISA) , email: sekimochesane@gmail.com

Grassland biomes globally are facing increasing anthropogenic pressure as human populations increase, resulting in an increased need for the resources that grasslands provide. Likewise, South African grasslands are facing increased habitat loss and fragmentation, and have thus become severely threatened, making them a priority for conservation efforts. There are growing concerns about the potential ecological consequences of the increased impact of human activities, especially loss of biodiversity. The knowledge and understanding of how resource availability and environmental distress affect plant diversity is key to proper conservation and management of grassland diversity. Our study aimed at providing more understanding on the interactions of environmental resources and biodiversity, by comparing plant diversity between wildlife-protected areas and adjacent non-protected grazing lands in the South African Grassland Biome. Three nature reserves were chosen around the Gauteng Province, namely Roodeplaat Nature Reserve (RNR) in Tshwane, Suikerbosrand Nature Reserve (SNR) in Heidelberg, and Abe Bailey Nature Reserve (ANR) in Carletonville. We selected three sites within RNR, SNR and ANR, and paired these with adjacent sites in private farming/grazing areas adjacent to the nature reserves. At each site, species composition and plant diversity were determined with the use of 50 m x 20 m Modified-Whittaker plots, making a total of eighteen plots at the nine paired sites. Animal grazing was visually estimated at each site, based on the amount of plant defoliation and trampling, soil disturbance, amount of dung, and animal footpaths. Three grazing intensities were distinguished: low/no grazing, moderate grazing, and heavy grazing. Our results for the 1000 m^2 plots indicate similar species richness (S) at two paired sites at ANR, but the third site had higher S in the adjacent private grazing area than in the nature reserve. This moderately grazed site also had the highest component of grass species, both inside and outside the nature reserve. At SNR, two moderately grazed sites had higher S in the adjacent private grazing area. There was no difference in S on the third site, but the adjacent private grazing area had a higher proportion of grass species. Two paired sites at RNR had similar S within the reserve and in the adjacent private grazing area, but one of the sites had a higher proportion of grass species. The third paired site had high S in the nature reserve compared to the adjacent private grazing area, however the site in the adjacent private grazing area had a much higher proportion of grass species. With regard to grazing, the moderately grazed and overgrazed sites had in general a higher number of palatable grass species as compared to the low grazing areas. The low grazing and heavy grazing sites had a higher cover abundance of the unpalatable and this was evident with the increase in species such as *Hyparrhenia hirta* and *Cymbopogon caesius*. The results suggest that species richness in both wildlife-protected and non-protected private grazing area sites is influenced by grazing intensity and this leads to lower S in over-utilised and under-utilized grasslands, compared to higher richness at moderately utilised sites.

PARALLEL SESSION A: RANGELAND ECOLOGY AND MANAGEMENT

SESSION CHAIR: JUSTIN DU TOIT

Wednesday, 25th July 2018, 11:15 - 12:55

Venue: ARC Training Centre Main Room, Roodeplaat

PLATFORM PRESENTATION: HERBACEOUS AND WOODY VEGETATION RESPONSE TO LAND MANAGEMENT PRACTICES AND SEASONS IN MOPANE SAVANNAH, NAMIBIA

Absalom Kahumba[1]* and Solomon Tefera[2]

[1]University of Namibia, [2]University of Fort Hare, email: akahumba@unam.na

Land management practices may affect the herbaceous and woody vegetation of savannah rangelands in different seasons. This study, therefore, determined the herbaceous and woody vegetation distribution and pattern under three land management systems (commercial ranch, game reserve and communal) over two seasons (summer and winter) in the central northern Namibia. For herbaceous sampling, a total of five 0.25 m^2 quadrats were randomly laid in each 250 m^2 belt transect in each of the three camps in each land management system. For woody sampling, a total of three 250 m^2 belt transect were randomly laid in each of the three camps in each land management system. A total of 23 grass species were identified in all three land management systems, of which 48 % were perennials and 52 % were annuals. In this study, *Aristida meridionalis, Eragrostis trichophora, Enteropogon macrostachyus, Eragrostis viscosa, Pogonarthria fleckii* and *Urochloa trichopus* were classified as the most commonly occurring species. The abundance of *A. meridionalis* responded significantly (p < 0.001) to land management systems being greater in the game reserve than the ranch. *Enteropogon macrostachyus* was recorded only in summer showing greatest (p < 0.05) and least abundance in the ranch and the communal land, respectively. The abundance of *E. trichophora* was high (p < 0.001) in summer in the game reserve followed by the communal and ranch sites, whereas in winter, the abundance was still greater in the game reserve followed by the ranch. The abundance of *E. viscosa* in summer was greater in the communal lands than the game reserve, but in winter this species was recorded in greatest frequency in the game reserve only. The occurrence of *Pogonarthria fleckii* was greater (p < 0.001) in the ranch than the game reserve in summer. *Urochloa trichopus* was rarely recorded in the ranch in summer, but the other land management systems showed similar abundance, though in winter *Urochloa trichopus* was recorded in greater abundance in the ranch sites only. Herbaceous plant tuft density was different (p < 0.001) between the land management systems, only in summer season being greatest in the game reserve and lowest in the communal area. Herbaceous dry matter yield was significantly different (p < 0.001) between the land management systems, in summer being greater in the game reserve than the ranch and communal areas. The total woody plant density was significantly higher (p < 0.05) in the ranch (542 TE ha^{-1}) than in the game reserve (449 TE ha^{-1}) and communal area (324 TE ha^{-1}). The percentage of woody cover did not differ significantly (p > 0.05) between the land management systems. Woody plant density in the height classes of >0–1 m, >1-2 m and >2-3 m were considerably greater (p < 0.05) in the ranch than the game reserve and communal area. The height class >3 m had the greatest density in the game reserve, being higher than in the ranch and communal area. Therefore, this study concludes that land management systems may greatly affect the herbaceous and woody vegetation of savannah rangelands in different seasons.

PLATFORM PRESENTATION: TREE-GRASS INTERACTIONS ACROSS A TOPO-SEQUENCE IN AN AFRICAN SAVANNA

John Mhlanga[1]*, Monicah Mbiba[2] and Justice Muvengwi[1]

[1]Bindura University of Science Education, [2]University of the Witwatersrand, email: tjgmhlanga@gmail.com

The savanna biome is characterized by a continuous herbaceous layer and a discontinuous layer of trees. The root systems of trees and grasses enable co-existence, with grasses utilizing resources in the top layers, while trees access water and nutrients from deeper layers of the profile. Although several studies have been carried out to assess the effect of trees on diversity and biomass of the herbaceous community, little is known of the effect of similar tree species occurring on different positions of the catena on herbaceous biomass and diversity. In order to understand how soils across a topo-sequence influences tree-grass interaction, we sampled grass species underneath *Vachellia nilotica* canopies as well as nearby open savanna matrix control plots. We hypothesized that diversity and biomass of herbaceous plants is higher in vertisols and under tree canopies. In order to visualise

differences in grass species community composition between tree and savanna plots, and between the two soil types, non-metric multidimensional scaling (NMDS) was carried out using the vegan package in R statistical software. Generalized linear mixed effects models were applied using the lme4 package in order to determine the influence of soils on grass on aerial cover, basal cover and biomass. There were significant differences in aerial cover and basal cover between open savannas in both soils ($p < 0.05$). Biomass varied significantly between open savannas in both soils ($p < 0.05$). Grass species composition was highly dissimilar between open savanna plots and under tree canopy plots in fersiallitic soils only. On vertisols, under tree canopy plots and open savanna plots had no effect on grass species composition. As expected, there were higher species diversity in fersiallitic soils and more pronounced under tree canopies than in open savannas. This suggests that the shading effect and leaf litter from the large trees have noticeable influence on vegetation in different soils. In conclusion, it is evident that composition and diversity of grasses are greatly increased through tree canopy effects.

PLATFORM PRESENTATION: RELATIVE ABUNDANCE OF PALATABLE AND UNPALATABLE HERBACEOUS SPECIES ON A CONSERVATION TO COMMUNAL SAVANNAH RANGELAND GRADIENT

Motlalepula Nchoe* and Chris Munyati

North-West University, email: mgtnchoe@gmail.com

Grazing intensity can induce changes in the relative abundance of herbaceous vegetation on savannah rangelands. The induced changes can be used for evaluating rangeland management regimes. In this study the change in abundance of herbaceous species with grazing management regime was investigated at Mahikeng, South Africa, in two parallel transects from a game reserve to a private cattle ranch and then onto a communal grazing area. Along the transect the numbers of palatable and unpalatable species were enumerated during March 2017, in 10 m × 10 m plots at sampling intervals of 100 m. Significance of differences in the relative proportions were assessed using χ^2 analysis. Spatial trends were mapped by interpolation in a Geographic Information System (GIS). The χ^2 analysis revealed significant differences in the relative abundances ($p > 0.05$) between the communal rangeland and both the game reserve and private cattle ranch rangelands. There were significantly higher proportions of unpalatable species on the communal rangeland. Indicative palatable species were *Brachiaria serrate*, *Digitaria eriantha*, and *Eragrostis lehmanniana*, with the unpalatable species being *Aristida congesta*, *Cymbopogon pospischilii*, and *Eragrostis gummiflua*. Spatial interpolation revealed a gradient towards the communal rangeland. Since the rangelands were adjacent (with similar soil and rainfall) and had similar types of ungulate grazers which included cattle and donkeys on the communal and private ranch, and zebra and buffalo on the game reserve, the differences were attributable to differences in grazing management. In comparison with the sedentary grazing on the communal rangeland, grazing was rotated on the private cattle ranch. The relatively large size of the game reserve ameliorated the effects of high grazing intensity since the ungulate grazers could roam over a large grazing area.

PLATFORM PRESENTATION: LONG TERM PERFORMANCE OF AFRINO SHEEP UNDER DIFFERENT STOCKING DENSITIES WITHIN THE UPPER KAROO SHRUBLAND, SOUTH AFRICA

Christiaan Harmse

Northern Cape Department of Agriculture, Land Reform and Rural Development, email: cjj.harmse@gmail.com

It is perceived that Karoo shrublands of South Africa are generally stocked in excess of the recommended stocking rate to increase profit margins under extensive farming conditions. This led to the establishment of a long-term stocking rate trial west of the town, Carnarvon in the Northern Cape Province of South Africa. Since 1988, four stocking rates (8, 7, 5.5 and 4 ha small stock unit^{-1} (SSU)) were applied in a rotational three camp grazing management system using Afrino sheep. The aim of this study was to quantify the effect of four different stocking density treatments on sheep production by making use of 16 years of historical weight data. The sheep in the grazing trial were weighed every 14 days and were replaced in the month of October each year. From this long-term study, animal performance did not vary markedly between treatments over the 16 years, except for gains per hectare when comparing the stocking densities during drought and wet seasons. Animal performance had a curvilinear relationship with seasonal rainfall, an indication that a rainfall year of 240 mm is optimal for sheep production in the Western Upper Karoo region. The average long term annual rainfall measured at the stocking rate trial was 219 mm. Production potential is further influenced by rainfall, where the meat grade quality was found to be lower ($p < 0.05$)

during the wet seasons compared with the drier seasons. The mean group weight for the very light stocking density (VLSD, 8 ha SSU^{-1}) treatment (911.8 ± 122.8 kg) was similar to the measured group weight for the heavy stocking density (HSD, 4 ha SSU^{-1}) treatment (851.4 ± 118.0 kg). The mean for the daily live weight gain per animal calculated was unaffected by treatments. The mean live weight gain found under the HSD treatment was 48.9 ± 34.0 g per day. The highest ($p < 0.05$) recorded mean live weight gain was found under the light stocking density (LSD, 7 ha SSU^{-1}) treatment with 62.7 ± 30.7 g per day. Lower performance due to higher energy outputs towards grazing and finding high-quality forage was expected to take place under HSD. However, the weight gain and overall group weight results of the HSD treatment did not confirm this. Differences in sheep performance were only found under drought conditions. From these results, it is evident that on condition that a well-managed three-camp rotational grazing system is implemented, conservative increases in stocking rate can improve profitability in a sustainable manner during non-drought situations in the Karoo rangelands of South Africa.

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

Keletso Mopipi, Thando Ntutha* and Solomon Tefera

University of Fort Hare, email: 01009337@ufh.ac.za

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 322 m above sea level. The area was divided into 3 open (grazing) and 3 fenced (rested) plots, each measuring 45 m x 100 m and were established down a slope gradient. Each plot was divided into four equal sub-plots 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) and 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 the 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: EXPLORING THE POTENTIAL VALUE OF GRAZING LAWNS IN RANGELAND ECOSYSTEMS

Gareth Hempson

South African Environmental Observation Network (SAEON), email: ghempson@gmail.com

Grazing lawns underpin some of Africa's most productive natural grazing systems, but yet are largely undervalued in a rangeland context. Consequently, the potential for higher grazer productivity that is also ecologically sustainable may be foregone in some rangeland ecosystems. However, establishing and maintaining grazing lawns requires frequent grazing, which under some environmental conditions can instead result in overgrazing, and substantial declines in primary and secondary productivity. Thus, before advocating widespread management for grazing lawns in rangeland ecosystems, a number of important questions need to be addressed. These include: 1) how do we recognise a 'valuable' grazing lawn, 2) where does frequent grazing produce lawns, and where it will result in overgrazing, and 3) what are the benefits and limitations of grazing lawns, and how could they best be integrated into rangeland management plans? Here I provide an emerging perspective on the potential role of grazing lawns in rangeland ecosystems, based on a synthesis of recent ecological literature, preliminary analyses of frequently grazed grass communities in South Africa and Tanzania, and a new trait-based framework for understanding grass responses to grazing. This synopsis aims to stimulate further discussion and research on the opportunities and risks associated with managing for grazing lawns in rangeland ecosystems.

POSTER : PRELIMINARY RESULTS: EVALUATION OF DRY MATTER YIELDS AND PRODUCTION TRENDS OF NINE CULTIVARS FROM FOUR TROPICAL GRASS SPECIES

Msawenkosi Fano Msomi* and Cynthia Fikile Luthuli

KwaZulu-Natal Department of Agriculture and Rural Development, email: msawenkosi.msomi@kzndard.gov.za

The sustainability of forage production in tropical and subtropical areas is affected by environmental and climatic conditions. Certain varieties of forage species may show better adaptability to certain conditions and produce greater yields throughout the growing season. A study was conducted at Owen Sithole Research Station near Empangeni, KwaZulu-Natal to evaluate three *Panicum maximum* cultivars (Gatton, Tanzania, Mombaca), three *Brachiaria brizantha* cultivars (Marunada, Xaraes, BRS Piata), two *Brachiaria humicola* (Humicola, Lianero) and one *Brachiaria decumbens* cultivar (Basalisk) in terms of dry matter yield and use in livestock production systems to increase fodder availability. The area has a sub-tropical climate and is frost free. The trial was laid out in a fully randomized block design with three replications under dryland conditions and with a nett experimental plot size of 10 m x 2 m. The results for the 2016/17 growing season showed that some cultivars performed differently during different seasons i.e. summer and winter. The best summer yield was for *P. maximum*, cv. Gatton (3.3 t DM ha^{-1}) and the lowest from *B. brizantha* cv. Xaraes (1.5. t DM ha^{-1}). During the winter, the highest DM yield was for the *B. decumbens* cultivar Basalisk (4.3 t DM ha^{-1}). The *P. maximum* cv. Gatton produced the second highest DM yield (3.3 t DM ha^{-1}). The *Brachiaria brizantha* cultivars Marunada and PRS Piata, and *Brachiaria humicola* cultivar Lianero were dormant during winter. The winter and summer yields of all three *Panicum* cultivars compared well, with Gatton as best performer. The *Brachiaria decumbens* cultivar (Basalisk) performed well in both seasons and seemed to be, as the Panicum cultivars, tolerant of cold. *The Brachiaria brizantha* cultivars Marunada and BRS Piata seemed to be sensitive to cold, and Xaraes, which produced some material in winter, performed poorly in both seasons. The data produced can assist in cultivar choices for the farmer in terms of total yields and seasonal production trends. The trial will continue to collect data from three years of results and will be replicated under irrigation. Nutritional values will be also compared between cultivars and seasons.

POSTER: THE RELATIVE DRY MATTER YIELD POTENTIAL OF VARIOUS EARLY-, MEDIUM- AND LATE-FLOWERING FORAGE CEREAL CULTIVARS

Patrick Rakau*, Lesedi Sere, Mpho Nzeru, Dave Goodenough and Thembinkosi Mkhize

Agricultural Research Council - Animal Production Institute, email: rakaup@arc.agric.za

Annual forage cereals including white oats (*Avena sativa*), black oats (*A. strigosa*), red oats (*A. byzantina*), rye/stooling rye (*Secale cereale*) and Triticale (*x Triticosecale*) are frequently sown during the autumn months under dryland conditions for subsequent grazing by livestock during late autumn, winter and early spring. An experiment was planted in April 2016 to compare dry matter yield of early-, medium and late-flowering forage cereal cultivars. This experiment was conducted on a Hutton soil type at the Cedara Research Station in the KwaZulu-Natal Mistbelt, South Africa (29º 32´S 30º 16´ E), at an altitude of 1075 m. The total rainfall recorded during the trial period from the planting date through to the final cut was 166 mm. Seed of 30 forage cereal cultivars of the above-mentioned species was sown at the recommended sowing rates with three replications in a 5 x 6 balanced lattice trial with a gross plot size of 2 m x 6 m and a nett plot size of 1.4 m x 4.6 m. All plots received 50 kg N ha^{-1} and 50 kg K ha^{-1} as 1:0:1 when the seedlings were approximately 10 cm high and the same amount again after each herbage cut. The plots were cut four times with a mower blade set at 5 cm above ground level when the plants reached grazing height. The fresh herbage was weighed within two to five minutes of cutting and the samples dried in an oven set at 75 ºC. Early-flowering cultivars, for example the rye cultivars LS 35 (1,05 t ha^{-1}) and SSR 727 (1,48 t ha^{-1}), generally yielded relatively well in late autumn (Cut 1: 07 June 2016) when they were in the early reproductive/flowering phase. Medium-flowering cultivars such as the stooling rye cultivars PAN 263 (0,96 and 2,79 t ha^{-1}) and NCD Grazer (0,65

and 2,97 t ha-1) yielded relatively poorly during late autumn (Cut 1: 07 June 2016) but relatively well in late winter (Cut 3: 01 August 2016). On the other hand, late-flowering cultivars such as the Triticale cv. PAN 299 (2,64 t ha^{-1}) and the stooling rye cultivar LS 62 (2,89 t ha^{-1}) were amongst the highest yielding cultivars as they moved into the reproductive phase in late winter and early spring (Cut 4: 20 September 2016). ANOVA indicated significant differences ($p < 0.05$) among early, medium and late-flowing cultivars, although the LSD showed that mean dry matter yields for early vs. medium and for medium vs. late-flowering cultivars were not significantly different. The LSD and CV for the total dry matter yields of the 30 different forage cereal cultivars were 1.15 and 11.11 % respectively. While forage cereal cultivars that are highly ranked in total dry matter yield should be noted in deciding which forage cereal cultivars to utilize, careful consideration must be given to their flowering behaviour and their

POSTER : CLIMATIC AND EDAPHIC TOLERANCE OF SOUTHERN AFRICAN SPECIES OF *INDIGOFERA* (LEGUMINOSAE)

Marike Trytsman[1]*, Letty Masemola[1], Francuois Müller[1] and Braam Van Wyk[2]

[1]Agricultural Research Council - Animal Production Institute, [2]University of Pretoria, email: MTrystman@arc.agric.za

The genus *Indigofera* is being evaluated for possible pasture potential of certain species occurring within the genus. There are at least 196 Indigofera species indigenous to southern Africa. Distribution records show that species in the genus *Indigofera* occur primarily in the Savanna and Grassland Biomes. The majority of *Indigofera* species are herbs, followed by shrubs and dwarf shrubs. Even though nearly 12 *Indigofera* species are known to contain indospicine, a free amino acid that causes hepatotoxicity (Fletcher et al. 2015), a few species have been through a forage selection and evaluation process. These include I. *alternans* var. *alternans* and *I. vicioides* var. *vicioides* (contains indospicine) with Müller et al. (2017) prioritising *I. meyeriana* and *I. nigromontana* for further evaluations for water-limited pasture systems. The aim of this work was to describe the *Indigofera* species indigenous to South Africa, Swaziland and Lesotho, in terms of their adaptation or range of tolerance to mean annual rainfall, mean annual minimum and maximum temperatures, soil pH and phosphorus levels. A discriminant analysis was performed to determine which bioclimatic and/or edaphic predictor contributed mostly to species distributions, as recorded by PRECIS (2008). A high correlation between distribution and mean annual rainfall and soil pH were noted. Species such as *I. auricoma* and *I. exigua* are listed only in one group, having several occurrences in the Kalahari Duneveld and Namaqualand Hardeveld Bioregions, respectively. These species are therefore narrowly adapted to these bioclimatic and edaphic conditions. Overall, *Indigofera* species are found mostly in the Central Bushveld and Mesic Highveld Grassland Bioregions and fall in the 400–800 mm mean annual rainfall regions with a soil pH level of < 6.4. Species identified as having a high pasture value and adapted to low soil P, are *I. alternans* var. *alternans*, *I. cryptantha* var. *cryptantha* (contains indospicine), *I. rhytidocarpa* subsp. *rhytidocarpa*, *I. torulosa* var. *torulosa* and *I. vicioides* var. *vicioides* (contains indospicine). Of the few species adapted to low soil phosphorus levels and relatively low rainfall, I*ndigofera alternans* var. *alternans* is the only herb recorded, occurring mainly in the Central Arid Region Group. These results shows that the genus *Indigofera* has numerous promising species available for further screening and pasture evaluations.

