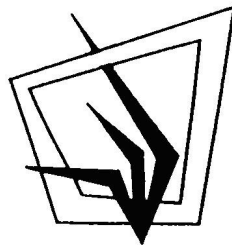




**GRASSLAND SOCIETY OF
SOUTHERN AFRICA**



46TH ANNUAL CONGRESS

ADVANCING RANGELAND ECOLOGY AND PASTURE MANAGEMENT IN AFRICA

GROOTFONTEIN AGRICULTURAL DEVELOPMENT INSTITUTE

MIDDELBURG, EASTERN CAPE

11 TO 15 JULY 2011

PROGRAMME COMPILED BY RACHEL JUDD AND FREYNI J DU TOIT

COVER DESIGN BY CATHRINE VERSVELD

WITH ORIGINAL PHOTOGRAPHS BY JUSTIN C O DU TOIT

PRINTED BY LT PRINTERS



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**CONGRESS PROGRAMME SUMMARY**

TIME	PROGRAMME EVENTS	
Monday, 11 July 2011		
08:30-12:30	GSSA Council Meeting (Conference Room)	
12:30-13:30	LUNCH	
13:30-17:30	Registration (Large Lecture Hall Foyer)	
	OPENING PLENARY SESSION Recreation Hall	
18:00-19:30	<p>Opening Address: Mr Strydom Schoonraad, Department of Agriculture, Forestry and Fisheries, Grootfontein Agricultural Development Institute</p> <p>Presidential Address: Dr Sikhhalazo Dube, Agricultural Research Council – Rangeland Management Program</p> <p>Keynote Address: Integrating science into the decision making process, Prof Tally (C) Palmer, Unilever Center for Environmental Water Quality, Institute for Water Research, Rhodes University</p> <p>Plenary Discussion</p>	
19:30	MEET & GREET BUFFET (Recreation Hall)	
Tuesday, 12 July 2011		
07:30-08:30	Registration (Large Lecture Hall Foyer) (continues)	
	PARALLEL SESSION A Large Lecture Hall	PARALLEL SESSION B Second Year Lecture Hall
08:30-09:50	Session: Plant Invasions - Processes and Outcomes	Session: Rethinking Approaches to Communal Rangelands I
09:50-10:30	Workshop: Slangbos (<i>Seriphium plumosum</i>) Encroachment in Natural Grasslands	
10:30-11:00	TEA and GROUP PHOTOGRAPH (Recreation Hall)	
11:00-12:30	Workshop: Slangbos (<i>Seriphium plumosum</i>) Encroachment in Natural Grasslands	Workshop: Communal Rangelands and Policy – Aligning the Realities of Livestock Keepers with Government Priorities
12:30-13:30	LUNCH (Recreation Hall)	<i>GSSA Trust Meeting</i>
13:30-15:10	Session: Using Planted Pastures for Rehabilitation and Restoration of Mined and Degraded Areas	Workshop: Communal Rangelands and Policy – Aligning the Realities of Livestock Keepers with Government Priorities
15:10-15:30	TEA (Recreation Hall)	
15:30-18:00	Annual General Meeting of the Grassland Society of Southern Africa (Large Lecture Hall)	
18:30	DINNER: Karoo Spitbraai (Recreation Hall)	
Wednesday, 13 July 2011		
08:00-08:30	Registration (Large Lecture Hall Foyer) (continues)	
	PARALLEL SESSION A Large Lecture Hall	PARALLEL SESSION B Second Year Lecture Hall
08:30-09:50	Session: Applying Remote Sensing to Rangeland and Pasture Management	Session: Piospheres as Indicators of Rangeland Condition
09:50-10:30	TEA (Recreation Hall)	
	SPECIAL PLENARY SESSION Large Lecture Hall	
10:30-12:30	Special Plenary Session: Rangelands - Both Sides of the Coin	
12:30-13:30	LUNCH (Recreation Hall)	
	PARALLEL SESSION A Large Lecture Hall	PARALLEL SESSION B Second Year Lecture Hall
13:30-14:30	Session: Past and Future Trends in Vegetation Change	
14:30-15:00	TEA (Recreation Hall)	
15:00-17:00	Mid-Congress Tours (departing from outside Recreation Hall): <ul style="list-style-type: none"> • Thornsprings Restoration Trial • Bergkamp Long Term Trial • History of Grootfontein 	
18:00	DINNER: Steak Evening (Recreation Hall)	

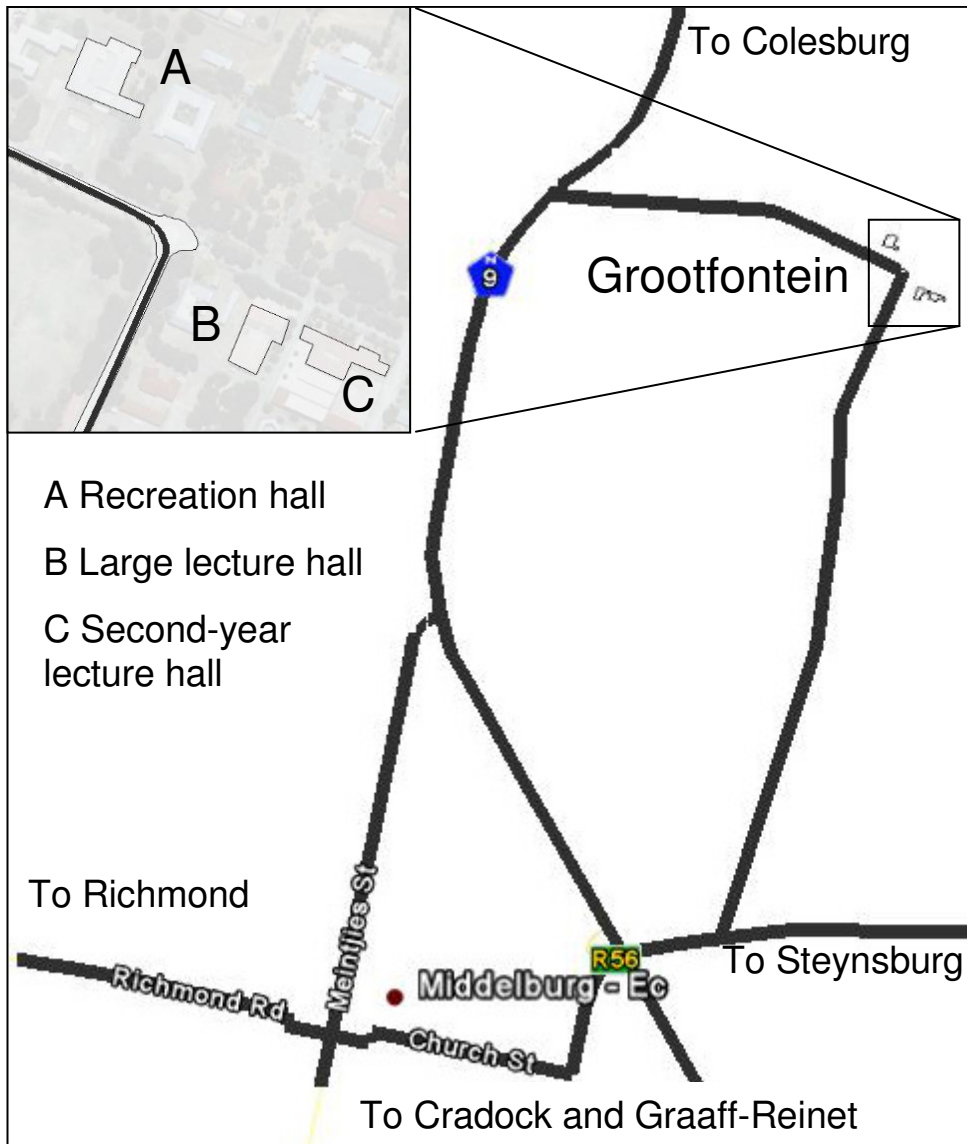


TIME	PROGRAMME EVENTS	
Thursday, 14 July 2011		
08:00-08:30	Registration (Large Lecture Hall Foyer) (continues)	
	PARALLEL SESSION A Large Lecture Hall	PARALLEL SESSION B Second Year Lecture Hall
08:30-10:00	Session: Fire Effects in Rangelands	Session: Improving Pasture Production with Legumes and Minimum Till – Techniques and Economics
10:00-10:30	Poster Session: Natural Resource Monitoring and Management Programmes	
10:30-11:30	TEA & Poster Session: Research Proposals (Recreation Hall)	
	PARALLEL SESSION A Large Lecture Hall	PARALLEL SESSION B Second Year Lecture Hall
11:30-13:00	Session: Plant – Herbivore Interactions on Natural Rangelands I	11:10-13:00 Session: Planted Pasture Production - Irrigation, Harvesting Stage and Dry Matter Yields
13:00-14:00	LUNCH (Recreation Hall)	
14:00-15:00	Session: Plant – Herbivore Interactions on Natural Rangelands II	Session: Rethinking Approaches to Communal Rangelands II
15:00-15:30	TEA (Recreation Hall)	
	SPECIAL PLENARY SESSION Large Lecture Hall	
15:30-17:00	Special Plenary Session: Fracking in South Africa: Implications for Rangelands	
18:30	GALA DINNER (Recreation Hall)	
Friday, 15 July 2011		
Times to be confirmed	Post-Congress Tours (departing from outside Recreation Hall): <ul style="list-style-type: none"> • Addo Elephant Park: Home to the Big Seven • Extended Tour of the Long Term Trials at Grootfontein: The Oldest in Southern Africa <i>Delegates who are not on post-Congress tours can depart or can go on local self drive tours from tourism information pack (eg Nieu Bethesda, Valley of Desolation, Mountain Zebra Park).</i>	