POSTER: OVERSOWING ITALIAN RYEGRASS (*LOLIUM MULTIFLORUM* VAR SUPREME Q) INTO IRRIGATED KIKUYU (*PENNISETUM CLANDESTINUM*) FOR IMPROVED TIMING AND QUALITY OF FODDER PRODUCTION

Donna Berjak* and Derryn Nash

KwaZulu-Natal Department of Agriculture and Rural Development , email: Donna.Berjak@kzndard.gov.za

Oversowing Italian ryegrass into kikuyu in autumn can be an aid to improving quality and quantity of pastures during the winter and early spring months. A trial conducted on Cedara research station in KwaZulu-Natal in 2016 and 2017, aimed to test the use of glyphosate herbicide at two levels and four different times of application vs the mechanical method of mowing at two levels to set back the kikuyu enough to oversow with Italian ryegrass (*Lolium multiflorum*). Glyphosate was applied at 400 mL ha^{-1} or 800 mL ha^{-1} either three weeks, two weeks, one week or one day before planting. The mowing treatments were to cut to a kikuyu residual canopy height of 5cm or 2cm one day before planting. A pure ryegrass control was attempted by applying glyphosate at 4 L ha^{-1} (Lm control) for a complete kill of the kikuyu. In the second year no herbicide was applied, but all plots were mowed to 2 or 5 cm before planting to determine any carry-over effects of the herbicide. The first year (2016) autumn results were erratic, with no clear indication of which herbicide concentration or time of application was superior, seemingly environmental effects

overshadowed time of application or concentration of herbicide. In spring, there was very little differences in yield between treatments, apart from the kikuyu control, which was the lowest yielding. Total yields across treatments in 2016 were not significantly different, averaging 17.1 t DM ha^{-1}, with the exception of the unexpectedly low yielding ryegrass control. The second year (2017), no herbicide was applied and the trial was planted later in the season, leading to a low yielding autumn. In winter all treatments were similar, except for a significantly higher yield for the ryegrass control and lower yield for the kikuyu control. Total yields across treatments in 2017 were not significantly different, averaging 14.2 t DM ha^{-1}, except for the ryegrass and kikuyu controls, which were lower. Year two had lower over-all yields than year one, as it had a shorter season. The time of year that pasture was available and the species of grass dominating differed between treatments. What is important is that for oversown kikuyu between 4 to 6 t DM ha^{-1} of pasture is available when it is needed more (in autumn, winter and early spring), and that it was of a better quality than pure kikuyu. Over two years it appeared that oversowing ryegrass into kikuyu gave a yield advantage over either species alone. The time of planting remains critical – an earlier planting, without herbicide, runs the risk of being swamped by kikuyu regrowth, planting too late may limit ryegrass production until late winter or early spring. The success and cost to this exercise is irrigation, as it will not be successful if planted dryland.

POSTER : DOES SEED SIZE, EMERGENCE RATE AND VIGOUR RELATE TO VARIATION IN PRODUCTIVITY OF WINTER CEREALS IN RELATION DROUGHT IN THE MPUMALANGA HIGHVELD

Norman Modau Magoro*, Thabile Joyce Mokgakane, Ontiretse Keromecwe, Collen Rabothata and Jan Theron

Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs, email: magoro@mpg.gov.za

Winter cereals play a principal role in maintaining livestock condition during winter months in the Highveld. Due to the potential of these species to achieve high winter yields and forage quality, they remain the preferred species for green winter feed for highveld mutton producing animals. Despite harsh environmental conditions, the Highveld in Mpumalanga is a stronghold for South Africa's agricultural production, boasting large herds of mutton sheep. Recent evidence shows that climate change, particularly trends related to increased seasonal variability of rainfall, has led to increased constraints on water availability in both rain-fed and irrigation-based agriculture. However, the effect of climate change, particularly those leading to below mean annual precipitation (MAP) in the Highveld, on the productivity of winter cereals is unknown. The aim of this study was to assess whether below average rainfall would adversely affect the production potential of winter cereals the Highveld area. Assessing whether resistance of winter cereals to drought is associated with seed size of cereal cultivars was a secondary aim of this study. Three winter cereals species (*Avena sativa* cv. Overberg (Oats), *Triticale hexaploides* cv. Cloc 1 (Triticale) and *Secale cereale* cv. LS62 (Stooling rye)), were evaluated. Each treatment was replicated three times in a randomised experimental design (plot = 1 ha) and greenhouse experiment that were planted mid-March 2014 at the Athole Research Station. The study was carried out seasonally from 2014 to 2017 in order to take into account the effect of seasonal variation on productivity. The ten year average for total autumn rainfall at the Athole Research Station is 320 mm. The actual rainfall during the four year study period was 70, 269, 325 and 439 mm for 2014 to 2017, respectively. Seed size of the varieties evaluated were categorized according to seed weight as large, medium and small for *A. sativa*, *T. hexaploides* and *S. cereale,* respectively. Production potential (kg DM ha^{-1}) was evaluated a week before grazing during the second week of June each year using an exclosure cage, a 0.16 m^2 quadrat and falling plate. Productivity was associated with rainfall seasonality. There was a significant positive correlation between drought level (rainfall/soil moisture availability) and yield two of two species (*A. sativa*, $R^2 = 0.90$ and *S. cereale*, $R^2 = 0.86$). Therefore, yields for consecutive years of study for the respective species were significantly different ($p < 0.05$). Emergence rate was evaluated as percentage of seed germinated for each species at regular day intervals (7d - 42d) and simultaneously vigour was inferred. *Avena sativa* and *Secale cereale* had significantly higher ($p < 0.05$) emergence and vigor than *T. hexaploides* during seasons with above normal rainfall, with the opposite true ($p > 0.05$) when rainfall decreased below normal (320 mm). The species with either large or small seeds (oats and stooling rye respectively), showed a greater ability to maintain yield potential during periods of moisture stress resulting from below average rainfall. In contrast, triticale was able to emerge, but not maintain production, during periods of short term water stress. We thus conclude that the results support the research hypothesis of winter cereals productivity varying with drought level. We recommend that producers should consider interchanging winter cereals based on the predicted or apparent rainfall, rather than being reliant on one species alone. Alternatively, *T. hexaploides* should be diversified with the other two cultivars during any one year to maintain forage production during unexpected drought conditions.

POSTER: HIGH ATMOSPHERIC DROUGHT EXACERBATES THE EFFECTS OF GROWTH UNDER MODERATE SOIL WATER CONTENT IN GUINEA GRASSES

Juan Andres Cardoso*, An Notenbaert, Solomon Mwendia and Michael Peters

International Center for Tropical Agriculture (CIAT), email: j.a.cardoso@cgiar.org

There is a growing interest in Guinea grass (*Megathyrsus maximus*, formerly *Panicum maximum*) for its use as forage to feed livestock under a range of sub-saharan African (SSA) conditions. Traits related to a plant's water use influence the fitness of genotypes for specific rainfall and evaporative demand environments. Atmospheric vapor pressure deficit (VPD) has been widely recognized as the force driving transpiration in plants, thereby influencing their efficiency in water use. The objective of this work was to test genotypic differences in water use efficiency (WUE: biomass produced per amount of water transpired), biomass production and leaf senescence of 126 accessions of M. maximus under three levels of VPD conditions (1.5, 3.0 and 4.0 kPa) and two irrigation conditions (soil kept at 90% and 60% of field capacity) under greenhouse conditions for two weeks. Overall, WUE, biomass production and leaf senescence were not affected in most genotypes when growing under moderate atmospheric and soil drought (3.0 kpA of VPD and 60% field capacity) when compared to plants growing under low atmospheric drought (1.5, kPa) and soil kept under 90% of field capacity. However, growth under high atmospheric drought (VPD of 4.0 kPa) resulted in reduced WUE (15% to 22% of reduction under soil kept at 90% and 60% of field capacity respectively) and biomass (26% to 35% under soil oil kept at 90% and 60% of field capacity respectively). Under moderate soil water content (60% of field capacity) and high atmospheric drought (VPD of 4.0 kPa), at least a two-fold increase in leaf senescence was recorded for all genotypes tested compared to the others treatments. Carbon starvation and hydraulic failure were likely the basis of reduced WUE and biomass and increased leaf senescence under high atmospheric drought and moderate soil water content in all genotypes tested. Our results suggest that the more productive Guinea grasses (15 genotypes showing biomass production of ~3 g pot^{-1}, which could be translated into an estimated productivity of above 25 ton dry matter hectare^{-1} under high fertility conditions) could be suitable options for forage production, without big yield penalties, in tropical agro-ecosystems across SSA where short, frequent and mild droughts and low atmospheric evaporative demand conditions are common (i.e., a range of humid to sub-humid agroecosystems with annual precipitation above 900 mm). Further research is needed to test promising genotypes under field conditions. This work was partially funded by CGIAR Research Program on Livestock (flagship on Feeds and Forages) and BMZ funded project "Improved forage grasses: Making the case for their integration into humid- to sub-humid livestock production systems in Kenya and Ethiopia".

POSTER: EFFECT OF FIBRE CONTENT ON THE IN VITRO DRY MATTER DEGRADABILITY OF FEEDLOT DIETS

Sanele Jiyana[1]*, Mamothaladi Moshidi[1], Moses Ratsaka[1], Khanyisile Mbatha[2] and Maxwell Mkhwanazi[3]

[1]Agricultural Research Council - Animal Production Institute, [2]University of South Africa, [3]Gauteng Department of Agriculture and Rural Development, email: jiyanas@arc.agric.za

Appropriate dry matter degradability (DMD) results in the efficient absorption of nutrients into the blood stream of an animal. Therefore, this study was aimed to determine the effect of fibre content on the *in vitro* DMD of beef cattle finisher diets. The study procedure was approved by the ARC − AP (Irene) Research Ethics Committee, reference number: APIEC15/047. Stomach tube was used to collect rumen fluid from three Nguni steers (380 ± 25 kg live weight) fed a feedlot finisher diet. Rumen fluid was collected within two minutes per animal, which was then poured into a pre-warmed flask and sent to the laboratory within 20 minutes, where it was filtered through 2 layers of cheesecloth and kept at 39 °C under constant flushing with CO_2. Treatment diets with three crude fibre contents (41,54 %, 18,18 % and 10,77 %, referred as diet 1, 2 and 3, respectively) were used in the study. Dried feed samples were weighed (0.5 g) into nylon bags (5 cm x 10 cm; 40 μm pore size) and heat-sealed. Samples were incubated in ruminal fluid combined with a buffer solution (1:4, vol/vol) for 0, 2, 4, 8, 12, 16, 24 and 48 hours according to the *in vitro* (IV Daisy[II]) procedure. After incubation, bags with feed residues were rinsed thoroughly with tap water until water ran clear, dried in a forced-air oven at 60 °C for 48 hours and weighed. Dry matter disappearance data were fitted to the equation: $Y(t) = a + b(1 − e^{-ct})$, where Y(t) = dry matter disappearance (%) at time (t) hours, a = soluble or rapidly degradable fraction, b = insoluble or slowly degradable fraction, c = fractional rate constant of degradation of b (1/h), t = incubation time and e = base for natural logarithm. There was a significant difference ($p < 0.05$) on the DMD of treatment diets for all incubation periods. A notable difference was observed in DMD (Mean ± SD) at 48 hours of incubation with 54,9 ± 0,71 % for diet 1; 61,6 ± 0,38 % for diet 2 and 71,5 ± 0,79 % for diet 3. A high fibre content such as in diet 1 (41.5 % CF) resulted in a marked decline in the DMD of the feedlot diets evaluated.

POSTER: EFFECTS OF BIO-WASTE APPLICATION ON *VIGNA UNGUICULATA* AND PENNISETUM *PURPUREUM* PASTURES ON LIGNIFICATION RATE OF STEM AND LEAF CARBOHYDRATE AND STRUCTURAL PROTEIN FRACTIONS

Florence Nherera-Chokuda[1]*, Mukengela Claude Muya[1], Mary-Jane Thaela-Chimuka[1], Wisani Goodness Mushadu[2] and Vincent Maphahla[2]

[1]Agricultural Research Council - Animal Production Institute, [2]Limpopo Department of Agriculture, email: nhereraf@arc.agric.za

Planted grasses and legumes are less expensive feed sources compared to grain based concentrates and provide dietary fibre that is crucial for stimulating rumen activity. Fibre fractions (cellulose, hemicellulose, lignin, cutin, silica) and crude protein availability determine relative forage value (RFV). Legumes tend to have a higher nitrogen and lignin content per kg fibre than grasses, although the latter have a higher tensile strength. Reducing lignification of fibre through genetic manipulation affects plant morphology and viability; hence soil fertility practices that minimize lignification of protein and carbohydrate fractions are preferred. Inorganic fertilizers improve pasture growth and lower lignin content, but are not environmentally friendly. The objective of the study was to determine the effect of bio-digestate application on *Vigna unguiculata (VU)* and *Pennisetum purpureum* (PP) pastures and evaluate quality of lignified nutrient fractions. The hypothesis was that organic fertilization would improve the uptake of soil nutrients and minimise lignification of plant carbohydrates during the early growth period. A factorial experiment (factor 1: forage type- legume vs grass; Factor 2: three levels of digestate application) was done in a temperature-controlled environment using potted plants. *Vigna unguiculata* (VU) and vegetative material of PP were planted in pots that were fertilized using semi-solid digestate from a cattle/sheep abattoir. Samples of stems and leaves were harvested weekly from 21 days to flowering point in VU and 6 weeks for PP to assess carbohydrate lignification. Samples of stems and leaves were analysed for total fibre and crude protein, soluble and insoluble fractions and indigestible components following 300 hrs of *in vitro* fermentation. Interrelationships between fibre fractions and organic N and C were determined and comparative synthesis of variance in lignin complexes between VU and PP were assessed. Preliminary results show that application of the organic resin improved leaf N of both PP and VU by 12 and 14.5%, relative to control plots. Leaf and stem lignin content of both VU and PP were less than 2% at 21 days; however, rapid accumulation was noted in PP stems from week 5 reaching 18% NDF in dry matter (DM) and 5.3% unavailable carbohydrate. There was a similar trend in VU however; leaf lignin was lower for VU at flowering (4.1% DM) compared to the PP at all fertilization levels. At most, 9.1 % dry matter disappearance (DMD) was noted for PP lignocelluloses (high organic matter plot) disappeared by 240 hrs and no significant change was noted thereafter; materials from had significantly lower rates of disappearance. There was no variance in VU disappearance across treatments over the 300 hr fermentation period and maximum disappearance was 7.2% DMD, which was higher ($p < 0.01$) than control (4.4% DMD). Pasture fertilization with animal sourced bio-digestate did not result in significant sloughing of lignified cellulosic materials and further research on application methods and determining optimum bio-digestate application rates is essential to achieve higher nutrient supply from pasture.

POSTER: THE IMPACT ON WOOL PRODUCTION YIELD OF GRAZING DOHNE MERINO SHEEP ON *BIDENS PILOSA* (BLACK JACK) INFESTED PASTURES IN THE HIGHVELD

Petros Khoza*, Ernest Nkambule and Marco Scheltens

Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs , email: khozapetros@gmail.com

Bidens pilosa is a pioneer weed listed as a global invasive species found in disturbed grazing lands and planted pastures, which are used for grazing. It forms dense stands that can out-compete, out-grow, and eliminate native vegetation of the lower strata. Its burrs are a nuisance to people, sheep and also a troublesome seed contaminant as they are difficult to separate once attached to wool during grazing. It creates challenges during both shearing and acts as undesirable foreign object during packaging of wool, thus negatively influences the yield and price of wool production. The coincidence of wool shearing season with the seeding period of *B. pilosa* in the Highveld negatively affects wool production. The Dohne Merino breed, the main wool producing sheep of the Highveld, is highly affected by contaminants of *B. pilosa*. The aim of this study was to determine the impact of *B. Pilosa* contamination on wool production yields of Dohne Merino sheep breeds in the Highveld of Mpumalanga Province. This study serves to quantify the damage on wool profits and highlight the significance of controlling *B pilosa* on grazing lands. The study was conducted at the Athole Research Farm in the Highveld region of Mpumalanga Province. The data was collected during three consecutive shearing seasons. Three groups of 150 Dohne Merino sheep were separated and

grazed on camps with various levels of *B. pilosa* infestation demarcated as none, low and high infested pasture camps. The groups of sheep were shorn, packaged and weighed separately to determine wool yields and analysed using excel. There was no difference in wool production yield between sheep in none infected and camps with low *B. pilosa*. Mean wool production yields per small stock unit of 3.0 kg, 2.6 kg and 2.0 kg were observed for none, low and high *B. pilosa* infested camps, respectively. The results demonstrate that wool production yield per sheep is inversely proportional to pasture infestation by *Bidens pilosa,* thus wool production yield increases with a concomitant decrease in infestation of the grazing camp. It is therefore recommended that wool producing sheep or any fleece producing livestock be prevented from grazing on camps infested with *B. pilosa*. The use of none fleece producing livestock at correct stocking rates will enhance re-establishment of indigenous vegetation and eliminate *B. pilosa*. These biocontrol mechanisms are economically viable and more sustainable than the use of highly expensive labour intensive physical and chemical control mechanisms.

POSTER: SPECIES COMPOSITION AND BIOMASS PRODUCTION IN TWO COMMUNAL COASTAL RANGELANDS OF THE EASTERN CAPE PROVINCE, SOUTH AFRICA

Sinethemba Matshawule[1] and Solomon Beyene[2]*

[1]Eastern Cape Department of Rural Development and Agrarian Reform, [2]University of Fort Hare, email: sbeyene@ufh.ac.za

This study investigated the influence of season, distance from homesteads and topography on species composition and biomass production in two communal rangelands surrounding homestead areas, in Dyamdyam and Machibi in the Eastern Cape. At Dyamdyam, rangelands are set on a flat slope. Therefore rangelands were divided according to distances from homesteads into near (up to 1 km), middle (> 1–2 km) and far (> 2–3 km). At Machibi rangelands are set on steep slope. Therefore, rangelands were divided into position on hill-slope into bottom, middle and top sites. In each site a Homogeneous Vegetation Unit (HVU) of 50 m x 20 m was used and six 0.25 m^2 quadrats were laid randomly on each HVU. Herbaceous species found within a quadrat were identified, counted and their height and tuft diameter were also measured. Herbaceous species were also harvested, bulked and placed into well labelled brown paper bags and oven-dried for 48 hours at 60 °C to determine biomass production. Herbaceous species were classified according to their palatability, ecological status and life form. Data were collected for two seasons over 2014/15 (winter and summer). A total of 20 herbaceous species were identified in the study areas. Of these, 17 were grass species. The most common or dominant grass species were *Themeda triandra, Cynodon dactylon, Erograstis capensis, Erograstis plana* and *Sporobolus africanus*. *Themeda triandra* had a higher frequency of occurrence at the far site than at the middle and near homesteads sites at Dyamdyam. The frequency occurrence of *S. africanus* at Machibi was similar in all the study sites. Density of herbaceous species was significantly lower on near and bottom sites at Dyamdyam and Machibi, respectively. In both winter and summer, far and top sits at Dyamdyam and Machibi respectively, had higher (p < 0.05) biomass production. The biomass production was significantly higher in the summer than the winter across the study sites in both study areas. It can be concluded that season, topography and distance from homesteads are important factors that affect biomass and grass species composition. Therefore, rangeland management programs in communal grazing lands should consider these factors. Adoption of rotation grazing in communal rangelands is recommended to improve grass species diversity and biomass production.

POSTER: EFFECT OF FRESH LUCERNE AND CONCENTRATE SUPPLEMENTATION ON MILK PRODUCTION OF JERSEY COWS GRAZING KIKUYU PASTURE IN SPRING

Portia Mamothaladi Moshidi*, Nelisa Apleni, Mukengela Claude Muya and Florence Nherera-Chokuda

Agricultural Research Council - Animal Production Institute, email: Moshidip@arc.agric.za

During spring, kikuyu pasture has high content of non-structural carbohydrates (NSC); however, dry matter and fibre content are low. The low fibre content affects fibrolytic enzymes-that affect, nutrient digestibility and subsequently intake, health and performance. Kikuyu is also high in oxalates, which reduce absorption of calcium and exacerbates metabolic disorders in lactating cows. High energy and high fibre feed and forage hay are critical for sustainable milk production in spring and early summer when nutrient supply from pasture is limited. Supplementing lucerne during spring would increase diet NSC, structural carbohydrates and calcium. The objective of the study was to determine effects of fresh lucerne (CP: 21.1 %; ME: 9.8 %; NDF: 42.7 5) and concentrate supplementation on milk production of lactating Jersey cows grazing kikuyu pasture (CP: 22.9 %; NDF: 27.8 %; ME 11.6 MJ/kg) during spring. Twelve mid-lactating primiparous Jersey cows (from the Dairy herd of the Bethel Agricultural College in Butterworth (Eastern Cape) were used in a randomised complete block design experiment. Three weeks before the start of the study,

Jersey cows (DIM: 105 ± 11; BW: 398 ± 34 kg; 13.6 ± 8 kg) were assigned to one of six blocks of two cows, based on milk production during the two weeks prior. The two treatment groups were 1) control (not supplemented with lucerne), and 2) supplemented with 2.5 kg d^{-1} of chopped lucerne hay. Cows in both groups received 6 kg d^{-1} (as is) of concentrate. Milk yield was recorded daily and milk samples collected on one day weekly to determine milk composition. Body weight (BW) was measured at start and end of the experimental study (30 days). Milk yield averaged 14 kg d^{-1} and did not differ between the two groups. Milk protein and lactose did not differ between the two groups and averaged 3.71% and 4.79 % respectively, but milk fat concentration was increased ($p < 0.05$) by supplementing lucerne (4.5 vs 4.25 %). On average, both groups produced 0.64 and 0.53 kg d^{-1} of milk fat and protein, respectively. Milk urea nitrogen values were within acceptable ranges, but were slightly lowered ($p = 0.04$) by supplementing lucerne (13.5 vs 15.9 mg dL^{-1}). The initial and final BW did not differ between the two groups. The absence of change in milk performance suggests that at the current feed intake, no rumen condition could justify supplementation of additional buffering fibre from lucerne hay.

LAND TRANSFORMATION AND REHABILITATION

SESSION CHAIR: TERCIA STRYDOM

Wednesday, 25th July 2018, 13:55 - 12:15:35

Venue: ARC Training Centre Main Room, Roodeplaat

PLATFORM PRESENTATION: CAN ECOSYSTEMS RECOVER SUCCESSFULLY WITHOUT HUMAN INTERVENTION? DEGRADED VS NATURAL GRASSLAND

Nobuhle Mweli[1]*, Zivanai Tsvuura[2] and Terry Everson[3]

[1]University of KwaZulu-Natal/ NRF/ SAEON, [2]University of Namibia, [3]University of KwaZulu-Natal
email: nobuhlemweli@gmail.com

Grassland degradation leads to the loss of ecosystem services valuable to humans, and causes negative impacts on landscapes and their functional abilities. The severity of degradation means more time and resources required to rehabilitate a landscape and therefore become a serious challenge. Various methods are used to assess ecosystem health and functioning and one such method is the Landscape Function Analysis (LFA). The LFA method is a field based technique which examines the functional status of rangelands. The LFA method is used to determine the impacts of transforming a grassland for crop production in a communal area, where subsistence farming is the dominating form of land use. The objective was to assess the recovery of old crop fields for the restoration of biodiversity in the catchment area. The study was conducted in Okhombe, located in the Bergville district, northern Drakensberg, where five previously cropped (PC) and five adjacent pristine grassland treatments were surveyed as reference sites. The PC treatments are degraded and have not been utilised for approximately 5 years, and are therefore under recovery with no human intervention. On the other hand, the pristine grassland found adjacent to the PC treatments have not had any severe disturbance, however, have been used for grazing by livestock. Two 50 m transects were laid out to measure landscape organization indices of patches and inter-patches (number, length, width) which characterize the landscape structure. For each plot, eleven soil surface indicators were assessed, recorded and, class ranks were given for each indicator. The classes represented an estimate of the observed patch/ inter-patch surface assessment for each indicator and each class was then grouped into their appropriate landscape index, namely: stability, infiltration and nutrient cycling. Soil samples were also collected to analyse for physical and chemical properties. Moreover, species richness and diversity was assessed using a Braun Blanquet sampling method. An independent samples t-test was used to test for difference between species richness, diversity, landscape organisation and soil surface assessment for each PC treatment. The results indicated that the pristine grasslands were significantly more functional compared to degraded areas based on several indices ($p < 0.024$). However, diversity and richness did not vary as $p > 0.125$. Species found on the PC area were mostly invading weed species such as *Bidens pilosa, Conyza floribunda, Senecio madagascariensis* and *Tagetes minuta*, to some extent *Cymbopogon caesius* and *Panicum ecklonii;* with high clay content, low pH and moderate (50%) infiltration rates and low soil stability. The adjacent grasslands had more grass species, including *Aristida junciformis, Diheteropogon amplectans, Eragrostis curvula, Cymbopoon caesius* and the herb *Chamaecrista grandulosa*, with high soil stability, infiltration, 60% and pH. Severe grassland disturbances impacts greatly on vegetation structure and soil stability. Monitoring grassland areas that were previously transformed for agricultural purposes provides adequate information on measures to be taken in order to restore biodiversity.

PLATFORM PRESENTATION: WORKING FOR WATER PRIORITISATION PLAN: TOWARDS A STRATEGY FOR MANAGEMENT OF INVASIVE ALIENS FOR THE TSITSA RIVER CATCHMENT, EASTERN CAPE

Sukhmani Mantel[1]* and Anthony Palmer[2]

[1]Rhodes University, [2]Agricultural Research Council - Animal Production Institute, email: s.mantel@ru.ac.za

Acacia mearnsii (black wattle) is an invasive alien plant that was introduced to South Africa in the middle to late 1800's, however since then it has expanded across the landscape particularly into the Eastern Cape grasslands. Black wattle is a high priority taxon for clearing by the Working for Water (WfW) programme as it is the top taxon responsible for reduction of the naturalised mean annual runoff of South Africa. This paper will present the results of

an area prioritisation plan for WfW's clearing of invasive aliens in the Tsitsa River catchment, where Ntabelanga and Laleni Dams are being planned in the Eastern Cape. The plan was developed through feedback obtained during a workshop attended by the Department of Environmental Affairs (DEA), WfW, the Gamtoos Irrigation Board (the implementing agent in the catchment) and other Rhodes University researchers working in the catchment. A Multi-Criteria Decision Analysis (MCDA), an analysis that aims to achieve multiple, conflicting objectives in decision-making, was conduced using spatial datasets (or criteria) entered into ArcMap to output clearing priorities for areas (pixel size 250 m x 250 m) in the Tsitsa catchment. Two of the criteria that were entered into the analysis included disturbed areas (or old cultivated lands) and riparian zones, both of which are particularly vulnerable to invasion; other criteria were soil erodibility and average density of invasive aliens. The criteria included and their weighting in the analysis are informed by the feedback obtained from the workshop participants and the output is therefore relevant for WfW's work. This research has implications for delivery on Sustainable Development Goals (SDG) #6 (Clean Water and Sanitation) and #15 (Life on Land) because invasive alien plants threaten the ecosystem's integrity and services provided.

PLATFORM PRESENTATION: THE CHARACTERISTICS OF THE MATLABAS MIRE, LIMPOPO PROVINCE: IMPLICATIONS FOR CONSERVATION MANAGEMENT

Antoinette Bootsma[1]*, Steven Khosa[2], Albert Pieter Grootjans[3] and Piet-Louis Grundling[4]

[1]Limosella Consulting Pty Ltd, [2]South African National Parks, [3]University of Groningen, [4]Centre of Environmental Management, University of the Free State, email: antoinette@limosella.co.za

The Matlabas wetland is a mire located in the headwaters of the Matlabas River, Marakele National Park, Limpopo Province. Various seepage zones and artesian peat domes are contained in this system that consists of two tributaries of which the western one is partially channeled. The mire's two tributaries are located on fairly steep slopes of approximately 4.6% to 6.3%, but are well vegetated. The vegetation is dominated by *Miscanthus junceus* and several sedge species, and can be correlated to different organic and mineral soils. The occurrence of decaying peat domes and desiccated areas of vegetation, as well as the apparent erosion on the western tributary, have raised concerns on the health of this wetland. The purpose of this presentation is to highlight results of our assessment on the hydrology and vegetation of the Matlabas Mire and the implications thereof on the management of this wetland. A network of piezometers was installed in the mire and results confirm that the system is mainly groundwater fed. Chemical analysis and temperature recorded in the transects indicates an isolated water source which does not mix with surface water. This is linked with isotope analysis of the age of peat in various sections of the mire. Results of the analyses found that the mire is primarily sustained by lateral seepage water that hydrates the peat. However, upward movement of deeper, chemically distinct, groundwater was recorded. Erosion was shown to be a natural process in the mire stabilised by the rough structure of the tussocks and rhizomes characteristic of the vegetation. However, since the construction of a road, erosion has become more pronounced. This road intercepts some seepage water from the surrounding slopes. This slightly changes the energy of the water to produce surface water flows with a higher energy than is the case in an undisturbed scenario. This study shows that desiccation of peat and its subsequent physical and chemical breakdown is related to the current erosion channels. The result is that erosion formation accelerates beyond what the mire is able to balance through sediment input and sustained seepage water input from the slopes. Rehabilitation should aim to firstly reinstate the hydrological drivers of the mire (sufficient subsurface lateral input of water to sustain the peat) and secondly to stabilise priority gullies and headcuts.

PLATFORM PRESENTATION: SEED MIX TYPE AND PLANTING METHOD DO AFFECT RESTORED GRASSLAND DIVERSITY

Stuart Demmer*, Kevin P Kirkman and Michelle J Tedder

University of KwaZulu-Natal, email: 214518784@stu.ukzn.ac.za

Restoration ecology is a growing discipline and its application is resulting in numerous commercial start-ups, however, diversity and seed reintroduction at restoration sites remains a constant barrier to successful restoration. Several commercial seed mixes and mechanical planting methods have been developed to overcome these barriers. Whether commercial mixes are sufficiently diverse is understudied, while mechanically planting harvested seed often requires clean seed, causing some species to be removed from the mix. Fluid seed drilling techniques have been proposed to overcome these challenges. By suspending the seed in a cellulose based gel matrix which is injected into the soil with a mechanical planter, variably sized naturally harvested seed can be reintroduced to restoration

sites. No formal evaluation of fluid seed drilling's effectiveness and interactive ability with other planting techniques such as smoke water seed priming is known. This study therefore aimed to assess the grass recruitment, biomass production and diversity responses of commercial and harvested seed under different planting methods. Three seed types; *Eragrostis tef*, commercially obtained Biomosome® grassveld rehabilitation seed mix (BGR) and locally harvested veld seed mix (HVS) were planted under greenhouse conditions using four planting method treatments; seed only, seed and smoke water, fluid seed drilling, and a combination of smoke and fluid seed drilling. These data were analysed using generalised linear modelling and multivariate analysis of variance and ordination techniques. All recruitment proportions differed significantly. *Eragrostis tef* (0.53 ± 0.02) showed the greatest germination proportion followed by BGR (0.34 ± 0.02) and HVS (0.21 ± 0.02). Biomass production was greatest under HVS whilst BGR and *E. tef* resulted in similarly lower biomass production. Planting method did not affect seed recruitment proportion or biomass production. Shannon H diversity results for recruitment and biomass distributions were similarly high for BGR (1.10 ± 0.05 – recruitment, 0.76 ± 0.06 – biomass) and HVS (0.96 ± 0.05 – recruitment, 0.52 ± 0.06 – biomass). *Eragrostis tef* diversity was consistently lower (0.09 ± 0.05 – recruitment, 0.11 ± 0.6 – biomass). Multivariate analyses of BGR and HVS showed spatial separation of seed types and seed type x planting method for recruitment data and seed type for biomass data. BGR showed a higher recruitment similarity than HVS. Greater biomass distribution heterogeneity was detected under HVS than BGR. An overall dissimilarity of 74.79 % between BRG and HVS was calculated. Here *Cynodon dactylon* (34.15%), *E. curvula* (21.26%), *E. tef* (13.28%), *Panicum maximum* (11.46%), *Plantago lanceolata* (5.78%), *Chloris gayana* (3.10%), and *Themeda triandra* (3.09%) contributing importantly to this dissimilarity. This study showed that planting method effects on seed recruitment, biomass production, and diversity are minimal and so fluid seed drilling techniques should be explored further. Seed type can, however, greatly affect restored community plant density, biomass and diversity. Whilst BRG and HVS showed similar diversities, their species compositions differed. More homogeneous BGR communities suggested that these communities may be less adapted to ecological change compared to HVS communities. Careful restoration seed mix selection is advised.

PLATFORM PRESENTATION: SEEDLING GROWTH OF DIFFERENT GRASSES GROWN ON MINE SOIL FROM A DISTURBED AREA WATERED WITH SOLUTIONS OF VARYING SALINITY (NaCl)

Mziwanda Mangwane[1,2]*, Ignacio Casper Madakadze[2], Florence Nherera-Chokuda[1] and Sikhalazo Dube[3]

[1]Agricultural Research Council - Animal Production Institute, [2]University of Pretoria, [3]International Livestock Research Institute (ILRI), email: mziwanda.mangwane@yahoo.com

The spread of toxic substances in opencast coal mines threaten the ecosystem and wellbeing of human beings, which necessitates phytoremediation. Phytoremediation is a technique that involves the use of green plants to remove elemental contaminants from the soil into above ground through shoot biomass. This experiment was conducted to examine the salinity tolerance of different forage grasses grown on mine soil. Twenty seeds for each of *Eragrostis curvula* (L.) *cv* Ermelo, *Lolium multiflorum* (L.) *cv* Archie and AgriBoost, *Cynodon dactylon* (L.) *cv* Bermuda and *Panicum maximum* (L.) *cv* PUK8 were sown in pots containing mine soil and watered once daily using distilled water. At the two leaf stage, seedlings were thinned out to 10 seedlings per pot followed by an application of NaCl solutions of 0, 100, 200, 400, 600, 800, 1 000 mS m^{-1} or treated mine water (557 mS m^{-1}). The experimental setup comprised of 3 pots × 5 varieties × 8 treatments × 4 sampling periods (weeks) over 2 runs. At each sampling period, 3 pots/variety/treatment were destructively sampled to determine biomass production. Salinity significantly affected the total biomass over four weeks. Entry × treatment interaction was significant ($p < 0.001$) on total biomass. In all NaCl solutions, biomass production increased linearly for all entries until week 2, beyond which it declined sharply up to week 4. Despite the decline, Archie, AgriBoost, Ermelo and PUK8 produced fairly high biomass at 400, 600 and 800 mS m^{-1} at week 3. Entry × treatment interaction was significant ($p < 0.001$) on the rate of decline. Post week 2, biomass reduction for Archie, AgriBoost Ermelo and Bermuda declined with increasing salinity. PUK8 biomass reduction increased with increasing salinity. Biomass production for all varieties increased in a quadratic pattern when watered with treated mine water. Archie, AgriBoost, Ermelo and PUK8 showed a potential for phytoremediation of opencast coal mines irrigated with treated mine water.

PLATFORM PRESENTATION: EFFECT OF VETIVER GRASS COMPETITION AND SOIL NUTRIENT STATUS ON NATIVE GRASSES

Lindokuhle Xolani Dlamini*, Michelle J Tedder and Kevin P Kirkman

University of KwaZulu-Natal, email: Leendoh.lx@gmail.com

Vetiver grass (*Chrysopogon zizanioides* (L.) Roberty) is a densely tufted perennial C_4 grass from central India, used worldwide for soil and water conservation. It is a hardy, fast-growing, and densely rooted grass enabling it to withstand most environmental hazards (drought, frost, and floods). Worldwide use of vetiver is grounded in the claims that it does not compete with neighbouring grasses and it is not invasive. Recent studies have demonstrated that nitrogen deposition has dramatically risen after the industrial and agricultural revolution, and is expected to continue rising. Such increase is predicted to alter plant species coexistence, particularly in grasslands, through making limiting resources non-limiting, hence eliminating the competitive trade-off that allows species coexistence. The claims about vetiver competitive ability were investigated using a pot trial examining the competitive interactions between vetiver and four native grasses (*Eragrostis curvula*, *Digitaria eranthia*, *Panicum maximum* and *Hyparrhenia hirta*) under different soil nutrient levels. Vetiver tufts were growing with one native species per pot and the experiment was a full factorial design, laid out in a completely randomized arrangement with six replicates of each treatment combination, and 24 treatment combinations in total (i.e. N =144). Nutrient addition was achieved using 80% Hoagland's solution (N=172, P=25, K=188mg L^{-1}), and the relative interaction index (RII) and the percentage change in yield (Ry) were used as indices to assess the effect of competition and nutrient status on native grasses. Vetiver exerted a weak competitive effect on all native grass tufts, except for *D. eriantha*, under low nutrient status. Vetiver exerted a facilitative effect on *D. eriantha* under low nutrient status. However, vetiver exerted a strong competitive effect on all native grass species under high nutrient status, except for *P. maximum*, which responded similar under low and high nutrients conditions. This suggests that, generally, vetiver competes directly with native grasses irrespective of soil nutrient status, but its competitive ability increases with increase in soil nutrient status. As expected, all native species benefited from nutrient addition, with *D. eriantha* gaining substantially greater aboveground biomass (271.9% ± 23.9) compared to *E. curvula* (181.9% ± 28.27), *H. hirta* (192.27% ± 24.25), and *P. maximum* (169.48% ± 10.92), which did not differ significantly from one another. Overall, narrow-leaved grasses (*E. curvula* and *H. hirta*) had a weak competitive ability compared to broad-leaved grasses (*P. maximum* and *Digitaria eriantha*). Therefore, morphological traits are important to consider in competition studies and could predict species that might co-exist with vetiver. As soil nitrogen continues to increase globally, this will affect co-existence between native grasses and vetiver, with vetiver gaining an increased competitive advantage over native grasses. For this reason the claims that vetiver does not compete with neighbouring grasses need to be reconsidered and caution taken when using vetiver for soil and water conservation.

RESEARCH PROPOSAL POSTER VIEWING

SESSION CHAIR: MIKE PEEL

Wednesday, 25 July 2018, 15:55 - 17:00

Venue: ARC Training Centre Dining Room, Roodeplaat

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: AN ECOLOGICAL STUDY OF TARCHONANTHUS *CAMPHORATUS* (CAMPHOR BUSH) IN THE NORTHERN CAPE PROVINCE OF SOUTH AFRICA

Imke Jutta Stehn* and Nico Smit

University of the Free State, email: ijstehn@gmail.com

Bush-thickening resulting in decreased agricultural productivity, inaccessible thickets and increased occurrence of pseudo-droughts is a common phenomenon in the semi-arid southern African savanna. Until recently, land users paid little attention to *Tarchonanthus camphoratus*, but there is a growing awareness of the potential threat that this species presents, largely because it: (1) reproduces sexually (seeds) and asexually (root suckers), (2) is evergreen, thus requires water all year round, (3) is not readily browsed by domestic livestock or game, and (4) is fire tolerant. To ensure effective management of *T. camphoratus* this research is aimed to obtain a better understanding of the ecology of this species. The research will be conducted in the Rooipoort Nature Reserve west of Kimberley in the Northern Cape Province on deep well-drained sandy soil and on shallow rocky soil. The proposed methods include: (1) a study of the phenology of marked trees by allocating a monthly leaf carriage score with classification of leaves into different phenophases and noting the presence of flowers and fruits, (2) monthly measurements of shoot lengths and base diameters to measure growth rates, (3) assessment of the coppicing ability of cut plants that were felled in summer and winter to compare the effect of season of cutting on regrowth, (4) determination of the existence of a soil seed bank and performing germination tests on these seeds , (5) collecting soil from three different subhabitats (at the stem and in the canopied and uncanopied zone) for chemical analyses to assess soil enrichment, (6) investigation of possible allopathic effects by growing seedlings in soil from these sub-habitats under controlled conditions in a greenhouse, (7) quantify root biomass and depth distribution by excavating monoliths of soil and washing the soil from the roots and, (8) investigate the response to fire of *T. camphoratus* and a co-dominant species, *Senegalia mellifera*. In addition, regression equations relating spatial canopy volume to leaf and wood biomass according to the BECVOL-3 (Biomass Estimates from Canopy Volume) model will be developed from harvested undamaged and coppicing plants in accordance with Smit (2014).

RESEARCH PROPOSAL POSTER: ASSESSING LIVESTOCK GRAZING DISTRIBUTION ON COMMUNAL RANGELANDS OF CATA AND GUQUKA, EASTERN CAPE, SOUTH AFRICA

Thantaswa Zondani[1]*, Anthony Palmer[1], Andiswa Finca[1] and Sukhmani Mantel[2]

[1]Agricultural Research Council - Animal Production Institute, [2]Rhodes University, email: zondanit@arc.agric.za

Rangelands play a vital role and contribute significantly to the livelihoods and well-being of South Africans. They are the main source of forage for livestock which are considered as wealth (economical, cultural and spiritual) and they support livelihoods through the provision of several goods and services. Communal livestock is currently managed under a continuous grazing system where livestock free range with absence of herding. The aim of this study is to assess the effect of livestock grazing patterns on plant species composition in communal rangelands of Cata and

Guquka. The emergence of Geographical Positioning Systems (GPS) technology has resulted in significantly easy and flexible techniques of studying livestock behaviour and movement. Therefore GPS collars will be used to determine the livestock grazing pattern of 12 cattle (six in each study site). The GPS collars will be fitted on livestock to record their position at 15 minute intervals for four weeks in the dry and wet season. The data will be downloaded using CatLog Generation 2 and R Studio i386 3.1.1(statistic package). Data will then be imported into ArcGIS 10.1, to create density maps showing areas that are frequently grazed. Then species composition of these frequently grazed areas will be determined through a point to tuft distance method. The expected outcome is that the frequently grazed areas will have mostly decreaser grass species which shows the palatability and health of the rangelands such as *Digitaria Eriantha* and *Themeda Triandra*. When overgrazed these grass species stand the risk of being replaced by increasers grass species.

RESEARCH PROPOSAL POSTER: DETERMINING THE BCS (BODY CONDITION SCORING) OF GIRAFFES (*GIRAFFA CAMELOPARDALIS*) IN DIFFERENT FARMING SYSTEMS

Amaria Janse Van Rensburg* and Francois Deacon

University of the Free State, email: AmariaJvR@yahoo.com

Effective body condition scores have been developed for other wildlife species, such as: elephant (Fernando *et al*., 2009), black rhino (Reuter & Adcock, 1998) and arabian oryx (Alqamy, 2013). The main aim of this study will be to better understand giraffes' overall performance and condition and how to manage that better before the loss of physical condition. This will allow the recognition of BCS changes in time, in a non-invasive manner. Trying to apply this on giraffe in extensive systems will be novel, and monitoring the different factors will help to understand and manage giraffe better. Variable factors such as habitat loss and fragmentations are known to be some of the biggest causes for animals to lose physical body condition. This study will investigate links between the habitat and animal health in extensive systems by developing a BCS through visual examination and by inspecting possible factors that can lead to or indicate a change in the BCS. This monitoring will include the inspection of endo-parasite infestation, tree biomass and nutrient quality of the food that giraffe consume. Included for the study are giraffe populations existing on five different reserves, where giraffe within the Free State are considered as an extralimital herbivore. Part of the investigation will also include bacterial and virological monitoring and will be analysed at the microbiology department. The 5 reserves differ greatly in terms of management practices, which we expect to be adding to the factors. Faecal samples will be analysed by the state veterinarian for each of the specified individuals using the MacMaster method (MAFF, 1986). Plant samples will be analysed for nutrient quality and to determine nutritional deficiencies (Janecke & Smit, 2011). The biomass and dry matter will also be determined, as well as which species are favoured and utilised, using the BECVOL-model (Smit, 1989). A full genome virus detection using sensitive nucleic acid preparation will be used to identify any viruses present (Cotten, *et al*., 2014). The BCS system and criteria was set up by Kearney & Ball in 2001 on giraffe that lived in captivity and zoo-systems. Hypothesizing that fluctuations in the parasite-load will possibly be linked to a reason/s, such as feeding habits and management practices leading to a change in physical condition. With giraffe resources and biodiversity rapidly shrinking in Africa, we need to understand conservation and resource management within different environments better, in order to improve our management decisions. If physical conditions of giraffe can be evaluated objectively, it can be used to manage the giraffe and their remaining resources more effectively.

RESEARCH PROPOSAL POSTER: DETERMINING THE STATUS AND DEVELOPMENT OF A CONSERVATION PLAN FOR GIRAFFE (*GIRAFFA CAMELOPARDALIS GIRAFFA*) IN SOUTH AFRICA

Cara-Anne Van Der Merwe[1]*, Francois Deacon[1] and Kelly Marnewick[2]

[1]University of the Free State, [2]Endangered Wildlife Trust, email: caravandermerwe95@gmail.com

The South African giraffe, *Giraffa camelopardalis giraffa*, together with the Angolan giraffe, *Giraffa camelopardalis angolensis*, populations coexist in South Africa after being reintroduced into areas where they historically occurred and did not occur (extralimital). However, many of these subpopulations were and are being translocated into areas without real knowledge on their taxonomic status, adaptation success or habitat suitability, as well as taking into consideration the possibility of inbreeding. The aim of this study is to fill this gap by determining the status and developing of a conservation plan for the South African giraffe subpopulations in South Africa in terms of creating a

habitat suitability index to improve the success rate of these translocations in the future. As what the aim was with other wildlife species such as the white rhino, *Ceratotherium simum*, (Knight, et al., 2015) and the cheetah, *Acinonyx jubatus*, (Lindsey & Davies-Mostert, 2009), etc. In general this plan will help, firstly, to understand but also then to develop a status distribution and habitat suitability map of giraffe in the different biomes of South Africa, including past and present translocation successes. Firstly, this study serves to develop a baseline/guideline for the development of a habitat scoring system to assist farmers in determining giraffe habitat suitability before giraffes are translocated. Secondly, it serves to create a baseline/guideline for future genetic studies to determine the genetic integrity of the subpopulation and to avoid inbreeding or the unnecessary loss of animals. In addition, this study will help to improve future decisions and translocations. Historical translocation data within each province and between provinces, nature reserves and private stakeholders owning giraffe will help to determine the outcome. From the datasets a detailed analyses will be done on how many individuals were translocated, the success of these translocations and how the translocations were in combination with preferred habitat types. The index will make use of historical distributions and more recent as well as current data on giraffe in the country with suitable habitat perimeters. This in turn will help to provide outcomes for management and future decision making to keep a healthy and divers genetic giraffe population in SA. This will be done primarily by obtaining all current information on the presence/absence of giraffes for specific habitat types, their actual numbers and translocation details from all national and provincial nature conservation agencies, in order to establish as well as evaluate the current available data on giraffe in South Africa. Thereafter, specific organisations will be contacted to distribute data mining surveys to individual game ranching members, along with direct interviews/phone calls with individual game ranchers.