MAPS OF MIDDELBURG AND SURROUNDS

MIDDELBURG-GROOTFONTEIN ROUTES AND GROOTFONTEIN CONGRESS LOCATIONS





SPAR SUPERMARKET, DOCTORS, DENTIST, OPTOMETRIST AND PHARMACIES



- A: Spar
- B: Karoo Apteek (049 842 1118)
- C: Dr van der Walt MD (049 842 4655)
- D: Dr Olls Optometrist (049 842 1127)
- E: Dr Burger MD (049 842 1071) and Medicor Pharmacy (049 842 1109)
- F: Dr Botha Dentist (049 842 1914) and Dr Leeuwner MD (049 842 1070)



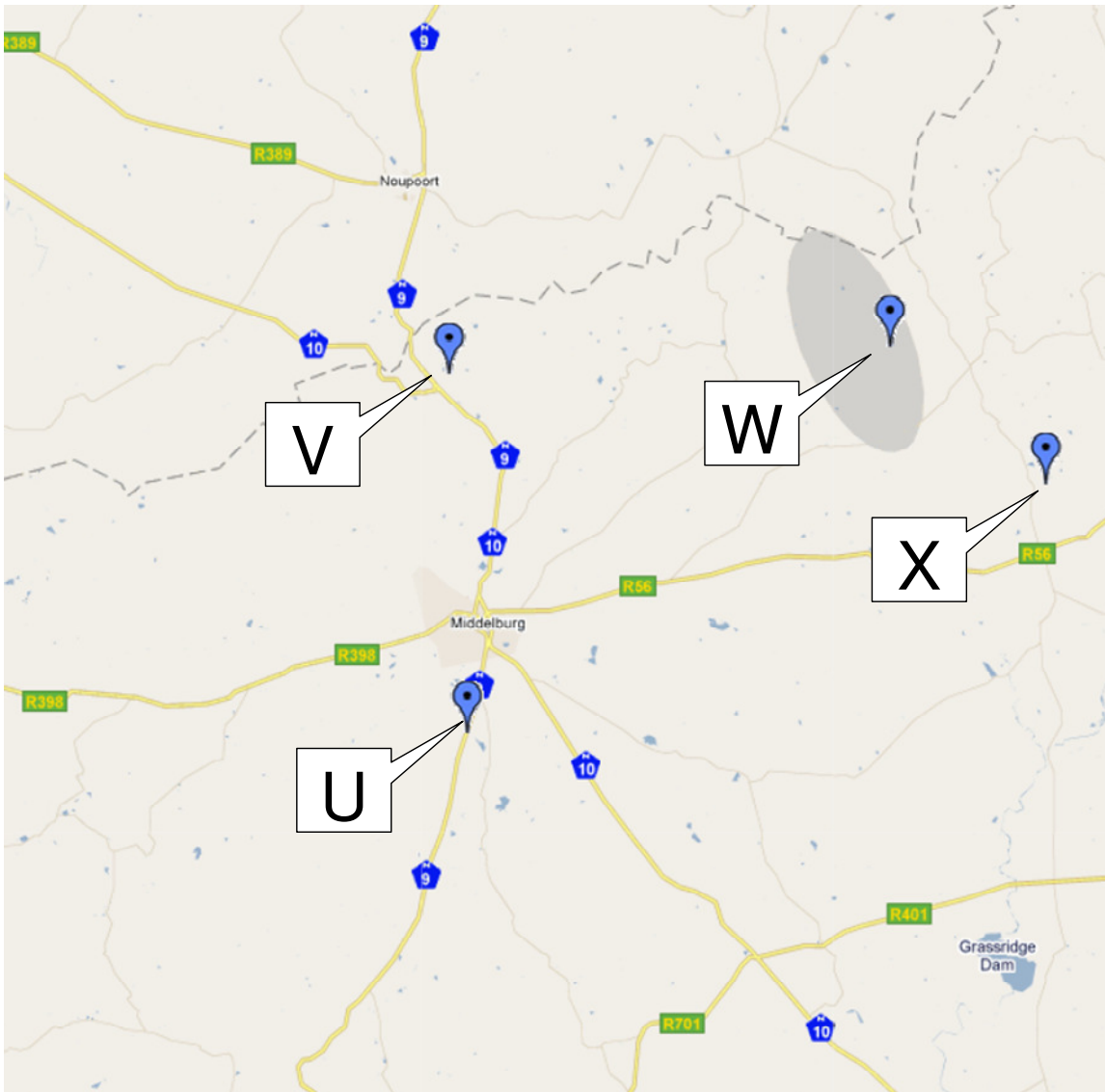
HOSPITAL, MUSEUM AND ACCOMMODATION IN TOWN



- G: Hospital
- H: Celtis Garden Cottages and Units
- I: Kampstraat House
- J: Karoo Country Inn Hotel
- K: Karoo Herberg
- L: Museum
- M: Desert Inn
- N: Karoo Ouberg Lodge
- O: Lynfaden B&B
- P: Your Home My Home
- Q: Oukor Overnight Flat and Rooms
- R: Carochalets
- S: Vanniekerkstraat Units
- T: Christina's Guest House



ACCOMMODATION IN SURROUNDS



NB: Please phone accommodation for specific directions

U: Erin Country House

V: Carlton Heights Farm and Welvanpas

W: Beestekuil Holiday Farm

X: Hillston Farm

**CONGRESS ORGANISING COMMITTEE**

Lorraine van den Berg (Chairperson)	Department of Agriculture, Forestry and Fisheries – Grootfontein ADI
Justin C O du Toit	Department of Agriculture, Forestry and Fisheries – Grootfontein ADI
Minette van Lingen	Department of Agriculture, Forestry and Fisheries – Grootfontein ADI
Jorrie (G) Jordaan	Eastern Cape Department of Rural Development and Agrarian Reform
Wilna Mellet	Department of Agriculture, Forestry and Fisheries – Grootfontein ADI
Rachel Judd (Scientific Reviewer)	Grassland Society of Southern Africa
Freyne du Toit (Administrator)	Grassland Society of Southern Africa

GRASSLAND SOCIETY OF SOUTHERN AFRICA: 2010/11 COUNCIL

PRESIDENT	Sikhalazo Dube
IMMEDIATE PAST PRESIDENT	Mike J S Peel
VICE PRESIDENT	Wayne F Truter
HONORARY SECRETARY	Nelmarie Saayman
HONORARY TREASURER	Justin C O du Toit
SCIENTIFIC EDITOR	Susi Vetter
PUBLICATIONS EDITOR	Julius T Tjelele
PUBLIC RELATIONS OFFICERS	Cobus (J) O Botha & M Igshaan Samuels
ADDITIONAL MEMBER (WEBSITE EDITOR)	Anuschka S Barac
ADDITIONAL MEMBER (ASSISTANT WEBSITE EDITOR)	Lisa Hebbelmann
ADDITIONAL MEMBER (ASSISTANT PUBLICATIONS EDITOR)	Ian A Rushworth
ADDITIONAL MEMBER (ASSISTANT PUBLICATIONS EDITOR)	M Igshaan Samuels
CHAIRPERSON OF TRUST	Chris S Dannhauser
CHAIRPERSON OF PAC	Leslie R Brown

THANK YOU TO OUR SPONSORS

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GRASSLAND SOCIETY OF SOUTHERN AFRICA AWARDS

PLATFORM ADJUDICATION GUIDELINES

Each year the Society awards a medal and certificate for the **Best Presentation** and for the **Best Presentation by a Young Scientist**. 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 ADJUDICATION GUIDELINES

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. Posters will be accompanied by a three minute oral presentation which should summarise the important points presented on the poster. Two minutes are allocated to a brief question and answer session. **The Research Proposals will be judged separately as they do not have an accompanying oral presentation.**

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.

**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	Dreadful – the speaker was embarrassing, I feel angry that I had to endure such a poor performance	1 2
B	Worse than I'd expect at this congress (no eye contact, stood with back to audience, did not speak audibly, etc)	3 4
C	Acceptable – I'd expect most presentations to be of this quality	5 6
D	Better than I'd expect at this congress (the speaker had a very good rapport with the audience)	7 8
E	Outstanding – the audience was captivated by the speaker	9 10
Two	The quality of the visual aids was (CIRCLE YOUR SCORE):	
A	Awful. They distracted from the speech, some were offensive or insulting	1 2
B	Worse than I'd expect (too little/much information, too many/few, writing too small, pictures/graphs unclear, etc.)	3 4
C	Acceptable – visual aids were understandable and supportive	5 6
D	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)	7 8
E	Amazing – they were a visual feast. I'll remember this presentation for years	9 10
Three	The supporting evidence (data, case studies, reviews, etc.) was (CIRCLE YOUR SCORE):	
A	Non-existent. The speaker put across ideas with no philosophical/historical/empirical evidence	1 2
B	Worse than I'd expect (too few data to draw conclusions, inappropriate analysis of data, omission of other important studies, poorly explained, over-complicated)	3 4
C	Acceptable – the conclusions were supported by evidence and I understood what was going on	5 6
D	Very good (complex ideas presented clearly, appropriate and interesting graphs, thorough reviews of other studies, clear link between data, theory and conclusions)	7 8
E	Ground-breaking (the evidence presented here shows a breakthrough in thinking in this field)	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 talk did not contribute significantly to the session; perhaps should have been presented as a poster)	3 4
C	Acceptable (this is the type of presentation I was expecting to hear)	5 6
D	High (this contributed more than most other presentations)	7 8
E	Exceptional (this was a highlight of the session, and one of the top contributions to the congress; this speaker should be encouraged to provide plenary talks in future)	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 PETER EDWARDS AWARD

This award is made each year to a land-user in the area of the annual Congress in recognition of the sound application and practice of the principles of range and forage science and conservation.

Objective: The aim of the award is to recognise top farmers in different areas of southern Africa, and thereby encourage the wise use of natural resources.

Criteria:

Potential recipients are identified by the Congress Organising Committee each year. The recipients are short-listed and farms or land-units visited by an adjudication panel comprising members of the Organising Committee and local advisory personnel. The recipient need not be a member of the GSSA but should be encouraged to join. Considerations when identifying potential candidates might include the following:

- The recipient should be utilising veld (range and/or pasture for domestic livestock production and/or game farming).
- Farming practices should include, as far as possible, sound cultural and management practices which are recommended to ensure the optimum economic utilisation, conservation and reclamation of natural resources.
- Contribution to his/her community by way of participation and leadership in study groups, soil conservation committees, organised agriculture, etc.
- Where a group is identified to receive the award, for example, a study group or soil conservation committee or a tribal authority or a community making use of communal land, the leader in such a group would receive the award on behalf of such a group.

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 46th Annual Congress of the Grassland Society of Southern Africa. Nominations should be received by Thursday 14th July at 3pm. Hand them in at the registration desk.

**SCIENTIFIC PROGRAMME****MONDAY 11 JULY 2011**

TIME	TITLE	PRESENTER	PAGE
OPENING PLENARY SESSION			
Opening of the 46th Annual Congress of the Grassland Society of Southern Africa (Session Chair: Loraine van den Berg)			
18:00-18:05	<i>Welcome</i>	Loraine van den Berg	
18:05-18:15	<i>Opening Address</i>	Strydom Schoonraad	
18:15-18:30	<i>Presidential Address</i>	Sikhalazo Dube	
18:30-18:35	<i>Introduction of Keynote Speaker: Prof Tally (C) Palmer</i>	Susi Vetter	
18:35-19:20	<i>Keynote Address: Integrating science into the decision making process</i>	Tally (C) Palmer	
19:20-19:30	<i>Questions & Discussion</i>		
19:30	MEET & GREET		

KEYNOTE ADDRESS: INTEGRATING SCIENCE INTO THE DECISION MAKING PROCESS*Tally (C) Palmer*

Rhodes University, Institute for Water Research, Unilever Center for Environmental Water Quality,
Grahamstown, email: tally.palmer@ru.ac.za

Professor Tally Palmer is the Director of the Unilever Centre for Ecotoxicology, within the Institute for Water Research at Rhodes University. She has recently spent four years in Australia as the Director of a research institute which spanned engineering and environmental science, and then two years at the National Research Foundation as the executive Director of applied research and innovation, which included oversight of the premier applied research programme (THRIP) – funded by the Department of Trade and Industry. These experiences together with her work on developing the South African water law and policy have left her with a deep commitment to engaging in research in ways that increase the likelihood that research outcomes move into practice – particularly research which increases the likelihood and skilfulness on living on this planet sustainably.

Tally is a riverine aquatic ecologist who has broad experience in aquatic ecosystem and pollution research and research applications in water resource management. Her research now focuses on transdisciplinary approaches, and the ways in which new thinking about complexity and integration can assist society to take account of a wide variety of data, information and knowledge in the search for innovative approaches to sustainability. Tally is passionate about research making a difference to society. She is also committed to the role of women in the development and success of South Africa, and is currently the Chairperson of the National Water Advisory committee.

**TUESDAY 12 JULY 2011**

TIME	TITLE	PRESENTER	PAGE
PARALLEL SESSION A (Large Lecture Hall)			
Plant Invasions – Processes and Outcomes (Session Chair: P Hanno (J) Kilian)			
08:30-08:50	<i>Platform Presentation:</i> An analysis of bush encroachment in the mesic Eastern region of South Africa using repeat photography	James R Puttick	24
08:50-09:10	<i>Platform Presentation:</i> The effects of goats and season of burn on dominant bush species at Bathurst Research Centre	Mfundo Macanda	25
09:10-09:30	<i>Platform Presentation:</i> The significance of plant volatiles in dry grassland	Mitsuru Tsubo	26
09:30-09:50	<i>Platform Presentation:</i> Seasonal phenology amongst common plant species in <i>Dichapetalum cymosum</i> (gifblaar) communities	Gilbert H Pule	27
Workshop: Slangbos (<i>Seriphium plumosum</i>) Encroachment in Natural Grasslands (Session Chair: Paul L Avenant)			
09:50-10:00	<i>Opening Address</i>	Paul L Avenant	28
10:00-10:20	<i>Platform Presentation:</i> The dynamics and rehabilitation of <i>Seriphium plumosum</i> encroachment in the arid- and semi-arid rangelands of the North-West Province, South Africa	Klaus Kellner	28
10:20-10:30	<i>Platform Presentation:</i> <i>Seriphium plumosum</i> - More than 10 years of experience in the North West province	Dieter G Jordaan	30
10:30-11:00	TEA AND GROUP PHOTOGRAPH (Recreation Hall)		
11:00-11:20	<i>Platform Presentation:</i> Slangbos (<i>Seriphium plumosum</i>) encroachment – A serious threat to grazing in Free State grasslands	Winston S W Trollope	30
11:20-11:40	<i>Platform Presentation:</i> Tebuthiuron control of Slangbos – defeating the point?	Justin C O du Toit	30
11:40-12:00	<i>Platform Presentation:</i> A brief overview of the control methods of <i>Seriphium plumosum</i> and the economic impact of the plant on agriculture in the Free State	Chris T B Smith	31
12:00-12:20	<i>Platform Presentation:</i> Preliminary investigations of genetic diversity studies of <i>Seriphium plumosum</i> – A grassland encroacher	Zama (M) Hadebe	32
12:20-12:30	Workshop Discussion		
12:30-13:30	LUNCH (Recreation Hall)		
Using Planted Pastures for Rehabilitation and Restoration of Mined and Degraded Areas (Session Chair: Kevin P Kirkman)			
13:30-13:50	<i>Platform Presentation:</i> The role of planted pasture principles in the reclamation of surface mined land	Wayne F Truter	33
13:50-14:10	<i>Platform Presentation:</i> Assessing the extent of degradation in the old lands at Dudumashe communal area near Nqamakwe	Unathi Gulwa	34
14:10-14:15	Poster Presentation: Measuring trends in landscape function in transformed savanna landscapes: a case study of a mine in north eastern South Africa	Mike J S Peel	34
14:15-14:35	<i>Platform Presentation:</i> The growth response of different pastures species on alleviated compacted mine soils	Johann Olivier	35
14:35-14:55	<i>Platform Presentation:</i> Evaluating stocking rates to optimally graze irrigated Tall fescue (<i>Festuca arundinacea</i>) pastures as a management tool for rehabilitated mine land	Riaan (A) W Jonker	36
15:10-15:30	TEA (Recreation Hall)		
15:30-18:00	Grassland Society of Southern Africa Annual General Meeting (Large Lecture Hall)		
15:30-15:35	Welcome	Sikhalazo Dube	
15:35-15:40	Present and apologies	Sikhalazo Dube	
15:40-15:45	Additions to and acceptance of the agenda	Sikhalazo Dube	
15:45-15:50	Approval of the minutes of 21 July 2010	Sikhalazo Dube	
15:50-15:56	Matters arising: Constitutional changes	Justin C O du Toit	
15:56-16:02	Matters arising: Name change debate	Ian A Rushworth	
16:02-16:10	Matters arising: Norman Rethman Award	Wayne F Truter	
16:10-16:20	Matters arising: Congress 47 (2012)	M Igshaan Samuels	



TIME	TITLE	PRESENTER	PAGE
16:20-16:30	Treasurer's report	Justin C O du Toit	
16:30-16:40	Scientific Editor's report	Susi Vetter	
16:40-16:50	Publication Editor's report	Julius Tjelele	
16:50-17:00	Website Editor's report	Lisa Hebbelmann	
17:00-17:10	Public Relations Officer's report	M Igshaan Samuels	
17:10-17:20	Professional Affairs Committee report	Mike J S Peel	
17:20-17:30	Trust report	Chris S Dannhauser	
17:30-17:35	Election of Office Bearer: Vice President	Sikhalazo Dube	
17:35-17:40	Election of Office Bearer: Public Relations Officer	Sikhalazo Dube	
17:40-17:45	Election of Office Bearers: Additional Members (3)	Sikhalazo Dube	
17:45-17:55	General: Congress 48 (2013)	TBA	
17:55-18:00	Date of next meeting	Sikhalazo Dube	
PARALLEL SESSION B (Second Year Lecture Hall)			
Rethinking Approaches to Communal Rangelands (Session Chair: M Igshaan Samuels)			
08:30-08:50	<i>Platform Presentation:</i> Sustainability in communal socio-ecological systems (SUCSES) - Characteristics of rural households most vulnerable to environmental change	Wayne C Twine	38
08:50-09:10	<i>Platform Presentation:</i> Is rangeland condition a reflection of municipal commonage policy? - The case of two Nama Karoo towns	Clement F Cupido	39
09:10-09:30	<i>Platform Presentation:</i> The growing indifference of youth towards agriculture in agro-pastoral systems in Namaqualand	Melvin B V Swarts	39
09:30-09:50	<i>Platform Presentation:</i> Small scale farming and the perspective of grazing management in the townships of South Africa	Jabulani G Mashiya	40
09:50-10:10	<i>Platform Presentation:</i> Rethinking herding as a livestock management strategy in South Africa?	Clement F Cupido	41
10:10-10:30	<i>Platform Presentation:</i> People, cattle, and the commons. the case of Enhlanokhombe, western KwaZulu-Natal	Monique L Salomon	42
10:30-11:00	TEA AND GROUP PHOTOGRAPH (Recreation Hall)		
Workshop: Communal Rangelands and Policy - Aligning the Realities of Livestock Keepers with Government Priorities (Session Chair: Monique L Salomon)			
11:00-11:10	<i>Opening and welcome</i>	Monique L Salomon	43
11:10-11:25	<i>Knowledge-to-policy: voices from the field I</i> - The perceptions of communal livestock keepers on veld condition, veld degradation and options for improving livestock production: A synthesis of studies from Sterkspruit in the Eastern Cape	Wiseman Goqwana	43
11:25-11:40	<i>Knowledge-to-policy: voices from the field II</i> - Understanding commonage policy: A challenge for pastoralists in the semi-arid regions of South Africa	M Igshaan Samuels	43
11:40-11:55	<i>Knowledge-to-policy: voices from the field III</i> - Facilitating bottom up policy development in communal rangelands in the uKhahlamba-Drakensberg	Monique L Salomon	43
11:55-12:15	<i>Position Paper:</i> New paradigms in communal rangeland management	Susi Vetter	43
12:15-12:30	The Rangeland Monitoring Programme	Alan D Short	43
12:30-13:30	LUNCH (Recreation Hall)		
13:30-13:45	The Draft Range and Forage Policy	Kedibone B Chueu	
13:45-15:10	Workshop Discussion and Way Forward		
15:10-15:30	TEA (Recreation Hall)		
Annual General Meeting of the Grassland Society of Southern Africa (Session Chair: Sikhalazo Dube) (Large Lecture Hall)			
15:30-15:35	Welcome	Sikhalazo Dube	
15:35-15:40	Present and apologies	Sikhalazo Dube	
15:40-15:45	Additions to and acceptance of the agenda	Sikhalazo Dube	
15:45-15:50	Approval of the minutes of 21 July 2010	Sikhalazo Dube	
15:50-15:56	Matters arising: Constitutional changes	Justin C O du Toit	
15:56-16:02	Matters arising: Name change debate	Ian A Rushworth	