RESEARCH PROPOSAL POSTER: DROUGHT RESISTANCE AND RECOVERY OF FORAGE LEGUMES IN THE GENERA *MEDICAGO* AND *TRIFOLIUM*

Francuois Müller[1]*, Lincoln Raitt[2] and Lilburne Cyster[2]

[1]Agricultural Research Council - Animal Production Institute, [2]Department of Biodiversity and Conservation Biology, University of the Western Cape, email: mullerf@arc.agric.za

In South Africa, it is estimated that approximately 16.9 million hectares of land is suitable for the establishment of forage legumes. In the Western Cape, approximately 2.5 million hectares of land is currently being cultivated, of which an estimated 600 000 hectares is planted with legumes. The most important annual pasture legumes cultivated in the Western Cape are annual *Medicago* (*M. polymorpha*, *M. truncatula*) and *Trifolium* (*T. subterraneum*, *T. michelianum*) species. Because these Medic and Clover species used in South African pasture-crop rotations are not native to South Africa, they first need to be tested for their ability to adapt to specific agro-ecological, bioclimatic and edaphic conditions. The current stock of commercially available forage legumes are well adapted to the current bioclimatic conditions of South Africa. However, climatic predictions for the Western Cape are indicating a trend of becoming hotter and drier. Unfortunately, no information is currently available in South Africa to predict the responses of commercially available Medics and Clovers to future changes in bioclimatic conditions. These future changes in the bioclimatic conditions of South Africa, specifically the amount and distribution of rainfall and rising temperatures within the Western Cape, could significantly affect the success of these legume-based pastures, affecting the establishment of these species/cultivars and their persistence. It is therefore important to obtain a greater understanding of how currently commercially available cultivars of annual forage legumes will respond to the predicted bioclimatic changes, especially changes in moisture availability and rising temperatures during germination and establishment of the forages. This in turn, could play a major role in the establishment of these forages under the predicted marginal conditions within the Western Cape. The aims of the current study are therefore: 1) to quantify the germination responses of Medics and Clovers to temperature and water stress; 2) to quantify seedling establishment, growth, and development under different levels of water-limitation, and; 3) to quantify the ability of Medics and Clovers to recover after different levels of water-limitation.

RESEARCH PROPOSAL POSTER: EFFECT OF TRANSLOCATIONS ON THE FAECAL GLUCOCORTICOID METABOLISM LEVELS OF *GIRAFFA CAMELOPARDALIS*

Ciska Scheijen[1]*, Andre Ganswindt[2], Ilse Luther-Binor[3] and Francois Deacon[1]

[1]University of the Free State, [2]Mammal Research Institute, University of Pretoria, [3]GEOsperm, Wildlife Reproduction and Biotechnology Services, email: ciskascheijen@gmail.com

Giraffe *(Giraffa camelopardalis)* are currently listed as 'vulnerable' on the IUCN red list as populations have declined by almost 40% and have become extinct in seven African countries over the last three decades; hence, the increasing need to move groups of individuals for conservation and management purposes. Despite this, literature on the translocation of giraffes is lacking, and could be ascribed to the high risk activity thereof for both humans and giraffes. It is known for many species that translocations are stressful events, which can lead to mortalities. Long-term stress can have a negative effect on the immune and reproductive function as well as disease resistance of an individual. The aim of this study is to identify the least stressful translocation method for giraffe. To deal with stressful situations, glucocorticoids are secreted by the adrenal glands. Modern techniques allow metabolites to be measured in the faeces of animals, also called faecal glucocorticoid metabolism (fGCM). This research focusses on different methods of translocation and their effects on the fGCM levels of the giraffes. Translocations throughout South Africa will be monitored from one game farm/reserve to another. Pre- and post faecal samples will be collected at both sites (primary and secondary locations). In some cases the animal will first be moved to a boma before release into their new environment. Samples will also be collected during that period. Samples will be preserved on ice in the field and stored in a freezer until it will can be analysed using the 3α ,11-oxo– CM enzyme immuno-assay. A pilot study in 2017 has been done on six sub-adults (three males and three females). The giraffes were translocated from one game reserve (36 000 ha) to another (3 500 ha), both situated in the Northern Cape, South Africa. The farms are approximately 130 km apart with similar climates and vegetation. The giraffes were released directly into their new environment. As the glucocorticoid metabolites have a delay of 1.6 days, pre-samples were taken from the rectum on the day of translocation. Only during the second week after the translocation, the giraffes allowed researchers to get close enough (approximately 150 m) to collect samples, suggesting that they already started to feel less stressed than the first week (where sample collection was impossible). Only one sample at day 6 after translocating showed significantly elevated fGCM levels (5.86 times higher) compared with the pre-samples taken from the rectum. Nonetheless after two weeks the fGCM levels seem to still be slightly higher (ranging from 1.96-4.85, µ3.56) compared to prior to translocation (ranging from 1.00-2.89, µ1.96).

RESEARCH PROPOSAL POSTER: EXPLOITATION OF *SERIPHIUM PLUMOSUM* WOODY PLANTS AND PASTURE-BASED FEED INGREDIENTS FOR IMPROVEMENT OF GROWTH RATE, CARCASS AND MEAT QUALITY OF SOUTH AFRICAN FREE RANGE BEEF

Motswapo Phoko[1]*, Julius Tjelele[1], Peter Scogings[2], Phillip Strydom[1] and Klaas-Jan Leeuw[1]

[1]Agricultural Research Council - Animal Production Institute, [2]University of KwaZulu-Natal, email: motswapophoko@gmail.com

Seriphium plumosum is an indigenous, woody, perennial shrub-let, with greyish, slender and wiry branches. *S. plumosum* encroachment decreases the grazing capacity of grassland by approximately 80%. Due to this encroachment threat in South African grassland, most farmers tend to lose about 100% of their natural veld. Despite the fact that it is detrimental to grazing capacity, which subsequently affects livestock productivity, this plant, is useful in other aspects. *S. plumosum* yield volatile oil and provide long lasting foliage. However, its use as ruminant supplement is unknown. This study seeks to evaluate the use of *S. plumosum* and natural pasture-based feed ingredients (maize, silage & peanut hay) as supplements on Free Range Beef for improvement of growth rate, carcass and meat quality. The objectives are 1) to formulate a diet supplement in Free Range Beef using *S. plumosum* 2) to compare growth performance, meat sensory and nutritional quality of Free Range Beef fed *S. plumosum* and natural pasture-based feed ingredients. Three on-farm trials will be conducted in three provinces i.e. Limpopo, Mpumalanga and Gauteng provinces. The study will be designed as completely randomised with a 2 x 4 factorial arrangement of treatments (1 control, 1 natural pasture grazing, 1 maize, 1 maize + silage, 1 maize + peanut hay). Forty ± 30 months old mixed breed animals will be divided into four groups of 10 steers per group. Growth performance will be measured fortnightly throughout the 90 days experimental period. Difference in weight

gain will be determined by weighing animals at the beginning of experiment, then minus weight gained within every 14 days. Nutritional composition of the feed ingredients and test diets will be evaluated at ARC Nutrition Labs. Twenty-four hours prior to slaughter, animals will be weighed and transported to Cavallier abattoir. At the abattoir, the animals will be slaughtered and dressed following the standard commercial procedures. Data will be analysed using the PROC MIXED procedure of SAS (2009).

RESEARCH PROPOSAL POSTER: LUCERNE CULTIVAR EVALUATIONS UNDER SUBTROPICAL CONDITIONS

Francuois Müller, Marike Trytsman, Letty Masemola and Isaac Kgonothi*

Agricultural Research Council - Animal Production Institute, email: mullerf@arc.agric.za

Medicago sativa (Lucerne) is a perennial legume species that is cultivated worldwide. It is arguably the most widely used pasture and hay crop in South Africa due to its high palatability and high forage quality. Only Lucerne cultivars that are registered on the South African variety list may be sold in South Africa. There are approximately 46 different cultivars on this list that are bred for specific agro-ecological conditions. The number of cultivars on this list, however, regularly changes. These cultivars are then further divided, based on the degree to which they are dormant during the winter. Winter dormancy, based on the American ranking system, ranges from 1 which is highly dormant during winter, and 11 which is highly winter active. Due to the large number of Lucerne varieties available and the corresponding large variation in winter dormancy, it is often challenging for livestock and hay producers to select a variety that is best suited to their specific agro-ecological requirements. This is because dormancy class not only affects the seasonal distribution of production in Lucerne, but is often associated with the ability of the variety to handle environmental stressors such as cold and drought, and its tolerance to grazing. In turn, varieties within a dormancy class often show large variation in terms of production potential, persistence and resistance to pests and diseases. Therefore, it is important to know the production potential of cultivars under particular bioclimatic and edaphic conditions. We therefore propose the need to urgently evaluate the production of all available Lucerne cultivars under the same agro-ecological conditions in the Pretoria area, where bioclimatic conditions are classified as moderately dry sub-tropical in nature, with long hot and rainy summers and cool, short and dry winters.

RESEARCH PROPOSAL POSTER: MANAGEMENT STRATEGIES TO SUPPORT SUSTAINABLE PRODUCTION OF LUCERNE IN LONG-ROTATION CROPPING SYSTEMS

Christoff Van Der Westhuizen[1], Johan Labuschagne[1,2], Tertius Brand[2] and Pieter Swanepoel[1]*

[1]Stellenbosch University, [2]Western Cape Department of Agriculture, email: 18448240@sun.ac.za

Lucerne (*Medicago sativa*) forms part of long-rotation cropping systems integrated with livestock in the southern Cape of South Africa. The region has a predominantly winter-rainfall pattern resulting in low productivity during cold winters and dry summers. Integration of livestock in cropping systems may improve resource utilisation. The aim of this study is to determine whether it is viable to establish a high quality forage for cropping systems integrated with livestock through oversowing dryland lucerne. For the pasture to be considered viable, the soil quality must be maintained or improved, productivity of the lucerne phase must be enhanced and the forage must be of a high enough quality to increase the number of animals it can sustain when compared to a pure lucerne sward. Field experiments will be conducted at Tygerhoek Research Farm (Riversonderend) during the 2018 and 2019 growing seasons. The experiment will be laid out in a split-plot design with four replicates. Whole plots will consist of 12 species compositions and sub-plots will have two levels of crop residue (high or low) in which lucerne was sward was established in 2017. Each sub-plot will cover an area of 2.5 x 24 m. Species composition treatments involve oversowing either single species or mixes of species into a lucerne base that was established in April 2017. Single species treatments will include oats, forage barley, stooling rye, westerwolds ryegrass, forage radish and canola. Mixes will consist of various combinations of hybrid ryegrass, Italian ryegrass, forage barley, oats, various annual *Medicago* and clover species, vetch and forage radish. Herbage production and agro-ecosystem benefits will be assessed according to soil, plant and herbage quality measurements. Representative soil samples will be taken annually for the duration of the study at depths of 0-15 cm and 15-30 cm. Standard soil fertility tests will be performed to evaluate if there was any improvement in soil fertility. Additional soil test indicators will include organic C, total N, C:N, active C, microbial biomass C, potentially mineralisable N, soil enzyme activity, nematode population

composition and aggregate stability. Lucerne longevity, herbage production, herbage removal during grazing and both pre- and post-grazing species composition will be measured to determine the best oversown treatment. Herbage quality will be assessed through analyses for dry matter, ash, crude protein, fat, crude fibre, acid detergent fibre, neutral detergent fibre and total digestible nutrients will be calculated. The identification of a more productive lucerne phase may increase overall productivity of farmers in the southern Cape. Possible spin-offs of livestock integration may include diversified income through wool and meat production, as well as weed suppression, environmental stability, reduced nutrient leaching and improved resource utilisation. Further research is required to realise the full potential and effect of an improved lucerne phase.

RESEARCH PROPOSAL POSTER: OBJECTIVE CALCULATION OF A RESILIENCE SCORE, USING UNGULATES, PLANTS AND SOILS AS INDICATORS

Wesley Black[1]*, Francois Deacon[1] and Pieter Zietsman[2]

[1]University of the Free State, [2]National museum, email: wesremus@yahoo.com

Using vegetation as a primary indicator of the state of rangeland health is based on the assumption that vegetation is a reliable mirror of its ecological environment. Over the years this assumption has led to the development of many rangeland condition scoring methods, however vegetation is not the only aspect of an ecosystem. Investigating literature, it was found that rangeland soils and their associated properties are one of the least studied aspects of rangeland ecology, especially research which connects the above-ground condition of rangelands and the below ground condition of soils. Soil, animal and plant health each affect the overall condition of a rangeland, measuring these three aspects together, in order to objectively score the veld, is severely complex. It has been well documented that there is a reciprocal relationship between herbivores and the condition and composition of the plants they utilize. This study will broaden the traditional view of veld condition scoring to incorporate soil condition and aim to develop a plant based method using correlations. This will be achieved by assessing the condition of the veld whereby it incorporates the soil condition based on soil quality indicators. The soil condition could then correlate with the ecological and/or agricultural plant status. Providing them both an ecological resilience score and an agricultural score at the same time. Soil benchmarks may also be calculated and scored based on known soil quality indicators. To be as objective as possible, ten individuals of four herbivores species will be collared using GPS collars in the Northern Cape. The data will be expressed as heat maps of preferred and avoided areas. On these preferred and avoided areas both vegetation samples and soil samples will be taken for analysis, and a variety of both ecological and agricultural vegetation surveys will be done. Both the soil benchmarks and the ecological resilience score are novel ideas and will aid rangeland scientists in the future.

RESEARCH PROPOSAL POSTER: MAPPING PATTERN AND SPATIAL DISTRIBUTION OF *SERIPHIUM PLUMOSUM* (SLANGBOS) INVASIVE SPECIES USING SENTINEL 2 IMAGERY IN GAUTENG PROVINCE, SOUTH AFRICA

Mduduzi Ndlovu[1]*, Abel Ramoelo[2], Julius Tjelele[3] and Elhadi Adam[4]

[1]Gauteng Department of Agriculture and Rural Development, [2]Council for Scientific and Industrial Research (CSIR), [3]Agricultural Research Council - Animal Production Institute, [4]University of the Witwatersrand, email: mduduzi.ndlovu@gauteng.gov.za

In South Africa, the problem of invasive species encroachment has been a concern for many years and it is anticipated to intensify. *Seriphium plumosum* is an indigenous shrub species of Asteraceae family that has converted most rangelands in the grassland biome into less productive shrub land, particularly in the Eastern Cape, Free State, Mpumalanga, North West and Gauteng provinces. This shrub outcompetes the resident grass species and endangers valuable grasslands which are the main source and cheapest forage available for livestock and wildlife. Thus, there has been a great reduction in grazing capacity and stocking rate on rangelands, which has affected the livestock production for both subsistence and commercial farmers. Although *Seriphium plumosum* occurrence is attributed to the interaction of different factors such as continuous anthropogenic-related disturbance, heavy grazing, fire regime, climate change, management regime and animal seed dispersal, it is still highly complex, debatable and controversial at times. There is very limited scientific knowledge about the plant's preferred habitat and very little has been published on species distribution patterns and extent of encroachment. Thus, effective control strategies will require accurate detection, spatial distribution patterns and to quantify the extent of encroachment. Traditionally, identification, monitoring and mapping of invasive species were done through field survey which is still useful and

provides detailed information. However, they are rarely feasible, costly, time-consuming, and inefficient for larger scale areas and in inaccessible terrain. Remote sensing technology offers economical, efficient and practical methodology to identify or discriminate and quantity invasive species. The project aims to use Sentinel-2 with improved finer resolution (10 m) to identify and quantify the spatial distribution of *Seriphium plumosum* using Sentinel 2 imagery and Random Forest and Support Vector Machine Classifiers. Red Edge with 3 bands, gives sensors the ability to detect biophysical and biochemical properties of target species. Thus, sensor's red edge enable it to discriminate between plant species. Objectives are to (1) Identify a robust and reliable method for discriminating *Seriphium plumosum* from native grass species communities, (2) To test the applicability of Object based Image Analysis (OBIA) on Sentinel-2 bands combined with environmental variables such as species phenology and texture using machine learning techniques such as RF and SVM and (3) Compare the mapping capabilities of the Pixel based and Object based Image analysis using machine. learning algorithm such as Support Vector Machine (SVM) and Random Forest (RF) as classifiers.

RESEARCH PROPOSAL POSTER: THE DIVERSITY-STABILITY DEBATE: DO WE KNOW THE UNDERLYING MECHANISMS?

Stuart Demmer*, Kevin P Kirkman and Michelle J Tedder

University of KwaZulu-Natal, email: 214518784@stu.ukzn.ac.za

The diversity-stability debate is among the longest running ecological debates. For decades empirical studies have been carried out, however, many of these have only considered a limited number of diversity and stability indices. This has restricted our understanding of the specific mechanisms driving stability. Recent reviews have consistently called for more experimental research measuring diversity and stability beyond only grass species and biomass production whilst suggesting that the inter-trophic level complexity is likely an important driver. If this idea is true, then understanding each trophic level's importance and contribution towards ecosystem stability is key to advancing both empirical and applied ecology which could aid ecosystem conservation efforts. This project aims to contribute importantly to the debate by expanding our understanding of these mechanisms. Firstly, a systematic map of the current status of the diversity-stability debate within the grassland ecosystem will be carried out to quantitatively identify knowledge gaps and knowledge clusters for future systematic reviewing and meta-analyses. Secondly, field experiments where four trophic levels (insects, grasses, forbs, belowground microbes) will be removed from grassland plots will be initiated. The resulting effect on grassland ecosystem stability (measured from both biotic and abiotic ecosystem components) will then be quantified and the results discussed.

RESEARCH PROPOSAL POSTER: THE EVALUATION OF BUSH CLEARING AT MELTON LIC, NORTH WEST PROVINCE

Ernest Mokua

North West Department of Rural, Environment and Agricultural Development , email: emokua@nwpg.gov.za

The control of encroaching woody plants is a tremendous problem worldwide since control methods are frequently not economically justifiable. Information gathered about the effects of bush clearing in grazing areas of South African savannah biomes may have not necessarily been aimed at relating the consequences to monetary gain or loss. However, it is evident that there has been ecological benefit in the use of arboricides in controlling woody plants. The fact of the matter is farmers are interested in striking the balance between money spend on control operation and veld improvement realised. It is therefore necessary to evaluate commonly used bush control arboricide in order to ascertain its effectiveness and practicality to small-scale and commercial farmers. The aim of the project is to evaluate the financial viability, implications and ecological gain of bush clearing. To achieve this, the efficiency and effectiveness of different application rates of Tebuthiuron granules on the control of indigenous woody plants will be evaluated and monitored on Melton LIC in the Dr Ruth Segomotsi Mompati district of the North West province. Tebuthiuron is a soil applied arboricide with long residual action for the control of woody plants in natural grazing. For the treatments a number of trees/shrub species will be identified for elimination/thinning at the time of trial establishment relying solely on the use of an arboricide Tebuthiuron. The identified trees/shrubs will be given appropriate dosage of this arboricide and their canopies left intact. The arboricide will be applied in the soil around the base of the target plant. The study site is comprised of 15 plots of one hectare each in a randomized block design. Within each plot, the woody plants will be thinned to represent the different treatments, according to bush density and application rate, ranging from 50 % below-, 25 % below-, 0 %, recommended and 25 % above

recommended dosage treatments. After the treatment has been applied, the effectiveness will be monitored over a period of time and different surveys will be carried out to collect different data aspects. Annual grass surveys will include herbaceous production, species composition, herbaceous (quality) analysis as well as soil seed bank studies. Every third year a more comprehensive grass basal cover survey will take place. Woody plants surveys will include bush density and dry matter production, carried out on a biennial basis. Soil samples and rainfall will be monitored. Multivariate Data Analyses will determine changes in tree species composition, biomass production and general phonological characteristics, and collectively used to evaluate different treatments for tree growth and mortality over time. Correlations between species occurrence, environmental and soil factors will also be carried out. The statistical programs Genstat (Payne, 2014) or Statistica will be used to carry out analysis of variance (ANOVA's). Treatment means will be separated using Fisher's protected t-test least significant difference (LSD) at the 5 % level of significance (Statistica for Windows, 1995). Costing will be done regarding labour and arboricide with regards to effectiveness and application times, to ascertain its effectiveness and practicality to small-scale and commercial farmers.

RESEARCH PROPOSAL POSTER: THE USE OF REMOTE SENSING TO PREDICT *SERIPHIUM PLUMOSUM* ENCROACHMENT SUSCEPTIBILITY

Nonkwekhwezi Princess Myeki[1]*, Hosia Pule[1], Julius Tjelele[1] and Solomon Tesfamichael[2]

[1]Agricultural Research Council - Animal Production Institute, [2]University of Johannesburg, email: myekin@arc.agric.za

Remote sensing can be used to detect vegetation condition and soil degradation caused by among other factors, woody plant encroachment. In South Africa, *Seriphium plumosum* encroachment threatens the sustainability of grasslands because it reduces grass species composition, diversity and increases the runoff of water and nutrients. However, its causes on rangelands communities remain little understood, yet important in managing its encroachment, particularly in the semi-arid grassland communities. Although local factors such as fire suppression, herbivory, soil texture and fertility are proposed to interact to cause woody plant encroachment worldwide, these factors are however, not adequately explored as causes of *S. plumosum* encroachment. To this end, the study seeks to explore the use of remote sensing to explore the role of soil texture in facilitating *S. plumosum* encroachment susceptibility in South African grassland communities. We hypothesise that an increase in coarse soil texture will increase *S. plumosum* density because of the separation in rooting depth between herbaceous and woody or shrubby plants, which allow woody or shrubby plant to use mainly water in deep soil profile. Data on soil texture (sand (%) and silt (%)) will be derived using ArcGIS (Version 10.5) software. Data on *S. plumosum* density will be obtained in the field by counting in a 2 m x 50 m plots from 34 *S. plumosum* encroached livestock farms in the Gauteng province. Since the assumption is that soil texture will influence *S.plumosum* encroachment susceptibility, a regression analysis will be used to determine the correlation between soil texture (sand (%), silt (%)) and *S. plumosum* density. The results obtained in this work will contribute to insight necessary to understand the relationship of *S. plumosum* with soil texture in South African grassland communities. Consequently, this information will contribute to managing and controlling *S. plumosum* encroachment of rangelands.

PARALLEL SESSION A: FEEDING ECOLOGY

SESSION CHAIR: TONY PALMER

Thursday, 26 July 2018, 08:00 - 08:40

Venue: ARC Training Centre Main Room, Roodeplaat

PLATFORM PRESENTATION: THE INFLUENCE OF PHENOLOGY ON BROWSE AVAILABILITY FOR GAME SPECIES IN A SEMI-ARID ENVIRONMENT OF THE NORTHERN CAPE PROVINCE

Marnus Smit[1]*, Francois Deacon[2], Paul Malan[2] and Nico Smit[2]

[1]Northern Cape Department of Environment and Nature Conservation, [2]University of the Free State
email: zmsmit.denc@gmail.com

The phenology of plants is known to influence the availability of food to browser game species, and ultimately their habitat selection and diet preferences. Phenology studies on woody plants done in the central and eastern regions of South Africa further highlighted the effect of phenology on browse availability and plant palatability. In the highly seasonal semi-arid environments of the Northern Cape Province of South Africa, the phenology of woody plants is expected to play an even greater role in food availability and palatability due to distinct wet and dry seasons and large temperature variations between summer and winter. To determine the potential impact of phenology on browse availability in a semi-arid environment, the phenology of twenty abundant woody plant species of the South-eastern Kalahari was studied in the Witsand Nature Reserve. A total of 10 - 30 individual plants representative of the population of each of the studied woody species were marked and inspected monthly. During each inspection, plants were allocated a leaf carriage score and leaves classified into different phenophases (budding leaves, young green leaves, mature green leaves, yellowing leaves and dry leaves still attached to the plant). The presence of flowers and fruits or pods were also recorded. Mean monthly leaf carriage scores were calculated and changes in phenophases of species over a year cycle determined. Strong seasonal influences on plant phenology were observed, especially in the case of the winter deciduous woody species. Most of the winter deciduous species started dropping leaves with the onset of the early dry season (May) and were largely leafless throughout the late dry season (Aug-Nov). Two regional dominant species, *Senegalia mellifera* (Black thorn) and *Rhigozum trichotomum* (Three thorn), were found to flush new leaves only as late as mid-December. The results highlighted the importance of palatable evergreen species such as *Boscia albitrunca* (Shepherd's tree), *Vachellia haematoxylon* (Grey camel thorn) and *Vachellia erioloba* (Camel thorn) as a food source during the late dry season. Where these evergreen species occur in low densities, the time of flowering and availability of pods/fruit may be crucial for game species to bridge this critical period. The implications of seasonal plant phenology changes on the management of browser game species in the semi-arid Northern Cape are discussed.

PLATFORM PRESENTATION: LEAFHOPPERS ASSOCIATED WITH RANGELANDS IN SOUTH AFRICA

Michael Stiller

Agricultural Research Council, email: stillerm@arc.agric.za

Leafhoppers are small jumping and flying insects with sucking mouthparts. Immature stages hatch from eggs inserted into plant tissue and resemble adults without wings, but that grow larger after every moult. Their sap-sucking habit, in phloem, xylem or superficial cells, means they are not noticed as easily as chewing insects such as grasshoppers, caterpillars, beetles or termites, and have the potential to transmit plant bacteria and viruses. Much is known about the grass-living insects of the Savanna biome through various studies, such as surveys of the grasshopper fauna of Nylsvlei and grasshoppers as grassland indicators. Some studies in the Drakensberg have examined the recolonization of invertebrates after fire. Leafhoppers are the most species rich group of the *Heteroptera* estimated at 700 species from records in the National Collection of Insects. Species are classified mainly by the structure of the male sex organ, and females often feeding only recognized by association with males while nymphs, are usually also difficult to associate. Pheromones and ultrasound play an important role in the communication between adults. The aim of this study is to use leafhoppers endemic to the Grassland or wide-spread in the Savanna Biome as an indication of biodiversity and habitat conditions, such as grazing and burning. Methods to collect leafhoppers include the sweep net, a strong net on a short stick to sweep through grass and shrubs and

vacuum machines, but also pan traps, sticky traps, malaise traps, intercept traps, sometimes pitfall traps, although the latter do not directly reflect an associated plant. Fogging is also suitable for leafhoppers and plant associations. Qualitative sampling of leafhoppers and associated feeding plants produced museum based specimens and supplemented by fieldwork. Curation required sorting, card pointing and pinning representatives, labelling, identification and accession. Systematic work has revealed 110 species in 40 genera in the Savanna, and 70 species in 14 genera in the Grassland Biome. This is a conservative estimate that excludes the leafhoppers that feed on superficial plant tissue, the Typhlocybinae. Savanna leafhoppers are generally long-winged, suggesting migratory behaviour and are wide-spread Afrotropical distribution and are expected to colonise regrowth in burned habitats. Most Grassland Biome leafhoppers are short-winged and thus unable or slow to recolonise regrowth in burned or overgrazed habitats. One species thrives on unpalatable species of *Merxmuellera* in the Eastern Cape Province. Leafhoppers with tree or shrub associations such as *Boscia*, *Galenia* and *Pentzia* has started recently. Many species were described from the Fynbos Biome mainly on shrubs, but many more require systematic work, with even more in the other biomes. Some leafhoppers appear to follow floristic links between the Fynbos and Grassland biomes, and even seem to show speciation in floristic centers of endemism. Thus high numbers of species and large population size despite small size of specimens, make leafhoppers a suitable group to study rangeland or grassland biodiversity.

PARALLEL SESSION A: LIVESTOCK IMPACTS ON RANGELANDS

SESSION CHAIR: TONY PALMER

Thursday, 26 July 2018, 08:40 - 09:40

Venue: ARC Training Centre Main Room, Roodeplaat

PLATFORM PRESENTATION: DISTRIBUTION AND BOTANICAL COMPOSITION OF GRASS SPECIES IN RELATION TO DISTANCE FROM THE FENCE-LINE IN SIX COMMUNAL GRAZING LANDS LOCATED IN THREE SOIL TYPES

Solomon Beyene[1], Ayanda Kwaza[2], Victor Mlambo[3] and Keletso Mopipi[2]*

[1]University of Fort Hare , [2]University of the Free State, [2]Eastern Cape Department of Rural Development and Agrarian Reform, North-West University, email: ayanda.kwaza@drdar.gov.za

The study examined the composition and distribution of grass species along a distance gradient from fenceline in the communal grazing lands of the Eastern Cape semi-arid rangelands. Six communal grazing lands, two in shallow, red sandy-ground (SRSG) soils, three in shallow, dark sandy-loam (SDSL) soils, and one in deep, dark clay-loam (DDCL) soils were selected. Data were collected at near (100 - ≤ 300 m) and far (> 300 m) sites from each fenceline. In total, 31 grass species were identified, 90% of which were perennials. Several grass species showed great variations between grazing lands and distance points from the fenceline. In SRSG, the abundance of Digitaria eriantha was greater (Abstract incomplete, please view on Dryfta app).

PLATFORM PRESENTATION: SOIL CHEMICAL AND PHYSICAL STATUS IN RELATION TO DISTANCE FROM THE FENCE-LINE IN SIX SEMI-ARID COMMUNAL GRAZING LANDS AND IMPACT OF EXCLOSURE

Solomon Beyene[1], Ayanda Kwaza[2], Victor Mlambo[3] and Keletso Mopipi[2]*

[1]University of Fort Hare , [2]University of the Free State, [2]Eastern Cape Department of Rural Development and Agrarian Reform, North-West University, email: ayanda.kwaza@drdar.gov.za

In South African communal rangelands, the local and spatial distribution of soil properties has not been adequately documented, in particular, in response to disturbance and abiotic factors. In addition, the use of enclosures has globally gained popularity as an effective strategy to enhance soil nutrient contents and properties, but in the country, empirical evidence that investigated the effect of enclosures on soil variables is lacking. This study therefore investigate the effect of communal grazing site, distance from the fence line and enclosures on the soil status of rangelands in six communal areas located in three soil types namely; Shallow, red stony-ground (SRSG), Shallow, dark sandy-loam (SDSL) and Deep, dark clay-loam (DDCL). 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 sites (>- 300 m) from the fence line depending on the vegetation change. Soil samples were collected from the protected and unprotected plots distributed across the near, middle and far sites. The sand, silt and clay contents showed similar levels in all the three soil types. In SRSG soil, soil Ca, Mg, OC and N levels differed (Abstract incomplete, please view on the dryfta app).

PLATFORM PRESENTATION: COMMUNAL LIVESTOCK MANAGEMENT FOR REHABILITATION AND LIVELIHOOD OUTCOMES: PROGRESS TO DATE

Helen Fox and Kate Rowntree*

Rhodes University, email: helenthefox@gmail.com

The Department of Environmental Affairs, through its Chief Directorate of Natural Resource Management (DEA NRM), has initiated an intensive rehabilitation programme to heal the badly degraded Tsitsa catchment. This is in light of the large Ntabelanga and Lalini dams planned for the area, which will have a shortened life span if the erosion of sediment is not addressed. The underlying approach of the Ntabelanga and Lalini Ecological Infrastructure Programme (NLEIP), the Science Management nexus of the Tsitsa rehabilitation project, is to link rehabilitation with Sustainable Land Management (SLM) and livelihood opportunities. The Sinxaku villages occurs in a particularly degraded area of the catchment and erosion is difficult to control due to the highly dispersive nature of the soils. Tunnel erosion has been a primary cause of the deep gullies that dissect the area and any form of structural erosion control mechanisms that lead to ponding of water can exacerbate the problem. Former cultivated fields have been abandoned, becoming erosion hotspots due to loss of soil structure and a low vegetation cover. The most effective soil and water conservation strategy on these soils is believed to be the recovery of the vegetation cover through effective grazing strategies. This is problematic in communal lands such as characterize Sinxaku due to the breakdown of communal institutions controlling livestock grazing. A WRC funded Green Village project has been working with NLEIP and the local village communities to promote sustainable land stewardship through livestock management institutions. The aim is to rehabilitate the area through both increased grass cover and livelihood opportunities derived from livestock. This requires a working partnership between the DEA NRM rehabilitation and SLM implementers and the livestock owners that can bring benefits to both groups. This presentation will report on the process to date and suggest the way forward.

PARALLEL SESSION A: BUSH ENCROACHMENT

SESSION CHAIR: TONY PALMER

Thursday, 26 July 2018, 09:40 - 10:00

Venue: ARC Training Centre Main Room, Roodeplaat

PLATFORM PRESENTATION: EFFECTS OF *SERIPHIUM PLUMOSUM* DENSIFICATION ON GRASSLAND VEGETATION AT TELPERION, MPUMALANGA, SOUTH AFRICA

Susannah Cleo Patrocinio[1]*, Leslie Brown[1], Alan Barrett[1] and Hanneline Smit-Robinson[2]

[1]UNISA - Applied Behavioural Ecology & Ecosystems Research Unit, [2]BirdLife South Africa, email: patrosc@unisa.ac.za

Mesic Highveld Grassland is important for rangeland and biodiversity conservation, but is under threat of bush densification by *Seriphium plumosum*. This indigenous encroacher has spread rapidly in the last decade. S. plumosum outcompetes the other herbaceous species, resulting in a loss in grass production. This study looks at different densities of *S. plumosum* and how this affects grassland biodiversity within the Telperion Nature Reserve, Mpumalanga. The aim of the study was to understand how species composition, biodiversity, and community structure is affected by various densities of *S. plumosum*. To test if *S. plumosum* densification affects species composition, biodiversity and community structure, three sites where selected with various densities of *S. plumosum*. One site had almost no *S. plumosum* present (grassland site), one was intermediately infested (intermediate site) and one was severely encroached (dense site). To determine species composition and species diversity, at each site, all plant species within twenty 1 m x 1 m quadrants were counted. Grass and *S. plumosum* height was measured every meter along a 100 m transect placed in each site. Percentages of woody species, grass and forb cover was estimated within three 10 m x 10 m sample plots placed in each site. All plant species identified were classified into five successional classes. Species richness was highest (n = 98 species) at an intermediate level of densification and was similar for the densely infested site and the grassland site (n = 59 and n = 60 species, respectively). The intermediate site was the most diverse (2,26 average Shannon-Wiener Index) and the grassland next (1,96 average Shannon-Wiener Index), with the dense site being least diverse (1,78 average Shannon-Wiener Index). There were noticeable differences between the three sites, when using ANOVA and Tukey's HSD test (p < 0.01) in terms of diversity, but the intermediate site was significantly more diverse than both the grassland and dense sites. The findings indicate that there was a significant difference between the sites in terms of their ecological status, when using two-way classification chi-square test (p < 0,01). *S. plumosum* density did not have a noticeable impact on alpha diversity, however it did affect plant species composition, structure and ecological status for the areas where it was present. The grassland site was in a better ecological condition than the densely infested site when comparing grass height, grass cover, ecological status, and diversity of species present. At an intermediate level of infestation, alpha diversity increased. The densely infested site was negatively impacted by *S. plumosum* and was noticeably different to the intermediate site in terms of diversity of species present, the ecological status showed that it was degraded. The presence of *S. plumosum* at low densities can be considered an integral part of the environment. That said, it is important that areas where *S. plumosum* occurs be monitored. If this species is not in balance within its environment, and it starts becoming dense, it could negatively affect the biodiversity, species composition and structure of the habitat.

PARALLEL SESSION A: FIRE ECOLOGY

SESSION CHAIR: HANNO KILIAN

Thursday, 26 July 2018, 10:30 - 11:30

Venue: ARC Training Centre Main Room, Roodeplaat

PLATFORM PRESENTATION: INITIAL INVESTIGATION OF THE EFFECTS OF PRESCRIBED BURNING ON THE INCIDENCE OF TICKS IN A MOIST SAVANNA COMMUNITY IN THE LOWVELD OF SOUTH AFRICA

LD Van Essen[1]*, Winston Trollope[2] and Lynne Trollope[2]

[1]Nyengere Solutions, [2]Working on Fire International, email: lourens.vanessen@gmail.com

Tick borne diseases such as heart water and babesiosis (red water) cause significant mortalities and economic losses to domestic livestock and game farmers in South Africa. The potential for reducing the incidence of ticks through prescribed burning was successfully achieved in the Ngorongoro Crater in Tanzania in 2003. However, the effects of burning on tick populations are complex because fires can affect both ticks and their host species. Based on the results from Ngorongoro Crater, the Research and Development Section of Working on Fire International initiated a research trial in 2015 in the Lowveld south of Nelspruit, Mpumalanga. Verification of the positive impact of prescribed burning to reduce or control tick populations will strengthen the basis for using prescribed burning as an effective veld management practice in African grasslands and savannas. However, fire cannot be seen as a stand-alone tool to reduce or control tick populations as it will require using appropriate fire regimes comprising type and intensity of fire and season and frequency of burning together with grazing management and animal stocking rates to reduce and/or control the density of tick populations. The main hypothesis being tested in this long-term project is that tick populations increase in abundance when the grass sward becomes moribund and exceeds a grass fuel load of 4000 kg/ha resulting in a favourable micro-climate involving higher air temperatures and humidity's. The first site for the research project is on the De Kaap Valley Conservancy, Nelspruit, Mpumalanga. At this initial stage the tick surveys are being restricted to open thornveld that include various aspect profiles. Twenty one vegetation surveys were conducted using an adapted point centred quartered method on 200m x 80m plots. The standing herbaceous biomass was estimated with a disc pasture meter using the generally accepted calibration for African grassland and savannas viz. ($y = -3019 + 2260 \sqrt{x}$, where y = mean grass fuel load (kg/ha) and x = mean disc height (cm)). Tick population densities pre- and post burn were recorded and monitored using an established flannel drag sampling technique used by the Onderstepoort Veterinary Institute. Drags were conducted on 33 sites, 100m x 1m in size, of which three were control sites. Initial cool burns (< 1000 kW/m) were applied to remove moribund grass material and establish time zero. Expected project duration will be a minimum of 60 months. The preliminary results presented pertain to the tick species identified on the site, as well as the relative numbers of each tick development phase on a species basis. The number of tick species identified on the research site was twelve, with the dominant species being *Rhipicephalus appendiculatus* and *Rhipicephalus decoloratus*. The former is known to be the vector for *Theileria parva*, the causative organism of East Coast fever in cattle as well as Rickettsia in humans.

PLATFORM PRESENTATION: PYRO-HYDROLOGICAL INTERACTIONS IN AFRICAN SAVANNA SOILS

Tercia Strydom[1]*, Eddie Riddell[1], Navashni Govender[1], Simon Lorentz[2] and Pieter Le Roux[3]

[1]SANParks, [2]SRK Consulting, [3]University of the Free State, email: tercia.strydom@sanparks.org

In African savannas, fluctuations in rainfall, nutrients, herbivory and fire plays a major role in sustaining these complex and dynamic systems. Simultaneously, soils play a vital role in supporting healthy and functioning ecosystems. Besides providing a medium for plant growth, soils play a major role in ecosystem functioning through nutrient cycling and water filtration through the system, thus when soils are degraded important ecosystem services are affected. Numerous studies from various locations around the world deduced that fire can play a major role and effect soil properties. Even though fire is regarded as a key driver in savanna systems, there is a lack in current understanding on the impacts of long-term fire management on soil properties.

The Experimental Burn Plots (EBPs) in Kruger National Park is a long-term fire/ herbivory experiment which was initiated in the 1950's. This experiment offered a unique opportunity to determine the impact of long-term fire treatments on soil water retention capacity, soil total carbon, total nitrogen and soil compaction. Results suggest that at water contents of < 5%, the No Burn plots where fires have been excluded for more than six decades, have a higher water retention capacity and retain water more efficiently than regularly burnt soils. This was measured on both coarse-grained granite-derived soils as well as finely-textured basaltic soils. When water retention capacities are compared across geologies, the finely-textured basaltic soils retained water more efficiently than the granitic soils. The ability of a soil to retain moisture is affected by soil properties such as soil texture and soil organic matter content. With regards to soil total carbon, results suggest that fire exclusion results in significantly higher total carbon in basaltic soils only ($p < 0.001$), and not granitic soils. Similarly, total nitrogen is significantly higher on the No Burn plots on the basaltic soils ($p < 0.001$) than the granitic soils. Overall, basaltic soils contain roughly double the total carbon and total nitrogen content than that of granitic soils. This relationship may be explained by the increase in biomass and clay content on the basaltic soils as opposed to the granitic soils.

With regards to soil compaction, results suggest that frequent annual burning increases to soil compaction ($p<0.05$). This may be attributed to veldfires denuding an area of vegetation and exposing the soil surface to environmental elements and processes such as raindrop impact and splash. Vegetation cover is important for protecting the soil surface and affects the fate of raindrops. Furthermore, the presence of herbivores enhances soil compaction due to trampling ($p < 0.05$). Herbivores tend to concentrate on recently burnt areas due to improved post-fire grazing as well as enhanced visibility against predators. Depending on the degree of soil surface compaction and the soil type, soil compaction may lead to decreased infiltration rates, increased runoff production and increased erosion rates. These results are particularly important for land-use management where veld burning is used as a management tool for controlling vegetation structure and composition, combatting bush encroachment and improving grazing quality for livestock and game.

PLATFORM PRESENTATION: THE EFFECT OF SEASON, FIRE AND SLOPE POSITION ON SERIPHIUM PLUMOSUM L. FORAGE QUALITY IN SOUTH AFRICAN GRASSLAND COMMUNITIES

Hosia Pule[1]*, Julius Tjelele[1], Michelle J Tedder[2] and Dawood Hattas[3]

[1]Agricultural Research Council - Animal Production Institute, [2]University of KwaZulu-Natal, [3]Department of Biological Sciences, [3]University of Cape Town, email: Gpule@arc.agric.za

Acceptability of plant material to herbivores is influenced by among other factors; nutrients, plant secondary metabolites and growth stage of the plants. However, the effect of these factors on *Seriphium plumosum* L. acceptability to livestock is still not clearly understood, despite its importance in managing its encroachment in grassland communities. The study used 2 x 2 x 2 factorial analysis of variance to investigate the effect of season (wet and dry), fire (fire and no fire), slope position (top and bottom) and their interaction on *Seriphium plumosum* forage quality. We tested the hypothesis that *S. plumosum* forage quality varies temporally, spatially and in fire and no fire treated *S. plumosum* edible materials. *Seriphium plumosum* edible material was collected during the wet and dry season from fire and no fire treated areas at both top and bottom slopes before analysed for forage quality; nutrients (protein (CP) content, neutral detergent fibre (NDF)), and plant secondary metabolites (total phenolics (TP) and condensed tannins (CT)). Season had a significant effect on *S. plumosum* forage quality (CT, CP, NDF, TP and CT). Fire had a significant effect on *S. plumosum* CP content. Interestingly, Slope position did not have any significant effect on *S. plumosum* forage quality. Interaction of season x fire had a significant effect on NDF and CP ($P < 0.05$). *Seriphium plumosum* had significantly higher CP and CT in the wet season (6.69 % ± 0.20 (SE)) and (1.56 mg/gDw ± 0.13) than in the dry season (5.22 % ± 0.13) and (1 mg/gDw ± 0.03), respectively. Neutral detergent fibre and TP was significantly higher (58.01 % ± 0.41) and (14.44 mg/gDw ± 1.03) in the dry season than in the wet season (53.17 % ± 0.34) and (11.08 mg/gDw ± 1.07), respectively. Crude protein was significantly higher in burned (6. 31 % ± 0.22) than in unburned *S. plumosum* edible material (5.60 % ± 0.15). *Seriphium plumosum* CP was significantly higher in wet season x burned (7.34 % ± 0.31) than wet season x unburned (6.08 % ± 0.20) material and dry season x burned (5.34 % ± 0.18) and unburned (5.09 % ± 0.18) material, which were similar. Neutral detergent fibre was similar in dry season x burned (58.31% ± 0.54) and dry season x unburned (57.69 % ± 0.62) material and significantly higher than similar wet season x burned (52.43 % ± 0.45) and wet season x unburned (53.88 % ± 0.47) material. This study suggests opportunities for integrating fire, browsers and supplements in the control of encroacher *S. plumosum*, especially during the wet season because of its high CP and CT content.

PARALLEL SESSION A: CONSERVATION OF RANGELANDS

SESSION CHAIR: HANNO KILIAN

Thursday, 26 July 2018, 11:30 - 12:50

Venue: ARC Training Centre Main Room, Roodeplaat

PLATFORM PRESENTATION: THE GAUTENG BIODIVERSITY STEWARDSHIP PROGRAMME

Christina Seegers

Gauteng Department of Agriculture and Rural Development, email: christina.seegers@gauteng.gov.za

The Gauteng Province has committed to expanding the number of hectares of land under formal protection in 2018/2019 by 9 000 ha, 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 or communally owned land under Biodiversity Stewardship within three years. Since its inception in 2015, the project has made enormous progress towards understanding the natural landscape in Gauteng and the identification of institutional processes needed within the GDARD to ensure effective implementation of stewardship in the province going forward. The project team has also streamlined the ecological assessment procedure for the Gauteng landscape and implemented these procedures in a number of sites; conducted desktop assessments of the sites, followed up on these on the ground with the assistance of the GDARD's Scientific Services unit, took the site assessment results through the review panel process, and have put in place the institutional steps required for the formal approval and subsequent recommendation of the appropriate Protected Area category to landowners. The team has also been very busy engaging landowners to communicate the recommended protected area category, confirming landownership information and is now taking the first steps into the declaration phase for four sites. Time was spent on identifying natural resource management activities for proposed stewardship sites and building partnerships with role-players in this space as a means of identifying potential incentives for stewardship sites whilst through this process started on the development, in negotiation with the landowner, of an Environmental Management Plan for the first privately owned Nature Reserve to be declared under the National Environmental Management: Protected Areas Act (NEM: PAA) in the Gauteng Province.