TIME	TITLE	PRESENTER	PAGE
16:02-16:10	Matters arising: Norman Rethman Award	<i>Wayne F Truter</i>	
16:10-16:20	Matters arising: Congress 47 (2012)	<i>M Igshaan Samuels</i>	
16:20-16:30	Treasurer's report	<i>Justin C O du Toit</i>	
16:30-16:40	Scientific Editor's report	<i>Susi Vetter</i>	
16:40-16:50	Publication Editor's report	<i>Julius Tjelele</i>	
16:50-17:00	Website Editor's report	<i>Lisa Hebbelmann</i>	
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17:45-17:55	General: Congress 48 (2013)	<i>TBA</i>	
17:55-18:00	Date of next meeting	<i>Sikhalazo Dube</i>	

**WEDNESDAY 13 JULY 2011**

TIME	TITLE	PRESENTER	PAGE
PARALLEL SESSION A (Large Lecture Hall)			
Applying Remote Sensing to Rangeland and Pasture Management (Session Chair: James R Puttick)			
08:30-08:50	<i>Platform Presentation:</i> Modelling evapotranspiration in the Kruger National Park using the Penman-Monteith Equation and MODIS LAI to approximate canopy conductance	Tony (A) R Palmer	56
08:50-09:10	<i>Platform Presentation:</i> Modelling trends of evapotranspiration using MODIS LAI in the catchments of the Eastern Cape	Andiswa Finca	56
09:10-09:30	<i>Platform Presentation:</i> Using MODIS NDVI as a measure of grazing capacity on a regional scale	Theunis Morgenthal L	57
09:30-09:50	<i>Platform Presentation:</i> Quantifying evaporation and biomass of kikuyu and ryegrass pastures using remote sensing technologies	Colin S Everson	58
09:50-10:30	TEA (Recreation Hall)		
SPECIAL PLENARY SESSION (Large Lecture Hall)			
Rangelands – Both Sides of the Coin (Session Chair: Loraine van den Berg)			
10:30-11:15	<i>Keynote Address:</i> Title to be confirmed	Mike Griffiths Norton-	60
11:15-11:30	<i>Platform Presentation:</i> Land reform - Lessons from the past	Gerdie Landman	60
11:30-11:45	<i>Platform Presentation:</i> Land reform – A success story	Trevor Elliott	60
11:45-12:00	<i>Platform Presentation:</i> Grazing management perspectives from a farmer	Chris Hobson	61
12:00-12:15	<i>Platform Presentation:</i> Blazing and high intensity grazing in southern African savannas - mortal enemies or inseparable workmates?	Mike J S Peel	61
12:15-12:30	<i>Platform Presentation:</i> Research and extension – what do farmers need?	Willem Loock	62
12:30-13:30	LUNCH (Recreation Hall)		
PARALLEL SESSION A (Large Lecture Hall)			
Past and Future Trends in Vegetation Change (Session Chair: Sue van Rensburg)			
13:30-13:40	<i>Poster Presentation:</i> Degraded vegetation in Bethlehem, South Africa - a revisit after four decades	Mamokete Dingaana N V	63
13:40-14:00	<i>Platform Presentation:</i> The extent and rate of vegetation change in southern Africa's rangelands over the last 100 years: using historical trajectories to inform future projections	M Timm Hoffman	64
14:00-14:20	<i>Platform Presentation:</i> Are there regime shifts in grassland plant communities of the east coast hinterland?	Rob C Scott-Shaw	65
14:20-14:30	Discussion		
14:30-15:00	TEA (Recreation Hall)		
15:00-17:00	Mid-Congress Tours (Gathering point outside the Recreation Hall)		
PARALLEL SESSION B (Second Year Lecture Hall)			
Piospheres as Indicators of Rangeland Condition (Session Chair: Michelle J Tedder)			
08:30-08:50	<i>Platform Presentation:</i> Preliminary investigation on piosphere formation around dip-tank areas in the semi-arid communal grazing lands of Swaziland - grass species distribution, soil nutrients and range condition assessment	Solomon B Tefera	66
08:50-09:10	<i>Platform Presentation:</i> Impacts of large herbivores on vegetation structure, composition and diversity around water points in Waterberg Plateau Park, central Namibia	Wellencia C Mukaru	67
09:10-09:30	<i>Platform Presentation:</i> Changes in vegetation composition, richness and diversity mediated by large herbivores along a distance-gradient at selected water points in Etosha National Park, Namibia	Isaac Mapaure	67
09:30-09:50	<i>Platform Presentation:</i> Herbaceous species abundance and composition around operational vs. non-operational water points in a small semi-arid savanna game reserve	S Wilfred Seithamo	68
09:50-10:30	TEA (Recreation Hall)		



TIME	TITLE	PRESENTER	PAGE
SPECIAL PLENARY SESSION (Large Lecture Hall)			
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12:00-12:15	Platform Presentation: Blazing and high intensity grazing in southern African savannas - mortal enemies or inseparable workmates?	Mike J S Peel	61
12:15-12:30	Platform Presentation: Research and extension – what do farmers need?	Willem Loock	62
12:30-13:30	LUNCH (Recreation Hall)		
PARALLEL SESSION B (Second Year Lecture Hall)			
Strategies for Animal Nutrition (Session Chair: Ntuthuko R Mkhize)			
13:30-13:50	Platform Presentation: Growth performance of growing pigs fed a concentrate diet and <i>ad libitum</i> kikuyu grass CANCELLED DUE TO NON ATTENDANCE	J Serge Kanga	70
13:50-14:10	Platform Presentation: Overnight supplementary feeding of indigenous goats in Moist Midlands Mistbelt of KwaZulu-Natal MOVED TO THURSDAY PARALLEL SESSION A: PLANT-HERBIVORE INTERACTIONS ON NATURAL RANGELANDS I	Zandile D Ndlovu	70
14:10-14:15	Poster Presentation: Nutritive value of <i>Acacia</i> species used as ruminant feed supplements in Vhembe District of South Africa CANCELLED DUE TO NON ATTENDANCE	Kgabo T Mahlako	71
14:15-14:30	Discussion		
14:30-15:00	TEA (Recreation Hall)		
15:00-17:00	Mid-Congress Tours (Gathering point outside the Recreation Hall)		

**THURSDAY 14 JULY 2011**

TIME	TITLE	PRESENTER	PAGE
PARALLEL SESSION A (Large Lecture Hall)			
Fire Effects in Rangelands (Session Chair: Winston S W Trollope)			
08:30-08:50	<i>Platform Presentation:</i> Fire in the Tarchonanthus Veld – Fire effects on soils, grasses, and bush clumps	Lisa Hebbelmann	72
08:50-09:10	<i>Platform Presentation:</i> Head vs backfires in the eastern Kalahari	P Hanno (J) Kilian	73
09:10-09:30	<i>Platform Presentation:</i> Long-term effects of burning frequency on herbaceous species composition in the False Thornveld of the Eastern Cape, South Africa	Keletso Mopipi	73
09:30-09:50	<i>Platform Presentation:</i> Investigating long-term effects of season of burn on species composition, basal cover and plant density in the Döhne Sourveld of the Eastern Cape, South Africa	Zamukulunga Ndovela	74
09:50-10:00	Discussion		
PLENARY POSTER SESSION (Large Lecture Hall)			
Natural Resource Monitoring and Management Programmes (Session Chair: Wayne F Truter)			
10:00-10:05	<i>Poster Presentation:</i> Challenges and opportunities for livestock-environment and feed options in developing countries	Sikhalazo Dube	75
10:05-10:10	<i>Poster Presentation:</i> The Kalahari-Namib project - enhancing decision-making through interactive learning and action in the Molopo-Nossop River Basin: A collaborative project between South Africa, Namibia and Botswana	Klaus Kellner	76
10:10-10:15	<i>Poster Presentation:</i> Stewardship for the environment	Bradley Gibbons	77
10:15-10:20	<i>Poster Presentation:</i> Local knowledge and perceptions of assessment indicators for a participatory evaluation of management and restoration practices to combat desertification in South Africa	Klaus Kellner	78
10:20-10:25	<i>Poster Presentation:</i> South African Environmental Observation Network: final two nodes established and operational	Yolandi Els	79
10:25-10:30	Discussion		
10:30-11:30	TEA & POSTER SESSION (Recreation Hall)		
PLENARY POSTER SESSION (Recreation Hall)			
Research Proposals (Session Chair: Sikhalazo Dube)			
10:30-11:30	<i>Poster Presentation:</i> The population dynamics of <i>Acacia nilotica</i> in Northern KwaZulu-Natal, South Africa	Janet M Taylor	80
10:30-11:30	<i>Poster Presentation:</i> Production potential of pastures planted with treated seed on degraded agricultural and mine soils	Dirk Coetzee	80
10:30-11:30	<i>Poster Presentation:</i> Biochemical links between plants and large herbivores - Consequences for browse utilization and animal productivity (a proposal)	Ntuthuko R Mkhize	81
10:30-11:30	<i>Poster Presentation:</i> Fire and wetlands - Yes or no?	Linda Luvuno	82
10:30-11:30	<i>Poster Presentation:</i> Review of research activities in the South Luangwa National Park and its surrounding areas, Zambia	Twakundine Simpamba	82
10:30-11:30	<i>Poster Presentation:</i> A scientific evaluation of the Holistic Management concept for veld management	Robin Ford	83
10:30-11:30	<i>Poster Presentation:</i> Effect of moisture and nutrients on coppice response of <i>Terminalia sericea</i> stumps	Hloniphani P M Mthunzi	84
10:30-11:30	<i>Poster Presentation:</i> Evaluating range condition and soil characteristics in Sakhi and Cangca communal rangelands of the Eastern Cape	Thembilihle Mjamba	85
10:30-11:30	<i>Poster Presentation:</i> Dynamics of the feed resource base, Nguni cattle feeding behaviour and nutritional values of common grass and browse species in the Cangca and Sakhi communal areas of the Eastern Cape	F Alice Gwelo	85
10:30-11:30	<i>Poster Presentation:</i> Soil quality of kikuyu-ryegrass pasture in the Southern Cape	Pieter A Swanepoel	86