PLATFORM PRESENTATION: THE GREATER LIMPOPO TRANS FRONTIER CONSERVATION AREA: IMPLICATIONS FOR MULTIPLE LAND USE OBJECTIVES

Mike Peel*, Lucas Manaka, Dalton Masia and Sweetness Myeni

Agricultural Research Council - Animal Production Institute, email: mikep@arc.agric.za

Large private protected areas (PAs) adjacent to the Kruger National Park (KNP) have embraced the basic philosophies of the KNP management approach since the removal of the fence between them. They have similar general objectives but function at different spatial scales. Animal movement is possible but due to actions such as differences in water provision policies, a unique set of management challenges arise. The recent serious drought resulted in steep declines in a number of larger herbivores and in this presentation, we examine trends across the range of protected areas open to one another to gain an understanding of the dynamics of these species. The 2017 aerial survey showed declines in mobile species such as buffalo in Balule, Klaserie, Umbabat, Timbavati, Sabi Sand and the KNP. Using a 10-year data set we explore possible explanations for these trends as they relate to drought, predation, poaching, movement and the implications for management and the achievement of land use objectives. The need for integration of monitoring and research between institutions is critical to track in ensuring the achievement of objectives for all stakeholders in the Greater Limpopo Trans Frontier Conservation Area.

PLATFORM PRESENTATION: THE USE OF UNMANNED AERIAL VEHICLES IN CONSERVATION

Debbie Jewitt

Ezemvelo KZN Wildlife, email: debbie.jewitt@kznwildlife.com

Drones or Unmanned Aerial Vehicles (UAVs) have the potential to revolutionize conservation and spatial ecology. Conservation agencies are required to monitor species populations and their habitats and report on management effectiveness. The use of UAVs may contribute towards more effective and efficient monitoring and management of biodiversity, by providing the opportunity to collect data and high resolution images in a better, faster, cheaper and safer manner. For example Cape Vulture population estimates have increased from 120 to 200 individuals and crocodile population estimates improved by 26%, using drone technology. High resolution imagery and mapping facilitates management decisions. I explore a range of scenarios to illustrate the benefits and challenges associated with the use of UAVs across the conservation spectrum.

PLATFORM PRESENTATION: THE DEVELOPMENT OF AN ALIEN AND INVASIVE TAXA LIST FOR REGULATION IN SOUTH AFRICA

Moleseng Moshobane

South African National Biodiversity Institute (SANBI), email: moshobanemc@gmail.com

The process of developing regulatory lists of alien and invasive taxa should be based on scientific evidence through an objective, transparent and consistent process. Here we review the development of the lists for the South African National Biodiversity Management Act (NEM: BA) alien and invasive species regulations. Lists published in the national Government Gazette were compared and assessed for changes in the taxa listed and their status between 2009 and 2014. Minutes from expert workshops convened to inform the listing were reviewed and relevant information like the criteria for listing taxa were extracted from the minutes. Three draft versions were published in the Government Gazette for public comment before the final list was published in August 2014, coming into force in October 2014. This list was further amended in May 2015. The main goal of the NEM: BA Alien and invasive species list was to document species known or suspected to have considerable negative impacts on natural ecosystems, or congenerics of alien and invasive species. The process endeavoured to get engagement with academics, conservation experts, managers and various stakeholders through inclusion either actively in workshops or through a public commenting process to achieve shared governance. A scoring tool based on the likelihood of invasion versus the impact of invasion was recommended for evaluating the risk of a species, but rarely used. We conclude with some recommendations for future refinements in the process.

PARALLEL SESSION A: PRIMARY PRODUCTION OF RANGELANDS

SESSION CHAIR: HANNO KILIAN

Thursday, 26 July 2018, 12:50 - 13:30

Venue: ARC Training Centre Main Room, Roodeplaat

PLATFORM PRESENTATION: EFFECTS OF ELEVATED AMBIENT AND SOIL TEMPERATURE ON ABOVE-GROUND PRODUCTIVITY OF HIGH ALTITUDE GRASSLAND OF SOUTH AFRICA

Thembeka Mvelase[1]*, Michelle J Tedder[1] and Mariska Te Beest[2]

[1]University of KwaZulu-Natal, [2]Utrecht University, email: 211517147@stu.ukzn.ac.za

Anthropogenic activities have altered the condition and composition of the atmosphere greatly since the onset of the industrial revolution. Consequences of this alteration in the atmosphere include severe rapid changes in the Earth's climate and biogeochemical cycles. Atmospheric CO_2 concentration, temperature and precipitation, which are the three most important determinants of plant growth, are significantly affected by the changing climate. Over the last century, surface temperatures have increased by 0.8 ˚C globally, and it is anticipated that it will rise with 1.4-5.8 ˚C by the year 2100. In South Africa, climate is changing at a more rapid rate when compared with other countries. The

average annual temperature in this country has increased by at least 1.5 times the observed global annual increasing average of 0.65 ˚C over the past five decades. Compared with other countries in the African continent, South Africa has the highest emissions per capita, highlighting the importance of implementing climate change mitigation strategies. The grassland biome, which is the second largest biome in South Africa, is dominated by fire-dependent vegetation. An increase in temperature also affects the fire regime and therefore has great impacts on the ecosystem services offered by this biome. The aim of this study was to determine how the interaction between fire and warming affects high altitude grasslands in South Africa. The main objectives were to determine the effects of experimental warming with open-top chambers (OTCs) on grassland productivity and soil moisture in fire-driven grassland. Sixteen OTCs were deployed in sixteen plots that received different burning treatments in Brotherton, Cathedral Peak in the Drakensberg Mountains, KZN. Each OTC was paired with a non-warmed control. Species biomass, composition and soil moisture were measured inside the OTCs and their controls. Temperature measurements were also recorded in all the OTCs and their controls. The OTCs increased ($p < 0.05$) mid-day ambient and soil temperature by 4 and 1 ˚C, respectively, when compared with the control. Soil moisture content differed significantly ($p < 0.05$) between OTCs and the controls across all plots. There was a significant difference in above-ground biomass between OTC and control ($p = 0.021$). Species composition was influenced by fire treatment and not by the effect of warming. Open-top chambers can simulate realistic increases of air temperatures in mesic grasslands. Grassland above-ground productivity is expected to increase with elevated temperature at the cost of soil moisture.

PARALLEL SESSION B: SPECIAL SESSION ON FEEDS AND FORAGE, WITH A FOCUS ON THE FORAGE SEED VALUE CHAIN
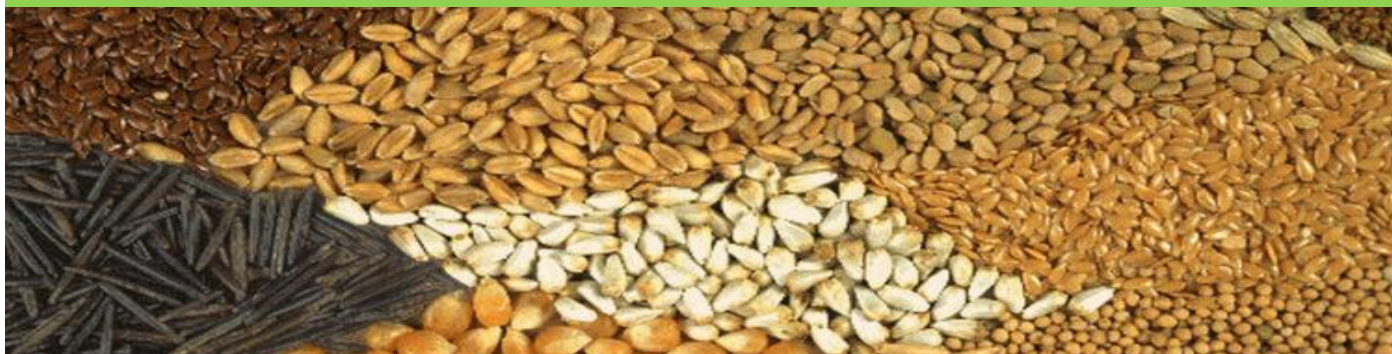
SESSION CHAIR: Sikhalazo Dube

Thursday, 26 July 2018, 08:00 - 10:00

Venue: ARC Training Centre Parallel Room, Roodeplaat

Livestock production in many farming systems, especially in rangelands, is constrained by the variation in quality and quantity of feed. Cultivated pastures and forages have been used to reduce the variation. However, the use of forages has been hindered by poorly developed forage seed value chain. The private seed producers have not taken up this challenge in a significant way; this compared to developed seed value chains for crops.

The aims of the Special Session are showcase promising forage and feed technologies, and create networks that will lead to broader promotion of the use of feed and forage technologies for improved livestock production and increased incomes. To inventory feed and forage resources available, their conservation and utilisation, and create opportunities to improve the forage seed value chain.

The aims will be achieved through the following objectives:

- To facilitate exchange of information on feed and forage resources and feeding systems within the region and beyond.
- Delivery, packaging and uptake of feed and forage resources and forage seed production technologies uptake.
- To improve forage seed value chain – identification of business models.
- To highlight feed and forage technologies that have potential under climate change scenarios.
- Strategies on conservation and utilisation of forage genetic resources.
- Works on more and better feeds: new feeds and forages; new strategies to use existing feeds and forages better.

There will be discussions on options for delivery at scale of feed and forage technologies (e.g. seed systems) that prioritizes opportunities for women, youth and new private enterprises.

PLATFORM PRESENTATION: FEEDS AND FORAGES IN THE LIVESTOCK CGIAR RESEARCH PROGRAM

Michael Peters[1]*, Chris Jones[2], Alan Duncan[2], Valheria Castiblanco[1], Uwe Ohmstedt[1], Udo Rüdiger[1], Barbara Rischkowsky[1] and Stefan Burkart[1]

[1]International Center for Tropical Agriculture (CIAT), [2]International Livestock Research institute (ILRI)
email: m.peters-ciat@cgiar.org

Animal Source Foods such as milk, meat spend eggs are essential for human nutrition. Demand is increasing and this offers multiple opportunities for livestock producers. However, sustainable productivity and efficiency gains are needed, addressing both seasonal and inter-annual variation. Feed is a key limiting factor and often the most expensive input into livestock production. The Feeds and Forages work, organized through a flagship program, aims

to respond to these bottlenecks by a) identifying and refining priorities through on-farm, large scale and global assessments; b) developing novel feed and forage options; c) better utilizes these feed options and d) identifying and testing approaches to scale these technologies through e.g. innovative business models, extension approaches and capacity building. The work in this paper would focus on novel forages, with emphasis on Eastern and Southern Africa. The aim is to identify specific needs and niches for forages and respond to this demand by developing novel forages either through selection or breeding. Advances include the availability of novel forage options either through selection e.g. of Napier grass (*Cenchrus purpureus*) or breeding of Brachiaria hybrids (*Urochloa ruziziensis* x *U. brizantha* x *U. decumbens*). The approach for scaling of these novel options through linkages with the public and private sector is being described.

PLATFORM PRESENTATION: AN UPDATE ON THE GLOBAL STRATEGY FOR THE CONSERVATION AND UTILISATION OF TROPICAL AND SUBTROPICAL FORAGE GENETIC RESOURCES

Chris Jones[1]*, Bruce Pengelly[2], Brigitte Maass[3] and Charlotte Lusty[4]

[1]International Livestock Research institute (ILRI), [2]Pengelly Consultancy / Consultant to the Crop Trust, [3]University of Göttingen / Consultant to the Crop Trust, [4]Global Crop Diversity Trust, email: C.S.Jones@cgiar.org

Tropical and sub-tropical forages (TSTF) are critically important for supplying livestock feed and environmental benefits in extensive and intensive livestock systems of developed and developing countries. There has been focused collection and conservation of forage genetic resources (FGR), and research on their diversity, adaptation and use for the past 60 years. This laid the foundations for the impacts TSTF have had, and continue to have. However, since about 1995 there has been significant reduction in forage science investment, and capability globally, and that has strangely coincided with the accelerated demand for livestock products. The status of TSTF germplasm conservation, capability and capacity are now at risk, and the decline must be reversed if the tropical and subtropical farming systems are to access the best genetic material and knowledge to meet the growing food/environmental needs. A strategy to reduce barriers to TSTF conservation, research and utilisation was developed under the Global Crop Diversity Trust in 2015 with input from across the TSTF-genetic resources community. Its aim was to build a functional network of national, regional and international genetic resource centres, introduce operational efficiencies, and enable genebanks to improve their role as knowledge managers and advisors for research and development programs. The strategy's main objectives are: 1) Rebuild the community of TSTF genebanks and genebank users to develop closer collaboration and trust; 2) Ensure more efficient and rationalized conservation within and among genebanks; and 3) Actively support utilisation by anticipating germplasm needs and responding to users' requests for information and seeds. Implementation of the strategy commenced in 2016, with the first aim being to win buy-in and cooperation of international and national genebanks. A new Newsletter, 'Forages for the Future', has >600 recipients and reports key implementation activities and the roles of forages across the tropics and subtropics. Making recent impacts more widely known indirectly helps build the body of evidence that improved forages deliver impacts and is the basis for growth in financial and human resources invested in TSTF. The CGIAR genebanks of ILRI and CIAT play key roles in TSTF research and use. In recognition of the need for greater efficiencies and better utilisation of the germplasm, ILRI and CIAT have undertaken an ambitious program to align collections to provide a one stop portal, with prioritised species/accessions for conservation and research, and a simplified germplasm request process. This change is occurring simultaneously with a TSTF strategy initiative encouraging some key national TSTF centres to work more closely together and with the CGIAR centres and with the update of the widely used TSTF database and selection tool, SoFT, with new content and ability to be used on smart phones. That new version will be released in 2019. Reversing the past downward trend requires the commitment and long-term engagement of partner countries and the donor community. The alternative is that 60 years of knowledge and expertise will have to be rebuilt, and generations of farmers and other users will not realize the production and environmental benefits that well-adapted and sustainably managed improved forages can attain.

PLATFORM PRESENTATION: FORAGE SEED SYSTEMS IN EASTERN AFRICA: CHALLENGES AND OPPORTUNITIES

Solomon Mwendia[1]*, Uwe Ohmstedt[1], Stanely Karanja[1], An Notenbaert[1], Michael Peters[1] and Chris Jones[2]

[1]International Centre for Tropical Agriculture (CIAT), [2]International Livestock Research institute (ILRI),
email: s.mwendia@cgiar.org

Despite the profound livestock importance in eastern Africa, livestock productivity remains low attributable to a number of challenges. One of the major drawbacks is lack of quality feeds and forages. This results in poor animal performance and suboptimal use of resources. Intertwined with this lack of quality forages is the dearth of forage planting materials - including seed and vegetative propagation – to offer producers improved forages adapted to different ecologies and agricultural context. To alter the landscape, developed forage technologies coupled with awareness creation is needed along the forage value chain to support commercially functioning forage seed systems. With the projected doubling of demand for animal products (meat and milk) in sub-Saharan Africa, the pressure will be exerted on livestock feed resources. This is likely to result in a knock-on demand for forage cultivation and hence forage seed demand. To be successful, the forage seed systems need to be supported by an enabling policy across the region, which include: functional procedures for certification and quality control, public-private partnerships for the production and dissemination of planting materials, and technical advice in the management of forages. Availability of proven forage technologies, coupled with awareness creation and facilitative movement of forage seeds across countries would boost forage seed system development in eastern Africa, for increased livestock productivity.

PLATFORM PRESENTATION: FARMERS' PERCEPTIONS ON THE CAUSES OF FEED SHORTAGES AND COST OF ESTABLISHING LEGUMINOUS PASTURES UNDER SMALL SCALE FARMING SYSTEM

Nobuntu Matyholo-Mapeyi*, Mzubanzi Ntengento, Gcotyelwa Nkohla and Nonzaliseko Edith Mlahlwa

Eastern Cape Department of Rural Development and Agrarian Reform, email: nobuntu.mapeyi@drdar.gov.za

Increase in livestock numbers in rural areas is leading to a growing demand for feed. Due to the high livestock numbers, available space for grazing decreasing, and this has led to overstocking and overgrazing of natural pastures. In 2010, a survey was carried out in Taleni and Shweni villages in the Ntsika Yethu Local Municipality, where semi-structured questionnaires were used to investigate farmers' perceptions and attitudes on the establishment of leguminous cultivated pastures. The following year, a demonstration was also conducted to verify affordability and the land area that is required during winter for a small-scale farming system. The objectives of both the survey and demonstration was to address the feed shortage during prolonged dry seasons. The survey and demonstration were also used as a means to measure cost of forage crop establishment versus buying feed or any supplementary feeding available. There were 80% and 20% males and females represented, respectively, of the total of 36 respondents interviewed in the two villages. All the respondents mentioned that the lack of proper fencing, which impacts on the implementation of veld management practices, was a major constraint for ensuring that there is enough feed. The majority of participants (60%) perceived that seed is expensive and 40% reported that establishment of pasture is for commercial farmers. The input costs were calculated on the basis of 25 m^2 and extrapolated to a 900 m^2, the average size of a garden in these villages. The cost for inputs, including labour, was R738, for the use of three cows or eight ewes or does for 30 minutes for the duration of four days per week, and thus far less than losing one animal. The reason for the perceptions among farmers that forage crop establishment is only for commercial farmers was mainly driven by the cost involved. Respondents were of the view that it is more expensive to plant a small area by hand and use kraal manure or fertiliser instead of having to transport and buy bales and industrial processed feed. The implementation of this study resulted in a change of these misconceptions of farmers in these two villages.

PLATFORM PRESENTATION: ADOPTION OF IMPROVED FORAGE LEGUME TECHNOLOGIES BY COMMUNAL FARMERS IN ZIMBABWE

Shirleen Fungisai Mushapaidze[1], Irenie Chakoma[2], Blessed Masunda[1], Venancio Imbayarwo-Chikosi[1] and Takudzwa Charambira[1]*

[1]University of Zimbabwe, [2]International Livestock Research institute (ILRI), email: takudzwacharambira@gmail.com

The translation of forage research results into usable technologies and the adoption of the same by livestock farmers is the only way to ensure returns to investment in forage research. A lot of work has been conducted on the feeding value of different forage legumes in livestock production, but this has not been matched by changed feeding practices on the ground. The objective of the study was to investigate the adoption level of improved forage legume technology by communal farmers trained and exposed to forage legume production. The study also intended to identify the socio-economic and bio-physical factors which led to adoption intensity and willingness to continue practice, the major constraints affecting uptake of the improved technologies and farmer's perception of forage legumes on livestock productivity. The study was conducted in Goromonzi and Murewha districts. Two and three wards were randomly selected in Goromonzi and Murewha, respectively. In each of the selected wards, 20 farmers were chosen by random sampling to participate in the study. A structured questionnaire was used to obtain data on socio-demographics aspects, asset endowment, income sources, land holdings/ tenure, farm size, livestock ownership and forage legume production by smallholder farmers. The data was analysed using a logistic regression model to determine the likelihood factors influencing the decision to adoption and willingness to continue growing improved forage legumes. A chi-square test was used to test for association between various farmer attributes and forage legume adoption. The study also employed descriptive statistics. The results indicate that the mean area under forage legume production has increased over the years from 2011 to 2017. There has been a cumulative rise in forage legume production since 2011, with 85 % of respondents still growing forage legumes from the inception of the project trainings and 88 % of farmers plan to continue growing legumes. Forage legume production ranked third in terms of area under crop cultivation ($p < 0.05$) after maize and groundnuts. Herd size and socio demographic factors did not influence the decision to continue growing legumes, except the size of household ($p < 0.05$).The major constraint to adoption was seed availability and affordability. It was concluded that adoption of forage legumes is labour intensive. Households with a lot of active members were more likely to continue growing and feeding forage legumes.

PLATFORM PRESENTATION: VALUE CHAIN ANALYSIS OF FORAGE SEED IN SMALLHOLDER SYSTEMS OF ZIMBABWE

Irenie Chakoma[1]* and Bibi Chummun[2]

[1]International Livestock Research institute (ILRI), [2]University of KwaZulu-Natal, email: i.chakoma@cgiar.org

In smallholder systems, farmers are increasingly becoming aware of the need to improve livestock productivity through production of quality fodder. This is in response to scarcity of feed, particularly in the dry season, associated with seasonal variations, land degradation and the need to meet an increase in demand for livestock products. An understanding of processes and actors involved along the forage seed value chain is important for developing strategies that enhance adoption and sustainability especially in smallholder systems. The study was conducted to evaluate the performance of forage seed sector value chain in Zimbabwe, focusing on germplasm availability, seed production and marketing. Actors involved and their roles were assessed, and strategies developed on how to enhance effectiveness of the value chain. The study employed household survey, focus group discussions (FGDs) and key informant interviews (KII) to collect data. The survey employed a questionnaire with structured and semi-structured questions. This was administered to a total of 414 randomly selected households from 10 purposively selected wards. Four FGDs (two in each district), each with an average of 14 participants were conducted using a FGD Guide with a checklist to collect data. KIIs, in-depth interviews, were conducted by employing the KII guide to gather qualitative data from people who are well versed with the seed industry, like seed companies, input suppliers and seed services regulators. Quantitative data from household survey was subjected to SPSS version 21 software generate descriptive statistics. Qualitative data from FGDs and KIIs was synthesised to crosscheck and validate responses from the household survey. A SWOT analysis was also conducted to establish strengths, weaknesses, opportunities and threats related to forage seed value chain in the study area. Results indicate that farmers use cropping lands to produce forage seed. Forage seed production is not a common practice as arable

lands are put to food crops. Seed is disseminated through sharing with other farmers, paying for farm services, exchanging for other seed types and selling to individuals and companies. Actors along the value chain include farmers (other seed producers, fodder producers and seed companies), seed companies who act as traders and retailers, research and extension institutions, and NGO's. Some linkages along the value chain are weak or non-existent, such as among forage seed breeders, farmers and NGO's. This is because forage seed production is not considered a priority activity compared to food crop production. This is also compounded by the fact that forage seed markets are not well developed, with transactions occurring informally. Challenges encountered in forage seed production include unavailability of seed, under-developed market infrastructure, limited knowledge on production and marketing of seed, and low prices. There is need to create awareness amongst farmers on production of forages and benefits to be realised from such activities. As farmers gain knowledge and acquire more assets, they would adopt forage seed technologies, resulting in improved livestock production and improved farmer participation in markets.

PARALLEL SESSION B: SPECIAL SESSION ON FEEDS AND FORAGE, WITH A FOCUS ON THE FORAGE SEED VALUE CHAIN

SESSION CHAIR: Sikhalazo Dube

Thursday, 26 July 2018, 10:30 - 13:30

Venue: ARC Training Centre Parallel Room, Roodeplaat

PLATFORM PRESENTATION: BREEDING FOR LATE FLOWERING AND IMPROVED LEAF AND ROOT YIELD IN FODDER RADISH

Patrick Rakau

Agricultural Research Council - Animal Production Institute, email: rakaup@arc.agric.za

Fodder radish (*Raphanus sativus),* which is often also referred to as Japanese radish, is the most popular and widely used root crop in South Africa due to its higher yield potential than most winter cereals. The cultivar "Nooitgedacht" was the first-ever locally bred fodder radish cultivar released, with six new cultivars subsequently bred and released by the Agricultural Research Council – Animal Production (ARC-AP) based at Cedara. However, in more recent years ARC-AP Cedara top-crossed their cultivars Geisha and Sterling onto a very late-flowering fodder radish line supplied by PGG Wrightson Seeds (PGGW) of New Zealand. Thereafter, following eight consecutive years of selection and breeding, the variety "Endurance" was released and is now inscribed in the South African Variety List, while "Line 2" is still undergoing selection and breeding to genetically stabilize it. A trial was established during May 2015 at Cedara to determine the production potential of these new South African bred varieties compared to other fodder radish varieties. The experiment was conducted on a Hutton soil type at the Cedara Research Station in the natal Mistbelt, South Africa (29º 32´S 30º 16´ E), at an altitude of 1075 m and with a mean annual rainfall of 885 mm. Seed of 12 radish cultivars of above mentioned species was planted. Four replications of the 12 cultivars were planted in 3 x 4 balanced lattice with gross plot size of 10 m x 6 m. Twenty plants with a inter row spacing of 0.5 m were planted. The trial was harvested for the first time three months after establishment, and then monthly thereafter during the winter. The yield of both leaf and root components were determined separately. Net plot size after border removal was 5.4 m x 10 m. The fresh herbage and roots were weighed within two to five minutes of sampling and dried to constant weight in an electric oven at 75 ºC. The fodder radish cultivars Nooitgedatcht, Australian purple and Samurai ran to seed in the late August, resulting in a decline in both leaf (0.0, 0.15 and 0.0 t DM ha^{-1}) and roots (0.13, 0.32 and 0.12 t DM ha^{-1}) yield. The ability of the late-flowering varieties Endurance and Line 2 to maintain leaf (0.93 and 1.04 t DM ha^{-1}) and roots (0.4 and 0, 52 t DM ha^{-1}) shows the potential of these varieties to improve yield related to other varieties. There was no significant differences between all three harvesting dates (10 July 2017; 30 July 2017 and 28 August 2017) respectively. The varieties did not differ in terms of their yielding potential over harvests e.g. Endurance yielding the same during all three harvest. This could be because of low production of this trial due to uncontrolled weeds. Therefore, it is recommended that the same trial be repeated in 2018 to confirm these results.

PLATFORM PRESENTATION: *BRACHIARIA* GRASS FOR LIVESTOCK FEED SECURITY IN SUB-SAHARAN AFRICA

Sita Ghimire[*], Elizaphan Rao, Abdu Fall and Jacob Mignouna

International Livestock Research Institute (ILRI), email: Sita.Kalpana@gmail.com

Livestock production is an important agricultural sector that contributes 40 percent of the agricultural gross domestic product in sub-Saharan Africa (SSA). It is a source of food, nutrition, crop production inputs, income, employment and livelihood of the people in SSA. Despite the importance, livestock productivity in SSA is the lowest in the world. The seasonal availability and low-quality feeds are among the major factors responsible for low livestock productivity. Forages of African origin, including *Brachiaria* grass, have been instrumental in the transformation of the livestock sector in tropical America, Australia and East Asia, but their potential has been little explored in SSA. Considering this fact, the International Livestock Research Institute (ILRI) initiated a collaborative research programme on *Brachiaria* grass in 2012 with the objective of increasing livestock productivity in East Africa by improving availability of quality forage. Through the farmer participatory varietal selection, the programme identified five *Brachiaria* varieties suitable to East Africa and integrated them into mixed crop-livestock systems: milk production increased by 15 - 40 % and live weight gains surpassed 50 %. For the past three years, ILRI has been upscaling *Brachiaria* technology, and over 30,000 farming households in Kenya and Mali have adopted the technology. Brachiaria grass is suitable for both cut-and-carry and grazing systems, and it is good for hay making. *Brachiaria* hay production has emerged as a new agribusiness for youth and women that has not only enhanced livestock feed availability in the dry season but also contributed to incomes and employment of rural people. Brachiaria grass is becoming a preferred forage option across SSA due to high biomass production, high nutritive value, remarkable increase in livestock productivity and resilience to drought. Recently, ILRI has expanded its *Brachiaria* program in Cameroon, DRC, Ethiopia, Malawi, Tanzania, Uganda, Somalia, South Sudan and Sudan. To better serve the large number of livestock farmers in Africa, ILRI collaborates with African National Agricultural Research Institutes, Universities, non-governmental organizations and the private sector for research, capacity building and upscaling of *Brachiaria* technologies.

PLATFORM PRESENTATIONPRESENTATION: GOAT FEEDS AND FEEDING SYSTEMS IN SEMI-ARID SMALLHOLDER FARMING SYSTEM IN ZIMBABWE

Takudzwa Charambira[1]*, Irenie Chakoma[2], Prisca Mugabe[1], Shelton Kagande[1], Venancio Imbayarwo-Chikosi[1], Gwinyai Chibaira[3] and Sikhalazo Dube[2]

[1]University of Zimbabwe, [2]International Livestock Research institute (ILRI), [3]Catholic Relief Services (CRS)
email: takudzwacharambira@gmail.com

Improved nutrition through planned supplementation of feed resources with sown pastures, locally available feeds and improved crop residue management could substantially improve goat production in the semi-arid smallholder farming sector. The major challenge to feed related interventions is lack of information on the current feed resources and feeding systems. This study was conducted to identify goat feed resources, feeding systems and feed related challenges for smallholder farmers in Beitbridge district located to the south east semi-arid region of Zimbabwe. Geographic information system (GIS) and remote sensing was combined with participatory research methods: key informant interviews, individual farmers' interviews, focus group discussions, participatory mapping and transect walks to determine the diversity of feed resources in two (Chamunangana and Joko) of the fifteen wards. One hundred and twenty households were included in the study. The diversity of rangeland feed resources included: browse species such as *Colophospermum mopane*, *Grewia bicolor* and *Grewia flavescens*, Acacia pods and forages. All farmers depended on rangeland feed resources for goat browsing. About 87% indicated that browse land was not adequate, yet only 54% of the respondents practiced supplementation. Participants predominantly used crop residues (40%), browse species (28%) and commercial feeds (22%) as supplements. Participants, however, under-reported the use of Acacia pods and Amarula fruits, yet they played a vital role in goat nutrition during the dry season. Of the 46% who did not supplement, 53% attributed this to unavailability of feeding material and 29% were not aware of the importance whilst the rest thought it was not necessary to supplement. The decision to supplement was influenced by geographic location and whether farmers milked their goats ($p < 0.05$).Gender, marital status, age, level of education and experience in goat keeping had no influence on supplementing. Respondents who supplemented had received some form of training in goat husbandry ($p < 0.05$). Shannon index was higher in Chamunangana (1.29) compared to Joko (1.19). There was however no significance difference in biomass

production between the study sites. The results show a diversity of feed resources, hence there is potential to improve nutrition through planned supplementation of feed resources with locally available feeds, sown pastures and better crop management.

PLATFORM PRESENTATION: EVALUATION OF DRY SEASON FODDER SUPPLEMENTS ON THE PERFORMANCE OF GOATS GRAZED ON NATURAL VELD IN A SEMI-ARID AREA OF ZIMBABWE

Tafadzwa Zvakumbirwa[1]*, Tapiwanashe Tembure[1], Venancio Imbayarwo-Chikosi[1], Blessed Masunda[1], Prisca Mugabe[1], David Mbiriri[1], Sikhalazo Dube[2], Irenie Chakoma[2] and Gwinyai Chibaira[3]

[1]University of Zimbabwe, [2]International Livestock Research Institute (ILRI), [3]Catholic Relief Services (CRS)

email: joshuazvakumbirwa@gmail.com

Inadequate nutrition for goats remains a major constraint among smallholder communal farmers particularly in dry regions, where, ironically goats are of high importance. A number of forages have been tested and gave encouraging results as supplements for goats on-station. However, relatively less on-farm testing of the same forages as supplements for goats has been done. The present study was conducted to determine the effect of supplementing goats with forages: Bana grass (*Pennisetum purpureum*) and Velvet bean (*Mucuna pruriens*) hays in one of the driest parts of Zimbabwe, Beitbridge, during the dry season on growth, kid mortality, milk quality and milk offtake. The study lasted ten weeks. Farmers in eight of the 15 wards took part in the study. The trials followed a nested design that took into account sex, forage supplement, goat class and farmer. Each of the eight farmers acted as a replicate. Data on weekly weight changes, pre-weaning kid mortalities, milk composition and milk offtake were recorded. Repeated measures ANOVA of SAS and non-parametric tests of SAS were used to analyze for the effect of supplements on weekly weight changes, milk composition, milk offtake and pre-weaning kid mortality. Dietary supplementation resulted in greater weight gains than non-supplementing ($p < 0.05$) but the difference was not significant between the supplemented groups ($p > 0.05$). There was no significant effect of supplementation on milk composition, offtake was significantly higher in supplemented groups. Supplements had no significant effect ($p > 0.05$) on pre-weaning kid mortality. Supplementing goats is therefore important during the dry months of the year as it ensures maintenance of goat weights and also availability of more milk for human consumption. Goat production is the most important economic activity in Beitbridge district throughout the year and maintenance of live weights will mean farmers can sell their goats throughout the year and get good returns per animal. We therefore concluded that supplementing goats with Bana grass or Velvet bean hay during the dry season in this arid region will improve weight gain and increase milk that can be available for household consumption; confirming results observed on-station.

PLATFORM PRESENTATION: VALUE CHAIN ANALYSIS OF GOATS IN BEITBRIDGE DISTRICT OF ZIMBABWE

Sikhalazo Dube* and Irenie Chakoma

International Livestock Research Institute (ILRI), email: s.dube@cgiar.org

The uptake of technologies is driven by incentives which are embedded in households' and firms' activities. The goat value chain project in Beitbridge also recognises that transactions and incentives for production and investment are made by a sequence of actors that connect production to consumption. The goat population in Zimbabwe is increasing and there is also an increase in demand of goat meat among consumers. However, natural pasture which is limited in quantity and quality especially in the dry season is the main source of feed and the market for goats is poorly developed. The overall objective of the study was to reveal information on goat production and marketing in the Beitbridge district, highlight actors involved, constraints and opportunities that exist and suggest strategies to improve goat productivity and smallholder farmers' livelihoods. Data collection included a consultative meeting with identified stakeholders within the district, followed by household surveys and interviews with various actors along the value chain. A Microsoft Excel spreadsheet was used for descriptive statistics. Discussions from the stakeholder workshop and key informant interviews were consolidated and information extracted from there to verify data from the survey. Goat production is mainly conducted on a subsistence level for the purpose of household consumption by smallholder farmers. The main source of feed for goats is natural pasture and farmers do not supplement nor fatten goats for the market. Reasons being that market prices for goats are low, there is limited access to goat supplementary feed, limited finance to engage in goat feeding and cultural values attached to goats that do not consider supplementation and fattening of goats important aspects. There are both formal and informal markets in the district, with the latter being most pronounced. Farmers sell directly to neighbours and outside their communities

through negotiations on the side of both parties, with prices being very varied. Prices range between US$40 and US$60 per live goat. Value chain actors include input suppliers such as feed and veterinary medicine. Other farmers act as traders or middlemen for goats which are sold to auctioneers, abattoirs and butcheries in and beyond the district. Traders in the district consist of middlemen, auctioneers and other farmers. Major constraints highlighted by producers include poor access to veterinary drugs and goat markets, and high levies being charged associated with livestock sales on the formal market. They also highlighted limited knowledge on goat production, low market prices which is compounded by perceived monopoly by big companies in the livestock business. Livestock thefts and predation are also prevalent, especially if goats are left in the rangelands. Traders, processors and retailers indicated that farmers dispose of sick animals which get condemned by animal health inspectors and old animals that will fetch low prices. Suggestions for improving goat productivity include a change of mindset to commercialising goat production, conducting training on goat production and marketing, investment in irrigation and market infrastructure, and access to credit facilities. Interventions such as livestock marketing should be promoted and be implemented by farmers in collaboration with relevant stakeholders for sustainability.

PLATFORM PRESENTATION: QUALITATIVE AND QUANTITATIVE NUTRITIONAL PARAMETERS OF DIFFERENT FEED SORGHUM CULTIVARS FOR RUMINANTS

Inge Neumann, Lindeque Du Toit and Willem Van Niekerk*

University of Pretoria, email: ingen247@gmail.com

There is a growing need to improve the quality of forages available to livestock producers in order to increase production and efficiency. Sorghum, due to its drought tolerance, has the potential to improve livestock production in sub-tropical regions. The aim of this study was to evaluate different sorghum cultivars available in South Africa (sorghum x Sudan grass hybrid, sweet sorghum x sweet sorghum, BMR sorghum x sweet sorghum and Sudan x Sudan grass hybrid) in terms of water use efficiency (WUE), dry matter yield and forage quality. Data was collected from four forage sorghum cultivars grown at an experimental farm in Delmas, Mpumalanga. The cultivars were planted in a randomised block design with four replicates under dryland conditions. The majority of the cultivars attained the recommended grazing stage (80 cm height) and were ready to be harvested by hand within 48 days. During the regrowth phase most cultivars reached 80 cm within 45-52 days. Water use efficiency and dry matter yield for the growing season was recorded. Proximal analysis and *in vitro* organic matter digestibility (IVOMD) was analysed according to international accepted methods to determine forage quality at different harvest stages (first cut, regrowth and silage stage). Total dry matter yield was unaffected ($p < 0.465$) by sorghum cultivar. BMR sorghum x sweet sorghum proved to be the most water use efficient (24 kg DM $1m^{-1}$ rain), followed by sweet sorghum x sweet sorghum, sorghum x Sudan grass and Sudan x Sudan. The average crude protein (CP) concentration at first harvest of the different sorghum cultivars was 11.19 %, with sweet sorghum x sweet sorghum being higher ($p < 0.05$) and BMR sorghum x sweet sorghum lower ($p < 0.05$) compared to the average at 12.75 % and 9.80 %, respectively. The CP concentration across all cultivars varied ($p < 0.05$) between the different harvest stages, at 11.19 %, 5.95 % and 8.08 % for the first harvest, regrowth and silage stages, respectively. Calcium (0.34 %) and phosphorous (0.16 %) was not different ($p > 0.05$) amongst cultivars, but did differ ($P < 0.05$) between harvest dates. Neutral detergent fibre (NDFom) varied ($p < 0.05$) between the first harvest (58.66 %) and the regrowth (64.08 %) stage and between the regrowth stage and the silage stage (57.42 %). Sorghum x Sudan grass NDFom (53.35 %) was lower ($P < 0.05$) compared to the other cultivars evaluated. In vitro digestibility was not different ($p > 0.05$) amongst cultivars within harvest stages, but it did differ between harvest stages, with the regrowth stage being lower (66.13 %) compared to the first harvest (76.02 %) and silage stage (76.02 %). Sorghum x Sudan grass showed the highest potential to improve production in sub-tropical livestock production systems followed by Sudan x Sudan under the experimental conditions.

POLICY AND PRACTICE WORKSHOP: ECOLOGICAL INFRASTRUCTURE

Friday, 27 July 2017, 09:00 - 13:00

Venue: ARC Training Centre Main Room, Roodeplaat

Over recent years, decision makers in South Africa have begun to recognise the value of healthy Ecological Infrastructure (EI) such as wetlands, grasslands and riparian zones, in ensuring the resilience of the country's environment, resources, and ultimately the survival of its people. These natural assets provide ecosystem services such as clean water supply, fertile soil and pollination for agriculture and food security, flood attenuation (and disaster prevention), as well as cultural and recreational benefits. These services are essentially provided free of charge, and EI in good condition can thus benefit the economy considerably through avoided costs such as water treatment, food imports, disaster management and prolonging the economic lifespan of built infrastructure.

Agriculture is a priority sector for realising food security, employment and economic growth and it is also a sector with a large geographical and ecological footprint. The bulk of EI assets are located in agricultural landscape and these are recognised as valuable assets underpinning the sustainability of agricultural production. The sector depends and impact on EI and their depletion and degradation undermines the provision of water, fertile soil, forage and food production. This workshop aims to provide participants with a background on South Africa's EI assets and their functions, as well as the gradual uptake of EI concepts into natural resource management structures, and opportunities for uptake in the agricultural sector, including their governance processes. We will discuss the challenges and benefits of investing in EI resilience to sustain agricultural landscapes, and making linkages to other relevant focus such as the water security sector.

PLATFORM PRESENTATION: INTRODUCTION TO THE ECOLOGICAL INFRASTRUCTURE CONCEPT AND ITS EVOLUTION IN SOUTH AFRICA

Mahlodi Tau and Kennedy Nemutamvuni*

South African National Biodiversity Institute (SANBI), email: m.tau@sanbi.org.za

The concept of investing in ecological infrastructure finds its origin in the financing model termed "Payment for Ecosystem Services" (PES). The PES model has proven to be an effective mechanism to raise funding for ecosystem restoration in other developing countries such as Costa Rica. The South African National Biodiversity Institute (SANBI), through its biodiversity mainstreaming projects, set up a number of PES pilot projects to test its effectiveness in South Africa. However, the pilot projects were proven unsuccessful due to regulatory issues, complex agreement, a complicated supply chain and unwillingness from potential buyers to enter into long term investment contracts. In parallel, SANBI embarked on a series of dialogues aimed at improving the communication of the essential PES messages and making the case for biodiversity and development. These participatory consultations resulted in the evolution of the concept of investing in ecological infrastructure in South Africa. Ecological infrastructure refers to naturally functioning ecosystems that generate and deliver valuable services to people, such as clean water, fertile soil, disaster risk reduction including flood attenuation, pollination for agriculture and food security. These natural assets include healthy mountain catchments, healthy rangelands, rivers and wetlands. It is the nature-based equivalent of built or hard infrastructure, and can be just as important for providing services and underpinning socio-economic development. Ecological infrastructure provides cost effective, and in most cases free, valuable services and long-term solutions that can benefit the economy and secure sustainable livelihoods. This concept helped to encourage the public sector to invest in ecological infrastructure in a similar manner, as it does with many forms of social and economic infrastructure. It has also resonated with the country's current intention of encouraging sustainable economic development and resulted in the establishment of catchment-based partnerships in some of the country's strategic water source areas.

PLATFORM PRESENTATION: INVESTING IN ECOLOGICAL INFRASTRUCTURE: OPPORTUNITIES TO INFLUENCE AGRICULTURAL PLANNING AND POLICY

Dan'sile Cindi* and Mahlodi Tau

South African National Biodiversity Institute (SANBI), email: d.cindi@sanbi.org.za

South Africa's agriculture sector is a national priority for realising food security, employment and economic growth and is primarily governed by two key pieces of legislation, the Conservation of Agricultural Resources Act, Act 43 of 1983 (CARA) and the Subdivision of Agricultural Land Act, Act 70 of 1970 (SALA). Both rangelands and cultivated lands occupy a large geographical and ecological footprint in the country. The sector has been an important target for biodiversity mainstreaming because of its large spatial footprint and significant impacts on ecosystems and species, both aquatic and terrestrial. Reducing the ecological footprint of agriculture through sustainable practices can contribute to the conservation of biodiversity, habitats and ecosystem services provision. Consequently, a number of programmes over the years have attempted to mainstream biodiversity into the agricultural sector, with varying degrees of success. Unlike the biodiversity message, the concept of investing in ecological infrastructure in the agriculture sector provides an opportunity for multidisciplinary sectors to collaborate and build partnerships geared towards improving healthy rangelands, build resilience of agricultural landscapes and ensure improved water and food security. The sector depends and impacts on ecological infrastructure and the depletion and degradation of ecological infrastructure undermines the provision of water, fertile soil, food production and forage. The bulk of ecological infrastructure assets are located in the agricultural landscape and these are recognised as valuable assets underpinning the sustainability of agricultural production. The concept resonate with the agricultural sector, its policies and legislations by encouraging investment in healthy wetlands, rehabilitation of degraded rangelands, management of virgin land and restriction of land use along the river banks aimed at realising sustainable management of agricultural resources. For instance, important ecological infrastructure such as healthy rangelands provide better quality grazing, clean water, a safety net for rural communities who rely directly on the rivers for water and the rangelands for food. By investing in ecological infrastructure, the agricultural sector will realise better aligned planning and policies with cross-cutting messaging, realise more job opportunities, reduce climate change vulnerabilities and build safer communities and resilient agricultural landscapes.

PLATFORM PRESENTATION: THE VALUE OF SPATIAL INFORMATION FOR THE AGRICULTURAL SECTOR

Paul Avenant

DAFF - Land Use and Soil Management , email: paula@daff.gov.za

As an economic sector, agriculture has the mandate not only to ensure food security but also contributes to the economy through the creation of jobs both in the production and processing sectors. Farming is regarded as a high-risk business and decisions should be taken on sound scientific principles with the support of timeous and reliable information. Effective planning, through the use of spatial information is essential to ensure optimal production with minimum risk. The department of Agriculture, Forestry & Fisheries is responsible for certain core data sets to guide and inform the agricultural sector. The purpose of these data sets is to strengthen the current legislation and to mandate the department. Current important data sets are the newly refined land capability and the demarcation of Agricultural protected areas, which will guide the new proposed bill on the preservation and development of agricultural land (PDALB). The new grazing capacity data set will replace the old map as part of regulation 10 in the Conservation of Agricultural Resources Act (CARA). Other important data sets include the cultivated fields, irrigated areas, soil capability, crop suitability and various agricultural infrastructure and land use data sets. Using these sources of information will really add value to the decision-making processes in proper farm management principles.