TIME	TITLE	PRESENTER	PAGE
10:30-11:30	<i>Poster Presentation:</i> A proposal for re-examining old friends - Combining Rhodes and Smuts finger grass	Yvette Brits	87
PARALLEL SESSION A (Large Lecture Hall)			
Plant – Herbivore Interactions on Natural Rangelands I (Session Chair: Yolandi Els)			
11:30-11:50	<i>Platform Presentation:</i> A goat's eye view of vegetation quality: increased fPAR improves goats' perception of foraging opportunities in the Richtersveld	Susi Vetter	89
11:50-12:10	<i>Platform Presentation:</i> Pastoral value in the High Bassin Zone of Mandrare rangeland in southern Madagascar PRESENTED BY JUSTIN C O DU TOIT AS PRESENTER UNABLE TO ATTEND	Arsene J M Randrianariveloseheno	89
12:10-12:15	<i>Poster Presentation:</i>	Mike J S Peel	90
12:15-12:35	<i>Platform Presentation:</i> Overnight supplementary feeding of indigenous goats in Moist Midlands Mistbelt of KwaZulu-Natal MOVED FROM WEDNESDAY PARALLEL SESSION B: STRATEGIES FOR ANIMAL NUTRITION	Zandile D Ndlovu	70
	<i>Platform Presentation:</i> Monitoring of vegetation in the Ngoma forest of Kafue National Park, Zambia CANCELLED DUE TO NON ATTENDANCE	Twakundine Simpamba	91
12:35-12:40	<i>Poster Presentation:</i> Influence of different veld management strategies on animal weight gain within a fourteen year trial in Eastern Cape False Thornveld	Craig Trethewey	92
12:40-13:00	<i>Platform Presentation:</i> Vegetation dynamics within a fourteen year veld management trial in Eastern Cape False Thornveld	Theunis L Morgenthal	93
13:00-14:00	LUNCH (Recreation Hall)		
Plant – Herbivore Interactions on Natural Rangelands II (Session Chair: Lisa Hebbelmann)			
14:00-14:20	<i>Platform Presentation:</i> Grazing, grass vigour and species composition change	Kevin P Kirkman	94
14:20-14:30	<i>Platform Presentation:</i> Effects of grazing, fire, nitrogen and water availability on nutritional quality of grass in semi-arid savanna	Khanyi R Mbatha	95
14:30-14:35	<i>Poster Presentation:</i> Wahroonga Farm: 40 years of protection from livestock grazing and reduced fire regimes – lessons learnt	Rob C Scott-Shaw	95
14:35-14:55	<i>Platform Presentation:</i> Above- and belowground competitive interactions between seedlings of three grass species and the surrounding native grass sward on three sites of differing soil depth	Michelle J Tedder	95
14:55-15:00	<i>Poster Presentation:</i> Phylogeny and phylogenetic diversity of trees and shrubs in the Kruger National Park using DNA barcodes	Kowiyou Yessoufou	96
15:00-15:30	TEA (Recreation Hall)		
SPECIAL PLENARY SESSION (Large Lecture Hall)			
Fracking in South Africa: Implications for Rangelands (Session Chair: Justin C O du Toit)			
15:30-15:40	<i>Opening and welcome</i>	Justin C O du Toit	
15:40-16:00	<i>Platform Presentation:</i> The impacts of fracking on agriculture and rural communities in the USA	Doug Stern & Lukie Strydom	
16:00-16:20	<i>Platform Presentation:</i> Is fracking an option for South Africa?	Jonathan Deal	
16:20-16:40	<i>Platform Presentation:</i> Department of Agriculture, Forestry and Fisheries preliminary position on fracking	Tino Herselman	
16:40-17:00	Discussion and questions		
PARALLEL SESSION B (Second Year Lecture Hall)			
Improving Pasture Dynamics with Legumes and Minimum Till – Techniques and Economics (Session Chair: T Phillip Nengwenani)			
08:30-08:50	<i>Platform Presentation:</i> Incorporating annual legume pastures into the cropping systems of the Swartland, Western Cape – an economic evaluation	Mark B Hardy	97



TIME	TITLE	PRESENTER	PAGE
08:50-08:55	<i>Poster Presentation:</i> Soil pH in different soil strata of kikuyu-ryegrass pastures in an 18 year no-till system	Pieter A Swanepoel	98
08:55-09:15	<i>Platform Presentation:</i> A minimum-till production system on marginal lands in the Eastern Cape province	Jorrie (G) Jordaan	98
09:15-09:35	<i>Platform Presentation:</i> The production potential of kikuyu (<i>Pennisetum clandestinum</i>) over-sown with ryegrass (<i>Lolium spp.</i>) in a no-till system	Janke van der Colf	98/99
09:35-09:55	<i>Platform Presentation:</i> The use of the loss-on-ignition method to predict soil organic carbon in Westleigh and Katspruit soil forms	Pieter A Swanepoel	99
09:55-10:00	<i>Poster Presentation:</i> The effect of different inoculation methods on nodulation of three clover species	Chris S Dannhauser	99
10:00-10:20	<i>Platform Presentation:</i> Assessing the value of the Jacobson table as a method to determine germination percentage for coated <i>Medicago sativa</i> seed	Leana Nel	100
10:20-10:25	<i>Poster Presentation:</i> The dry matter production of annual forage legumes in the southern Cape of South Africa	M Dalena (M) Lombard	100
10:25-10:30	Discussion		
10:30-11:10	TEA & POSTER SESSION (Recreation Hall)		
PLENARY POSTER SESSION (Recreation Hall)			
Research Proposals (Session Chair: Sikhhalazo Dube)			
10:30-11:10	<i>Poster Presentation:</i> The population dynamics of <i>Acacia nilotica</i> in Northern KwaZulu-Natal, South Africa	Janet M Taylor	80
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PARALLEL SESSION B (Second Year Lecture Hall)			
Planted Pasture Production – Irrigation, Harvesting Stage and Dry Matter Yields (Session Chair: Pieter A Swanepoel)			
11:10-11:30	<i>Platform Presentation:</i> Water production function of annual ryegrass as affected by nitrogen	Amanuel A Abraha	102
11:30-11:50	<i>Platform Presentation:</i> The evaluation of dry matter yield and forage quality for four pastures as influenced by three frequencies of flood irrigation in the False Upper Karoo	T Phillip Nengwenani	102
11:50-12:10	<i>Platform Presentation:</i> Developing simple irrigation scheduling calendars of pasture using soil water balance model - ryegrass as an example	Melake K Fessehazion	104
12:10-12:30	<i>Platform Presentation:</i> Calibration of the rising plate meter for pasture yield determination in kikuyu (<i>Pennisetum</i>)	Janke van der Colf	104



TIME	TITLE	PRESENTER	PAGE
	<i>clandestinum</i>) over-sown with ryegrass (<i>Lolium spp.</i>)		
12:30-12:50	<i>Platform Presentation:</i> The effect of harvesting stage on herbage yield and nutritive value of <i>Panicum coloratum</i> under sub humid climatic conditions of Ethiopia	Diriba G Challi	105
12:50-12:55	<i>Poster Presentation:</i> The summer dry matter production of eight sub-tropical grass species under dryland conditions in the southern Cape of South Africa	M Dalena (M) Lombard	106
12:55-13:00	<i>Poster Presentation:</i> The dry matter production of <i>Brassica</i> and <i>Raphanus</i> species in the southern Cape of South Africa	M Dalena (M) Lombard	107
13:00-14:00	LUNCH (Recreation Hall)		
Rethinking Approaches to Communal Rangelands II (Session Chair: Clement F Cupido)			
14:00-14:20	<i>Platform Presentation:</i> Perception of communal farmers on causes, types of degradation and techniques to restore degraded rangelands	Mota S Lesoli	108
14:20-14:40	<i>Platform Presentation:</i> Testing the acceptance of a box baler for hay in a society of high technology development	Nobuntu Mapeji	109
14:40-15:00	<i>Platform Presentation:</i> Rainwater harvesting for increasing livestock forage on the semi -arid rangelands of Lambani Village, South Africa	Ntuwiseni E Mmbi	110
15:00-15:30	TEA (Recreation Hall)		
SPECIAL PLENARY SESSION (Large Lecture Hall)			
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16:40-17:00	Discussion and questions		
Scientific Programme of the 46th Annual Congress of the Grassland Society of Southern Africa ENDS			