PLATFORM PRESENTATION: SUPPORTING SOCIAL CHANGE FOR IMPROVED WATER STEWARDSHIP

David Lindley

World Wide Fund for Nature (WWF), email: dlindley@wwf.org.za

Social change that supports improved agriculture practices which strengthen the stewardship of freshwater ecological infrastructure are complex and most of us struggle to understand how our work can bring about transformative change. Over the past 26 years of the WWF-Mondi Water Stewardship Partnership's history (previously known as the Mondi Wetlands Programme) of working with the forestry and agriculture sectors, it has

undergone a number of evaluations that have used social change theory to deeper understand what has worked, what hasn't and why. Some lessons will be shared from these evaluations. The research highlighted that the WWF water stewardship case is still unfolding and redefining historically entrenched structures and relationships that define the cultural and ecological landscapes that actors work in. These social and cultural structures can inhibit or enable practice to better manage ecological infrastructure, so it is vital to understand them. It also highlights that it is not just standards, policies and best practice tools that lead to better practice but the mediating spaces that standards, policies, certifications and management systems can open up that bring about change. How these are mediated into different contexts becomes vital for forming lasting learning and practice networks across the landscapes (both ecological and cultural) of the farmers as well as within the value chains of the different agriculture sectors that the WWF-Mondi Water Stewardship Partnership has worked in over the past 26 years. It is through these learning networks that changes can be brought about. It also highlights that locally driven initiatives are more likely to bring about meaningful change. From starting in 1991 as wetland practitioners focusing on wetland management and rehabilitation, staff of the WWF-Mondi Water Stewardship Partnership have over time become conveners of people. Bringing different role players together up the value chain in the sugar, dairy, citrus, and forestry sectors that we work in, from farmers to processors, to retailers. This means we have had to develop new skills and knowledge in how to work with people, understand how adults learn informally, and how social change happens. These new skills have allowed us to deeper understand that how we work with people is often more important than what we work on and the results we are working towards. It has also allowed us to begin to reflectively measure the impact of our work that captures both not just the quantitative aspects of our work, but the intangible unseen qualitative aspects as well. The challenge is to see whether the years of work into building relational agency between actors will ultimately result in ecological and structural change at scale, or just more well-oiled agriculture value chains that can tick the boxes of sustainability.

PLATFORM PRESENTATION: WATER SECURITY FROM A FARMER'S PERSPECTIVE

Richard Meissner

Council for Scientific and Industrial Research (CSIR), email: RMeissner@csir.co.za

South Africa is one of the driest countries in the world in terms of mean annual rainfall. Additionally, South Africa's economic development is closely linked to its water security. Despite the high permium placed on South Africa's water resources, there is no commonly shared understanding of water security. By using qualitative social scientific methods, a team of CSIR social scientists investigated how people in two South African localities understand water security. The team interviewed a number of stakeholders, including commercial and emerging farmers in the Greater Sekhukhune District and the eThekwini Metropolitan Municipalities. We discovered that water security perceptions depend on many different factors, such as the changing state of the natural environment and the socio-economic status of people is also important. The objective of this presentation is to report on farmers' perspectives of water security. We interviewed a number of commercial and emerging farmers and asked them how they understand water security. The issues of a changing environment and their socio-economic status featured strongly in their answers. Even so, we also uncovered the finer nuances of water security linked to their lived experience as farmers.

LIST OF CONGRESS DELEGATES AS AT 21 JULY 2018

LAST NAME	FIRST NAME	COMPANY	EMAIL
Ammann	Sigrun	Western Cape Department of Agriculture	sigruna@elsenburg.com
Auret	Willie	Corteva AgriScience	wpauret@dow.com
Avenant	Paul	DAFF - Land Use and Soil Management	paula@daff.gov.za
Baloyi	Ashley	SANBI	m.baloyi@sanbi.org.za
Barrett	Alan	UNISA - Applied Behavioural Ecology & Ecosystems Research Unit	barreas@unisa.ac.za
Berjak	Donna	KwaZulu-Natal Department of Agriculture and Rural Development	Donna.Berjak@kzndard.gov.za
Bester	Johan	DAFF - Forest Technical and Information Services	johanbe@daff.gov.za
Bila	Nedick	North West Department of Rural, Environment and Agricultural Development	mbila@nwpg.gov.za
Black	Wesley	University of the Free State	wesremus@yahoo.com
Bootsma	Antoinette	Limosella Consulting Pty Ltd	antoinette@limosella.co.za
Botha	Cobus	KwaZulu-Natal Department of Agriculture and Rural Development	cobus.botha@kzndard.gov.za
Brits	Yvette	North West Department of Rural, Environment and Agricultural Development	yvettebrits@yahoo.com
Brown	Leslie	UNISA - Applied Behavioural Ecology &amp; Ecosystems Research Unit	LRBrown@unisa.ac.za
Chakoma	Irenie	International Livestock Research institute (ILRI)	i.chakoma@cgiar.org
Charambira	Takudzwa	University of Zimbabwe	takudzwacharambira@gmail.com
Chibaira	Gwinyai	Catholic Relief Services (CRS)	gwinyai.chibaira@crs.org
Chueu	Kedibone	DAFF - Animal Production	kedibonec@daff.gov.za
Cindi	Dan'sile	SANBI	d.cindi@sanbi.org.za
Cupido	Clement	Agricultural Research Council ? API	clementfcupido@gmail.com
Demmer	Stuart	University of KwaZulu-Natal	214518784@stu.ukzn.ac.za
Deysel	Rouxdene	Gauteng Department of Agriculture and Rural Development	rouxdene.deysel@gauteng.gov.za
Diko	William	KwaZulu-Natal Department of Agriculture and Rural Development	mboniso.diko@kzndard.gov.za
Dini	John	Water Research Commission (WRC)	johnd@wrc.org.za
Dlamini	Lindokuhle Xolani	University of KwaZulu-Natal	Leendoh.lx@gmail.com
Du Toit	Justin	DAFF - Grootfontein ADI	justindutoit@gmail.com
Du Toit	Freyni	dNA Solutions	dnasolutionscc@gmail.com
Du Toit	Lindeque	University of Pretoria	linde.dutoit@up.ac.za
Dube	Sikhalazo	International Livestock Research Institute (ILRI)	s.dube@cgiar.org
Duigan	Patrick	Gauteng Department of Agriculture and Rural Development	patrick.duigan@gauteng.gov.za
Els	Heleen	Mangosuthu University of Technology	els.heleen@gmail.com
Fish	Lyn	SANBI	l.fish@sanbi.org.za
Fouche	Jaco	Corteva AgriScience	jfouche@dow.com
Fox	Helen	Rhodes University	helenthefox@gmail.com
Gachao	Leah	International Livestock Research institute (ILRI)	L.Kago@cgiar.org
Genis	Amelia	Landbouweekblad	agenis@landbou.com

SURNAME	FIRST NAME	ORGANISATION	EMAIL
Gerber	Hannes	Northern Cape Department of Agriculture, Land Reform and Rural Development	hannelibbys@gmail.com
Ghimire	Sita	International Livestock Research institute (ILRI)	Sita.Kalpana@gmail.com
Goodall	Victoria	VLG Statistical Services	victoriagoodall@gmail.com
Gordijn	Paul	SAEON	paul@saeon.ac.za
Grobler	Marsia	Agricultural Research Council - API	mgrobler@arc.agric.za
Gulwa	Unathi	Eastern Cape Department of Rural Development and Agrarian Reform	ugulwa@yahoo.com
Harmse	Christiaan	Northern Cape Department of Agriculture, Land Reform and Rural Development	cjj.harmse@gmail.com
Hassen	Abubeker	University of Pretoria	abubeker.hassen@up.ac.za
Hempson	Gareth	SAEON	ghempson@gmail.com
Hendry	Elsa	Briza Publications	elsa@briza.co.za
Henschel	Joh	SAEON	henschel@saeon.ac.za
Horn	Natalie	Gauteng Department of Agriculture and Rural Development	natalieh1811@gmail.com
Hughes	Catherine	Endangered Wildlife Trust	catherineh@ewt.org.za
Janse Van Rensburg	Amaria	University of the Free State	AmariaJvR@yahoo.com
Janse Van Rensburg	Sue	SAEON	sue@saeon.ac.za
Jewitt	Debbie	Ezemvelo KZN Wildlife	debbie.jewitt@kznwildlife.com
Jiyana	Sanele	Agricultural Research Council	jiyanas@arc.agric.za
Jones	Chris	International Livestock Research institute (ILRI)	C.S.Jones@cgiar.org
Jooste	Stephan	Corteva AgriScience	sjooste@dow.com
Jordaan	Gideon	Eastern Cape Department of Agriculture, Rural Development and Agrarian Reform	gideon.jordaan01@gmail.com
Joshua	Quinton	Gauteng Department of Agriculture and Rural Development	quinton.joshua@gauteng.gov.za
Joubert	Erica	Grassland Society of Southern Africa	info+@grassland.org.za
Kahumba	Absalom	University of Namibia	akahumba@unam.na
Keretetse	Moagi	Gauteng Department of Agriculture and Rural Development	moagi.keretetse@gauteng.gov.za
Kgope	Barney	Department of Environmental Affairs	bkgope@environment.gov.za
Khanyile	Sandile	KwaZulu-Natal Department of Agriculture and Rural Development	sandile.lecturer@gmail.com
Khoza	Petros	Mpumalanga Department of Agriculture ,Rural Development, Land and Environmental Affairs	khozapetros@gmail.com
Kilian	Hanno	Khamab Kalahari Reserve	ecologist@khamab.co.za
Kleyn	Linda	CSIR Meraka Institute	kleyns@spesfeed.co.za
Kraai	Fusi	Free State Department of Economic Development, Tourism and Environmental Affairs	kraaifm@gmail.com
Kwaza	Ayanda	Eastern Cape Department of Rural Development and Agrarian Reform	ayanda.kwaza@drdar.gov.za
Labuschagne	Willem	Agricol (Pty) Ltd	sswanepoel@agricol.co.za
Laka	Tshepo	Gauteng Department of Agriculture and Rural Development	tshepolaka@gmail.com
Le Roux	Pieter	University of the Free State	leRouxPA@ufs.ac.za
Lesabe	Aobakwe	Taung Agricultural College	kialesabe@yahoo.com
Lester	Ntsikelelo	North West Department of Rural, Environment and Agricultural Development	nlester@nwpg.gov.za
Letsoalo	Ngoako	Agricultural Research Council-API	letsoalonl@arc.agric.za
Lindley	David	World Wide Fund for Nature (WWF)	dlindley@wwf.org.za

SURNAME	FIRST NAME	ORGANISATION	EMAIL
Links	Petrus	Gauteng Department of Agriculture and Rural Development	petrus.links@gauteng.gov.za
Lotter	David	Themeda Game Farm Services	davidslotter@gmail.com
Loza	Joyce	Ezemvelo KZN Wildlife	joyce.loza@kznwildlife.com
Lukuyu	Bernard	International Livestock Research institute (ILRI)	b.lukuyu@cgiar.org
Luthuli	Cynthia Fikile	KwaZulu-Natal Department of Agriculture and Rural Development	fikile.luthuli@kzndard.gov.za
Madikizela	Zinceba	Department of Environmental Affairs	zpeter@environment.gov.za
Magadlela	Andrew	Agricultural Research Council	amagadlela@arc.agric.za
Magandana	Thabo	University of Pretoria	tmagandana@gmail.com
Magawana	Mpumelelo	KwaZulu-Natal Department of Agriculture and Rural Development	mpumelelo.magawana@kzndard.gov.za
Magoro	Norman Modau	Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs	magoro@mpg.gov.za
Malan	Paul	University of the Free State	malanPJ@ufs.ac.za
Malatji	Billy	UNISA	malatmb@unisa.ac.za
Manaka	Lucas	Agricultural Research Council	manakam@arc.agric.za
Mangwane	Mziwanda	Agricultural Research Council / University of Pretoria	mziwanda.mangwane@yahoo.com
Mantel	Sukhmani	Rhodes University	s.mantel@ru.ac.za
Masemola	Letty	Agricultural Research Council - API	lmasemola@arc.agric.za
Mashau	Caroline	SANBI	c.mashau@sanbi.org.za
Masia	Dalton	Agricultural Research Council	masian@arc.agric.za
Masuku	Vakele	North West Department of Rural, Environment and Agricultural Development	vmasuku@nwpg.gov.za
Mathebula	Noza	Gauteng Department of Agriculture and Rural Development	noza.mathebula@gauteng.gov.za
Matshawule	Sinethemba	Eastern Cape Department of Rural Development and Agrarian Reform	matshawule.sinethemba@yahoo.com
Matyholo-Mapeyi	Nobuntu	Eastern Cape Department of Rural Development and Agrarian Reform	nobuntu.mapeyi@drdar.gov.za
Mavulwana	Lomas	Gauteng Department of Agriculture and Rural Development	lomas.mavuluana@gauteng.gov.za
Mbiriri	David	University of Zimbabwe	dtmbiriri@gmail.com
Mbolekwa	Zola	Senqu Local Municipality	mbolekwaz@senqu.gov.za
McLeod	Nicky	Environmental &amp; Rural Solutions (ERS)	nicky@enviros.co.za
Meissner	Richard	CSIR	RMeissner@csir.co.za
Meissner	Heinz	Milk SA	heinzmeissner@vodamail.co.za
Mhlanga	John Gamuchirai	Bindura University of Science Education	jgmhlanga@gmail.com
Mhlanga	Dudu Emmah	Limpopo Department of Agriculture &amp; Rural Development	duemma@webmail.co.za
Midgley	Stephanie	Western Cape Department of Agriculture	stephanie.midgley@gmail.com
Mkabile	Qawekazi	Rhodes University - Institute for Water Research	qmkabile@gmail.com
Mkhize	Ntuthuko	Agricultural Research Council	mkhizen@arc.agric.za
Mkhize	Mbali	SANBI	m.mkhize@sanbi.org.za
Mkhwanazi	Maxwell	Gauteng Department of Agriculture and Rural Development	maxwell.mkhwanazi@gauteng.gov.za
Mlahlwa	Nonzaliseko Edith	Eastern Cape Department of Rural Development and Agrarian Reform	nonzaliseko.mlahlwa@drdar.gov.za

SURNAME	FIRST NAME	ORGANISATION	EMAIL
Mochesane	Moseketsi	UNISA	sekimochesane@gmail.com
Moeketsi	Thabang	University of the Free State	2013058603@ufs4life.ac.za
Mokgakane	Thabile Joyce	Mpumalanga Department of Agriculture ,Rural Development, Land and Environmental Affairs	mokgakanetj@gmail.com
Mokolopi	Gloria	UNISA	kgobebg@unisa.ac.za
Mokou	Baltimore	University of Limpopo	ball40more@gmail.com
Mokua	Ernest	North West Department of Rural, Environment and Agricultural Development	emokua@nwpg.gov.za
Mokwala	Michael	Gauteng Department of Agriculture and Rural Development	Michael.Mokwala@gauteng.gov.za
Molale	Gontse	Taung Agricultural College	gontse.molale@gmail.com
Moncho	Tshiamo	Northern Cape Department of Agriculture, Land Reform and Rural Development	tshiamo.moncho@yahoo.com
Mongale	Boitumelo	UNISA	mongabf@unisa.ac.za
Morwe	Bontle	Free State Department of Economic Development Tourism and Environmental Affairs	morweb@destea.gov.za
Moshidi	Portia Mamothaladi	Agricultural Research Council-API	Moshidip@arc.agric.za
Moshobane	Moleseng	SANBI	moshobanemc@gmail.com
Mpungose	Nhlakanipho	KwaZulu-Natal Department of Agriculture and Rural Development	nmpungose18@yahoo.com
Msomi	Msawenkosi Fano	KwaZulu-Natal Department of Agriculture and Rural Development	msawenkosi.msomi@kzndard.gov.za
Mthembi	Nyiko	SANBI	nyikowm@gmail.com
Mthi	Siza	Eastern Cape Department of Rural Development and Agrarian Reform	siza.mthi@drdar.gov.za
Muller	Anieka	Stellenbosch University	aniekam@elsenburg.com
Muller	Morne	UNISA	mullem@unisa.ac.za
Müller	Francuois	Agicultural Research Council	mullerf@arc.agric.za
Munyai	Fhatu	Limpopo Department of Economic Development, Environment and Tourism	fmmunyai@gmail.com
Musetha	Victor	DAFF - Animal Production	victormu@daff.gov.za
Mushadu	Wisani Goodness	Limpopo Department of Agriculture	mushaduwg@agric.limpopo.gov.za
Mvelase	Thembeka	University of KwaZulu-Natal	211517147@stu.ukzn.ac.za
Mweli	Nobuhle	University of KwaZulu-Natal / NRF/ SAEON	nobuhlemweli@gmail.com
Mwendia	Solomon	International Center for Tropical Agriculture	s.mwendia@cgiar.org
Myeki	Nonkwekhwezi Princess	Agricultural Research Council-API	myekin@arc.agric.za
Myeni	Sweetness	Agricultural Research Council	myenis@arc.agric.za
Nash	Derryn	KwaZulu-Natal Department of Agriculture and Rural Development	derryn.nash@kzndard.gov.za
Nchoe	Motlalepula	North-West University	mgtnchoe@gmail.com
Ncisana	Lusanda	University of KwaZulu-Natal / Agricultural Research Council	ncisanalusanda@gmail.com
Ndlovu	Mduduzi	Gauteng Department of Agriculture and Rural Development	mduduzi.ndlovu@gauteng.gov.za
Nel	Leana	DLF Seeds	ln@dlfseeds.co.za
Nemutamvuni	Kennedy	SANBI	k.nemutamvuni@sanbi.org.za
Nemutandani	Mashudu	North West Department of Rural, Environment and Agricultural Development	mnemutandani@nwpg.gov.za
Nengovhela	Nkhanedzeni	DAFF - Animal Production	nkhanedzenin@daff.gov.za
Neumann	Inge	University of Pretoria	ingen247@gmail.com

SURNAME	FIRST NAME	ORGANISATION	EMAIL
Ngala	Philemon	DAFF - Grootfontein ADI	philemonn@daff.gov.za
Nherera-Chokuda	Florence	Agricultural Research Council	nhereraf@arc.agric.za
Nicholson	Denise	University of the Witwatersrand	denise.nicholson@wits.ac.za
Nkohla	Gcotyelwa	Eastern Cape Department of Agriculture, Rural Development and Agrarian Reform	gcie5@gmail.com
Nkomo	Mandla	Solidaridad Network	mandla.nkomo@solidaridadnetwork.org
Paledi	Mashego	DAFF - Animal Production	mashegop@daff.gov.za
Palmer	Anthony	Agricultural Research Council - API	palmert@arc.agric.za
Patrocinio	Susannah Cleo	UNISA	patrosc@unisa.ac.za
Paulse	Jamie	University of the Free State	jpaulse363@gmail.com
Peel	Mike	Agricultural Research Council	mikep@arc.agric.za
Peters	Michael	CIAT	m.peters-ciat@cgiar.org
Phoko	Motswapo	Agricultural Research Council ? API	motswapophoko@gmail.com
Pittaway	Timothy	Nelson Mandela University	timothy.pittaway@mandela.ac.za
Pool	Tiaan	Nelson Mandela University	tiaan.pool@mandela.ac.za
Power	John	North West Department of Rural, Environment and Agricultural Development	john.safaris@gmail.com
Pule	Hosia	Agricultural Research Council ? API	Gpule@arc.agric.za
Rakau	Patrick	Agricultural Research Council ? API	rakaup@arc.agric.za
Ramatla	Sauli	Department of Range Resources Management, Lesotho	sauliramatla@gmail.com
Ramoelo	Abel	CSIR	aramoelo@csir.co.za
Ramoletla	Elizabeth	Gauteng Department of Agriculture and Rural Development	elizabeth.ramoletla@gauteng.gov.za
Ramsay	Keith	Ramsay Animal Agriculture	keithrms9@gmail.com
Reitz	Christo	Briza Publications	christo@briza.co.za
Scheijen	Ciska	University of the Free State	ciskascheijen@gmail.com
Scholes	Bob	WITS - Global Change Institute (GCI)	bob.scholes@wits.ac.za
Scholtz	Michiel	Agricultural Research Council - API	gscholtz@arc.agric.za
Seegers	Christina	Gauteng Department of Agriculture and Rural Development	christina.seegers@gauteng.gov.za
Seitlhamo	Wilfred	North West Parks Board	wilfred.seitlhamo@gmail.com
Sekgobela	Seboke	DAFF - Animal Production	sebokes@daff.gov.za
Sere	Lesedi	Agricultural Research Council - API	SereL@arc.agric.za
Shrader	Adrian	University of Pretoria	adrian.shrader@up.ac.za
Smit	Marnus	Northern Cape Department of Environment and Nature Conservation	zmsmit.denc@gmail.com
Stehn	Imke Jutta	University of the Free State	ijstehn@gmail.com
Stiller	Michael	Agricultural Research Council	stillerm@arc.agric.za
Strydom	Tercia	SANParks	tercia.strydom@sanparks.org
Svinurai	Walter	University of Pretoria	wsvinurai@gmail.com
Swanepoel	Pieter	Stellenbosch University	pieterswanepoel@sun.ac.za
Swemmer	Tony	SAEON	tony@saeon.ac.za
Tanner	Jane	Institute for Water Research	j.tanner@ru.ac.za
Tau	Mahlodi	SANBI	m.tau@sanbi.org.za
Taylor	Emily	Endangered Wildlife Trust	emilyt@ewt.org.za
Taylor	Janet	KwaZulu-Natal Department of Agriculture and Rural Development	janettaylor84@gmail.com

SURNAME	FIRST NAME	ORGANISATION	EMAIL
Thubela	Tanki	Eastern Cape Department of Rural Development and Agrarian Reform	thubelat@gmail.com
Tjelele	Julius	Agricultural Research Council	jtjelele@arc.agric.za
Tokozwayo	Sive	Eastern Cape Department of Rural Development and Agrarian Reform	furaluke@gmail.com
Trethewey	Craig	Eastern Cape Department of Rural Development and Agrarian Reform	cat01@telkomsa.net
Trytsman	Marike	Agricultural Research Council - API	MTrystman@arc.agric.za
Tshenkeng	Phenya	North West Parks Board	ptshenkeng@nwpb.org.za
Twine	Wayne	University of the Witwatersrand	wayne.twine@wits.ac.za
Van Der Colf	Janke	Western Cape Department of Agriculture	jankevdc@elsenburg.com
Van Der Merwe	Cara-Anne	University of the Free State	caravandermerwe95@gmail.com
Van Der Westhuizen	Christoff	Stellenbosch University	18448240@sun.ac.za
Van Essen	LD	Nyengere Solutions	lourens.vanessen@gmail.com
Van Huyssteen	Kobus	SANSOR	techoffice@sansor.co.za
Van Oudtshoorn	Frits	Africa Land Use Training	frits@alut1.co.za
Van Schalkwyk	Johan	Vergelegen Trust	mwjovs@mweb.co.za
Van Wyngaard	Josef	Voermol	jdvvanwyngaard@gmail.com
Van Zyl	Erika	KwaZulu-Natal Department of Agriculture and Rural Development	erika.vanzyl@kzndard.gov.za
Veldsman	Stephan	Gauteng Department of Agriculture and Rural Development	stephan.veldsman@gauteng.gov.za
Viljoen	Charné	Western Cape Department of Agriculture	charnea@elsenburg.com
Zikishe	Vathiswa	SANBI	v.zikishe@sanbi.org.za
Zondani	Thantaswa	Agricultural Research Council-API	zondanit@arc.agric.za
Zvakumbirwa	Tafadzwa	University of Zimbabwe	joshuazvakumbirwa@gmail.com