ABSTRACTS: TUESDAY 12 JULY 2011

Note: *Presenting Author

Plant Invasions – Processes and Outcomes

SESSION CHAIR: P HANNO (J) KILIAN

Tuesday 12 July 2011, 08:30 – 09:30

Platform Presentations

PLATFORM PRESENTATION: AN ANALYSIS OF BUSH ENCROACHMENT IN THE MESIC EASTERN REGION OF SOUTH AFRICA USING REPEAT PHOTOGRAPHY

James R Puttick^{1}, M Timm Hoffman¹ and Tim G O'Connor²*

¹University of Cape Town, Plant Conservation Unit, Cape Town email: vart007@yahoo.com, timh.hoffman@uct.ac.za, ²South African Environmental Observation Network (SAEON), Grasslands-Wetlands-Forest Node, Pietermaritzburg, email: timoconnor@xsinet.co.za

Woody plant encroachment in savannas and grasslands is a phenomenon observed worldwide over the last century and has social, economic, and conservation impacts due to associated losses in herbaceous productivity and biodiversity. Although it is a widespread occurrence, the dynamics and drivers of bush encroachment are poorly understood. This preliminary analysis of approximately 100 repeat landscape photographs from the Eastern Cape and Kwazulu-Natal regions examines the nature of bush encroachment in the mesic east of South Africa. Repeat photograph sites cover an altitudinal gradient from the coast to the Drakensberg and a latitudinal gradient from the Border region in the south to the Tugela Valley in the north. Land-use on photographed landscapes was predominantly communal or commercial, or both, although sites in protected areas were also re-photographed. The increase in woody cover observable in the majority of re-photographed landscapes suggests that global drivers are playing a role in promoting woody growth at a regional scale. Rates and extent of woody increase varied and tended to be most rapid and widespread at moister warmer sites at lower altitudes, although there was also an increase in woody cover in grasslands at higher altitudes. Repeat photographs also provided insights at the landscape scale, and highlighted landscape scale dynamics taking place in relation to land-use. Most notable was the dramatic increase in thornbush cover occurring on abandoned lands. The abandonment of agricultural land and general trend of woody thickening in communal areas suggests that land-users are not utilising the entire landscape as intensively as earlier in the twentieth century. Woody cover increase was generally high on commercial land although it was evident that encroachment had been reversed in some instances. Woody encroachment was also observed in protected areas. Vegetation change was characterized by increases in dense thornveld and thicket cover in the savanna and coastal belt areas, and a spread of thornveld into grassland at higher altitudes. Repeat photographs of thicket areas on hillslopes at lower altitudes tend to suggest that these areas are recovering from previous heavy utilization rather than being encroached. The dynamic in the savanna and grassland areas appears to be different and involves the thickening of the savannas and a spread into the grassland of mainly *Acacia* species. The spread of woody cover into higher altitude grassland areas may signal a biome-shift from grassland to savanna as predicted in climate change forecasts. A detailed study of the changes in woody cover over the last century along the savanna/grassland boundary coupled with an analysis of climate and land-use histories in the study area is proposed to better understand how local drivers such as land-use, fire and herbivory, and global drivers such as CO₂ enrichment and climate change are affecting vegetation change in the eastern parts of South Africa.

Keywords: encroachment; repeat landscape photographs; altitudinal gradient; latitudinal gradient; thornbush; biome-shift



**PLATFORM PRESENTATION: THE EFFECTS OF GOATS AND SEASON OF BURN ON
DOMINANT BUSH SPECIES AT BATHURST RESEARCH CENTRE**

Mfundo Macanda and Nolonwabo Jokani*

Eastern Cape Department of Rural Development and Agrarian Reform, Döhne Agricultural Development Institute, Stutterheim, email: mcmfu@yahoo.co.uk, njokani@gmail.com

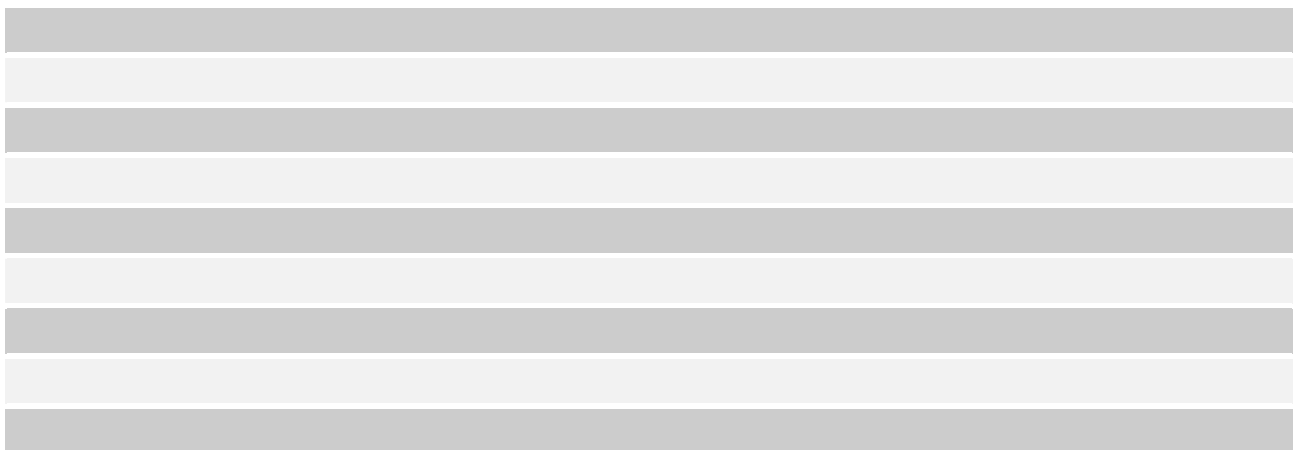
In the savanna ecosystem the balance between bush and grass is important for productivity. Fire has for a long time been regarded as a natural factor in the southern African environment. While fire has been accepted as the control measure for bushes, its effect on individual species might be different from community response. The studies have shown that fire causes the rupture in the seed coat which allows water inside the seed for germination thus promoting growth of new trees. Fire has not been popularly practiced in the Coastal Thornveld of the Eastern Cape. This paper reports on the data from two burning seasons on the effect of fire on three dominant bush species i.e. *Acacia karroo*, *Rhus fastigiata* and *Lantana camara* in terms of density and average tree height. In addition, the effect of combining fires with browsing by goats is examined.

The burning experiment was initiated at Bathurst Research Farm where season of burn and browsing were tested as control methods for bushes. There were two fire treatments, one where fire treatment was applied during the mid-summer drought, here referred to as summer fire, and another fire applied during the conventional burning season, referred to as winter fire. In both cases a hot fire must be attained to control bush and therefore these fires should be applied only when at least 2500 kg.ha⁻¹ of grass fuel have been accumulated to support such a fire. In the experiment 6 kapater goats were kept in two groups of three and were rotated between the browsing treatments. Changes in the woody component were monitored along two fixed transects (30 m x 3 m) per plot. The data in the trials were collected in 2003 at the start, in 2005 before burning in 2006, in 2008 before burning and in 2010. The 2003 data was used as the baseline date and used in the analysis as covariate data and response data was the 2005, 2008 and 2010 data. The variables were number of trees per species and average height per species. The data was analysed using general linear model (GLM) of StatSoft.

The number of *A karroo* trees was significantly increased by fire ($p = 0.005$) but the average height was significantly reduced by goats ($p = 0.002$) and number of fires applied ($p = 0.018$). Both burning treatments had higher numbers of *A karroo* trees compared to unburnt plots. After two burns the height of the trees in 2010 was below half that of unburnt plots. The height was reduced by the fire. The total number of *L camara* trees was not significantly affected by fire and goats. Height was significantly reduced by summer burning ($p = 0.036$) but not by winter burning. There was a combined effect of fire and goats on *R fastigiata* height ($p = 0.006$). This species benefited from burning and browsing when combined but was detrimentally affected by burning, while burning alone increased the number of trees, especially with summer burning.

Burning and goat browsing had different effects on these trees. As expected the fires were hot enough to cause topkill but total kill of trees has not been achieved after two burns. Fire and goats are proving to increase *R fastigiata* while *L camara* is reduced by summer burning. Fire does not kill *A karroo*, instead it increased in number. Summer burning generally had more detrimental effects on trees than winter burning in all three tree species.

Keywords: burning seasons; *Acacia karroo*; *Rhus fastigiata*; *Lantana camara*; goats; browsing



**PLATFORM PRESENTATION: THE SIGNIFICANCE OF PLANT VOLATILES IN DRY GRASSLAND**Mitsuru Tsubo^{1*}, Eiji Nishihara², Ken Nakamatsu², Yunxiang Cheng¹ and Masato Shinoda¹Tottori University, ¹Arid Land Research Centre, ²Faculty of Agriculture, Tottori, Japan, email: tsubo@alrc.tottori-u.ac.jp

To a greater or lesser degree, all plant species produce volatile organic compounds (VOCs), i.e., secondary metabolites emitted into the air. In the steppe (semi-arid grassland) of Mongolia, *Stipa krylovii* (palatable perennial grass) shares the community with small colonies of *Artemisia adamsii* (unpalatable perennial forb). After long-term overgrazing, the forb becomes dominant in the community, hence an indicator of vegetation degradation in the semi-arid grassland. To return the degraded vegetation to its original state, long-term exclusion of livestock is required. The forb releases a large amount of VOCs, but the role of the VOCs in the community is not clear. This study aimed to examine the ecological significance of plant volatiles.

Ex situ experiments were designed to investigate the growth of *S. krylovii* exposed to VOCs released by *A. adamsii*. *Stipa* plants were grown with naturally dried *Artemisia* leaves for 24 days under well-watered and water-deficit conditions. We identified the major components of the VOCs, i.e., cineole and camphor, with solid-phase micro-extraction, so *Stipa* plants were also grown with those VOCs for 14 days under water stressed conditions.

Our experiments showed that the growth of *S. krylovii* was greater with than without exposure to VOCs from leaves of *A. adamsii* under both well-watered and water-deficit conditions (Figure 1), as the *S. krylovii* consumed more water when exposed to the VOCs. Volatile cineole and camphor both promoted the growth of *S. krylovii* in small amounts but inhibited it in large amounts (Figure 2), indicating that VOCs emitted from *A. adamsii* can both stimulate and inhibit *S. krylovii*. However, the large leaf biomass of *A. adamsii* that we used was the maximum available *in situ*, so perhaps there is no inhibitory effect of *A. adamsii* on *S. krylovii*.

Revealing positive responses of the grass to the VOCs, viz, plant hormesis, we propose that in the degraded semi-arid grassland, when there are long dry spells during the growing period, the grass ceases to grow earlier than the VOC-releasing forb. This is due to a water deficit arising as a result of greater water use by the grass on exposure to the VOCs, while the generation of more VOCs may enhance the forb's tolerance to drought. We therefore conclude that plant volatiles may reduce the resilience of overgrazed, degraded vegetation in arid environments.

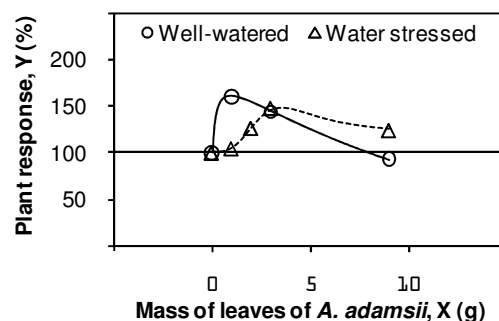


Figure 1: Hormetic effects of VOCs from *A. adamsii* leaves on aboveground biomass of *S. krylovii*. The data are shown as percentages of the control (no exposure to the VOCs). The model (An et al., 1993: J. Chem. Ecol. 19, 2379-2388) is fitted as $Y = 100 + [S_m \times X_q / (K_S q + X_q)] - [I_m \times X_q / (K_I q + X_q)]$ where $S_m = 90$, $I_m = 310$, $K_S = 0.2$, $K_I = 20$ and $q = 1$ ($r^2 = 0.9998$) for well-watered (solid line); and $S_m = 340$, $I_m = 320$, $K_S = 3$, $K_I = 3.5$ and $q = 3$ ($r^2 = 0.9957$) for water stressed (dashed line).

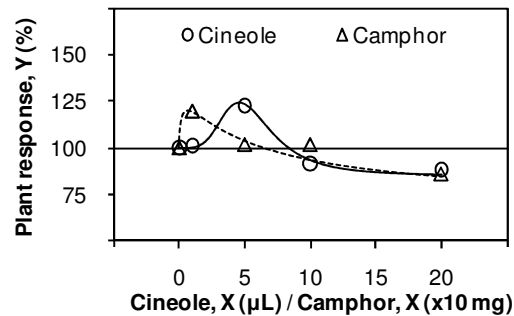


Figure 2: Hormetic effects of volatile cineole and camphor on aboveground biomass of *S. krylovii*. The data are shown as percentages of the control (no exposure to the VOCs). The model (An et al., 1993: *J. Chem. Ecol.* 19, 2379-2388) is fitted as $Y = 100 + [Sm \times Xq / (KSq + Xq)] - [Im \times Xq / (KIq + Xq)]$ where $Sm = 75$, $Im = 90$, $KS = 4$, $KI = 6$ and $q = 4$ ($r^2 = 0.9841$) for cineole (solid line); and $Sm = 35$, $Im = 65$, $KS = 2$, $KI = 60$ and $q = 1$ ($r^2 = 0.9142$) for camphor (dashed line).

Keywords: volatile organic compounds; *Stipa krylovii*; *Artemisia adamsii*; water deficit; grassland degradation

PLATFORM PRESENTATION: SEASONAL PHENOLOGY AMONGST COMMON PLANT SPECIES IN *DICHAPETALUM CYMOSUM* (GIFBLAAR) COMMUNITIES

Gilbert H Pule^{1,2*}, Wayne F Truter² and Luthando E Dziba³

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³Council for Scientific and Industrial Research (CSIR) - Natural Resources and the Environment, Pretoria, email: ldziba@csir.co.za

Niche separation by phenology, a mechanism to counteract competition and promote coexistence, was investigated amongst 6 coexisting plant species in 15 South African savanna communities where *Dichapetalum cymosum* occurs over the period October 2010 - March 2011. At each site, two x 100m transects were placed 50m apart across the slope and 12 points at 15 m intervals were used for data collection. At each point, the nearest experimental trees (<2m or >2m) and shrubs species within four 90° quarters were inspected with respect to phenological state. During each month, individuals of each of the 6 species were observed and assigned a score based on either their reproductive or vegetative phenological state. Data was then expressed as the mean proportion (%) of plants per transect displaying any of these phenological conditions. No niche separation was observed amongst tree species (*Burkea africana*, *Terminalia sericea* and *Ochna pulchra*) on their vegetative phenologies despite inconsistent patterns observed amongst various sites. Reproductive phenologies also revealed no niche separation between *B. africana* and *T. sericea*. However, there was an observed niche separation on reproductive phenologies between *O. pulchra* and both *B. africana* and *T. sericea*. Furthermore, there was no niche separation by vegetative phenologies amongst the shrubs (*Dichapetalum cymosum*, *Perinari capensis* and *Pygmaeothamnus zeyheri*). However, there was an observed niche separation by reproductive phenologies between *D. cymosum* and both *P. capensis* and *P. zeyheri*. *D. cymosum* produces its reproductive buds/flowers early in the rainy season and then aborts, while the two associated shrubs produce dehiscent fruits late in the rainy season. Generally, lack of clear niche separation by phenology amongst species in *D. cymosum* communities suggests that species can coexist without trophic niche separation, i.e. habitat preferences and/or resource utilization. These species differ in other ecologically significant characteristics such as life-form, reproductive strategies and/or seed dispersal mechanisms and such differences may render niche separation by phenology unnecessary.

Keywords: habitat; niche separation; phenology; transect; trophic



Workshop: Slangbos (*Seriphium plumosum*) Encroachment in Natural Grasslands

SESSION CHAIR: PAUL L AVENANT

Tuesday 12 July 2011, 9:50 – 10:30

Platform Presentations and Workshop Discussion

OPENING ADDRESS

Paul L Avenant

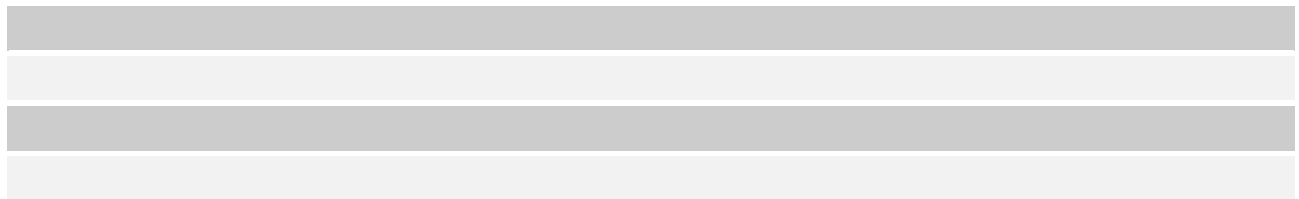
Department of Agriculture, Forestry and Fisheries – Land Use and Soil Management, Pretoria, email: paula@daff.gov.za

Bankrupt Bush or slangbos (*Seriphium plumosum*) is an indigenous, woody dwarf shrub, that has encroached into large areas of our most valuable grassland at an alarming rate. Although the Free State province has experienced the worst invasion, it has also encroached wetlands of the Waterberg in Limpopo, grasslands of North-West, Eastern Cape, Gauteng and Mpumalanga.

Most farmers are fighting a losing battle, spending millions of rands each year on fruitless efforts to eradicate this plant, while many have already lost up to 80% of carrying capacity on natural pastures.

Although much research has been done on this plant, very little is known of its ability to adapt and encroach at such an alarming rate.

In March 2010, a national work group was established to investigate the extent and control of this problem plant. This resulted in a national survey which has been very well accepted by the farmer communities. Preliminary data from this survey will be presented.



PLATFORM PRESENTATION: THE DYNAMICS AND REHABILITATION OF *SERIPHIMUM PLUMOSUM* ENCROACHMENT IN THE ARID- AND SEMI-ARID RANGELANDS OF THE NORTH-WEST PROVINCE, SOUTH AFRICA

Klaus Kellner and J P Wepener*

North-West University, School of Environmental Sciences and Development, Potchefstroom, 2520, e-mail: klaus.kellner@nwu.ac.za, jeanpierre.wepener@nwu.ac.za

About 80% of the total land area of South Africa is regarded as rangelands of which most are arid- or semi-arid. It is estimated that approximately 66% of the rangelands are moderately to severely degraded (Snyman, 1988) due to a loss in cover and density of forage species caused by a combination of overgrazing and drought, the encroachment of alien and indigenous woody dwarf species, such as *Seriphium plumosum* (bankrupt bush), as well as socio-economic pressures by local communities living off the land. Many of these degraded lands have passed the thresholds of self recovery and once irreversible transitions have occurred, rehabilitation practices have to be implemented. In most cases, the general aims of rehabilitation for agricultural, i.e. grazing purposes in the Savanna areas, is to control the encroachment of the woody species and increase the cover of palatable grasses for improved production potential and higher grazing capacity. The dynamics and especially the phenology of the species must first be better understood, before it can be controlled by different technologies, such as burning, mechanical clearing or the use of herbicides.

The phenology (e.g. growing period, flowering time, seed dormancy, germination, production and dispersal period, etc) of *Seriphium plumosum* was studied at different sites around Potchefstroom in the North-West Province. The effectiveness of the use of a herbicide (active



ingredient-Tebuthiuron) to control *S. plumosum* encroachment on old and newly implemented sites was also evaluated by vegetation surveys on 6 farms in the Potchefstroom and Hartebeesfontein areas. Laboratory and glass house experiments were carried out to assess the germination potential of *S. plumosum* seed.

The active growing period of *S. plumosum* starts as early as October until March, with the flowering period from December to February and seed dispersal from April to the beginning of June, all depending on the rainfall and temperature of the season. Seeds mostly germinate after a period of 14 days and do not depend on pre-chilling for dormancy breaking.

The density and cover of *S. plumosum* decreased by >75% and 95% respectively in controlled areas over one year, whereas an increase of 30% and 50% respectively occurred in areas that were not controlled. The vegetation cover and density of especially more palatable, perennial species increased by >50% in sites that were actively controlled and the grazing capacity improved by >60%. The dry matter (DM) production of grass species increased by >60% and the biodiversity improved by >30%, depending on the condition of the surrounding vegetation and habitat.

The results show that sites that have been encroached by *S. plumosum* can be controlled using herbicide applications, but that the dynamics of the species, as well as the environmental factors, land-use types and seed banks must be considered. A “follow-up” or “after-care” program after the implementation of control technologies, as well as a good management plan is necessary to ensure effective rehabilitation.

Keywords: *Seriphium plumosum*; phenology; germination potential; dormancy; herbicide applications



PLATFORM PRESENTATION: SERIPHIMUM PLUMOSUM - MORE THAN 10 YEARS OF EXPERIENCE IN THE NORTH WEST PROVINCE

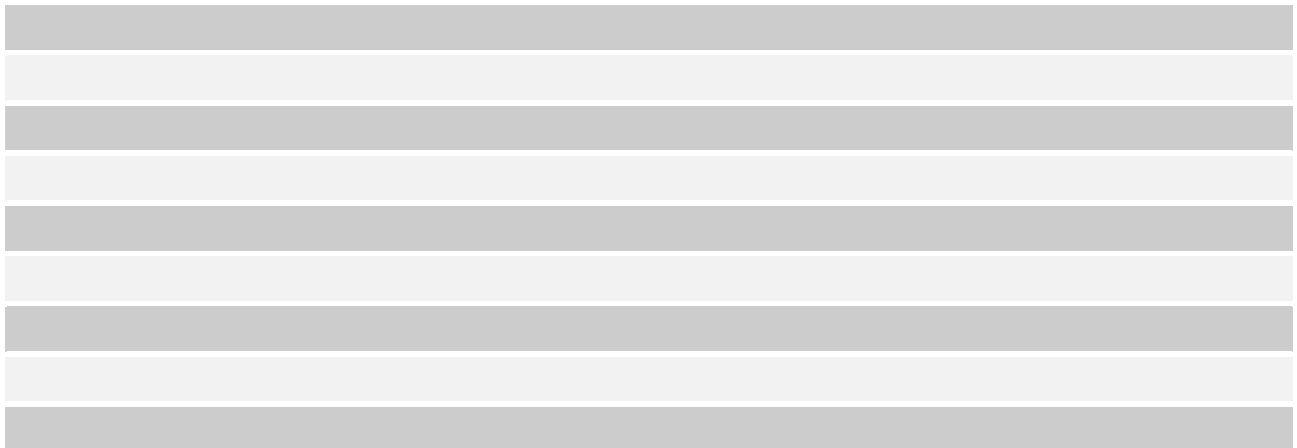
Dieter G Jordaan

North West Department of Agriculture and Rural Development, Potchefstroom, email: djordaan@nwp.gov.za

The challenge that six provinces have with the eradication of this bush is quite serious. Experiences over the last 10 years in certain parts of the North West Province are shared. Amongst these are the issues of burning, hacking and /or chemical control. Challenges that were encountered with the LandCare projects are discussed. A few recommendations are given. An unexplained phenomena regarding the vanishing of the bush (biological control?) is under inspection.

Cost implications are given with the two LandCare projects as examples. Images of before and after situations with the control are discussed. The promoting of the programme, capacity building and training are shown. Furthermore the challenges with regards to the occurrence of this bush throughout the province are discussed.

Keywords: *Seriphium plumosum*; eradication; LandCare





PLATFORM PRESENTATION: SLANGBOS (*SERIPHIMUM PLUMOSUM*) ENCROACHMENT – A SERIOUS THREAT TO GRAZING IN FREE STATE GRASSLANDS

Winston S W Trollope^{1*}, Herman J Fouche², Lynne Trollope¹ and Willem B Cronje³

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A serious veld management problem has developed in the *Cymbopogon Themeda Veld* in the Free State Province involving the encroachment of the highly unpalatable fynbos shrub *Seriphium plumosum* (“Slangbos”). It is believed that the encroachment has been the result of a lack of controlled burning and selective overgrazing, particularly by sheep, since settled livestock farming developed in this region. Ecologically this has involved the development of the vegetation from the sub-climax grassland stage to the climax shrub stage where *S. plumosum* is the dominant climax plant species that the soil and climate can support in the absence of fire. This in turn has caused a significant reduction in the grazing capacity of the veld resulting in a marked reduction in the economic viability of livestock farming in the affected areas. Research conducted in the Döhne Sourveld on the control of fynbos species in the Amathole, Katberg and Winterberg mountain grassland areas in the Eastern Cape has shown that a burning and resting program can be effectively used to reduce and control the encroachment of similar fynbos species and re-establish a dense and productive grass sward. It was therefore decided to determine whether a program of rotational burning and resting could be used to reduce the size and density of “Slangbos” and thereby rehabilitate the grass sward. The investigation was conducted on the farm “Leeufontein” in the Zastron district of the south eastern Free State belonging to Mr Willem Cronje. Other methods of possibly controlling “Slangbos” comprising stumping, slashing with a rotary cutter and spraying with Molopo weedicide were included in the investigation and the results of the trial since its initiation in 2007 will be presented.

If successful, an improvement in the condition of the veld in these areas could have significant beneficial economic effects on livestock production and also on the alleviation of rural poverty in this region.

Keywords: *Seriphium plumosum*; encroachment; fire; rotational burning; resting; rehabilitation

PLATFORM PRESENTATION: TEBUTHIURON CONTROL OF SLANGBOS – DEFEATING THE POINT?

Justin C O du Toit^{1*} and Willem B Cronje²

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Seriphium plumosum is a small woody fynbos shrub that has encroached extralimitally in grasslands in east-central South Africa. Its unpalatability and propensity to displace grass has prompted farmers to attempt to eradicate or at least reduce its abundance. One popular method has been to use Tebuthiuron, a systemic, residual, non-selective, soil-applied herbicide. The main attraction of this chemical is that it can be applied at high concentrations directly onto the soil, either by hand or aerially, which precludes the need for diluting it with water which, in turn, reduces the cost of application.

On the farm Leeuwfontein, in the Zastron district of the eastern Free State, Tebuthiuron has resulted in the formation of large, persistent (> 5 years) patches denuded of vegetation. Arguably, the loss of grass production has negated any benefits associated with killing the Slangbos in the first place, and has probably exacerbated the overall level of degradation. A recommended application rate had been given as being 2 ml of a 15% concentration mixture of a Tebuthiuron-based herbicide and water for plants under 30 cm, 4 ml for plants 30-60 cm, and 6 ml for plants larger than that. (Later applications were reduced to 10%, without a noticeable reduction in the formation of bare patches.)



We hypothesized that the recommended dose was too high and had caused the denudations. Accordingly, we conducted an experiment to investigate the degree of mortality of Slangbos plants across a wide size gradient when treated with 2 ml of a Tebuthiuron/ water mix at concentrations of 0, 0.5, 3, 7.5, 15, and 30%. Multiple regression revealed that both herbicide concentration and plant size were significantly ($P < 0.001$) related to the degree of mortality ($R^2_{adj} = 49.7\%$) after six months. Comparing the predicted necessary application rate and the recommended rate revealed that the recommended rate was approximately 55% higher than the predicted rate to achieve the same effect. Despite this, there was no evidence of widespread denudation around any of the treated plants. The experiment suggests that although Tebuthiuron may often be over-applied on a per-plant basis, denudation is a result either of a) long-term residual effects of Tebuthiuron in the soil (our experiment will reveal this over time), or b) high dosages per unit area, either because of a high plant density or through operator negligence. Cause (b) is supported by observation of two nearby sites that were treated aerially with a Tebuthiuron-based herbicide at a rate of 5 kg/ha. Most Slangbos plants had been killed, but the denuded areas were small (c 20 cm diameter) and widely spaced. The efficacy of the herbicide when broadcast over the grassland highlights the potential for mass local-extinction of grassland species, notably shrubs and forbs, with extensive root systems.

**PLATFORM PRESENTATION: A BRIEF OVERVIEW OF THE CONTROL METHODS OF
SERIPHIMUM PLUMOSUM AND THE ECONOMIC IMPACT OF THE PLANT ON AGRICULTURE IN
THE FREE STATE**

Chris T B Smith

Free State Department of Agriculture and Rural Development, LandCare, Bloemfontein, email:
smith@fs.agric.za

The LandCare programme in the Free State is a community based initiative that aims to enhance the sustainable utilization of natural resources through the implementation of projects that are identified in consultation with relevant communities, through existing LandCare committees.

The eradication of invader plants was the main focus for the year as it was indicated as the highest priority by our clients. Invader plants are threatening the sustainable farming activities on many farms in the Free State at a very alarming rate. Through the LandCare program we combated about 3000 ha of invader and alien plants with nine of the nineteen overall projects concentrating on invader plants. Slangbos (*Seriphium plumosum*) is the biggest problem and is invading and effecting a big part of the eastern Free State. The grazing capacity is so low that former economical farm units are becoming completely unproductive. By controlling slangbos, with its competitive effect on grass, production will be increased and more soil moisture will be available for grass production. The final result will be that the current unproductive area will be changed to a productive area due to optimal grass growth by climax species. LandCare Free State is working in close collaboration with Working for Water, SANBI, DAFF and other role-players in an attempt to be more effective in the war against invader species.



PLATFORM PRESENTATION: PRELIMINARY INVESTIGATIONS OF GENETIC DIVERSITY STUDIES OF *SERIPHIMUM PLUMOSUM* – A GRASSLAND ENCROACHER

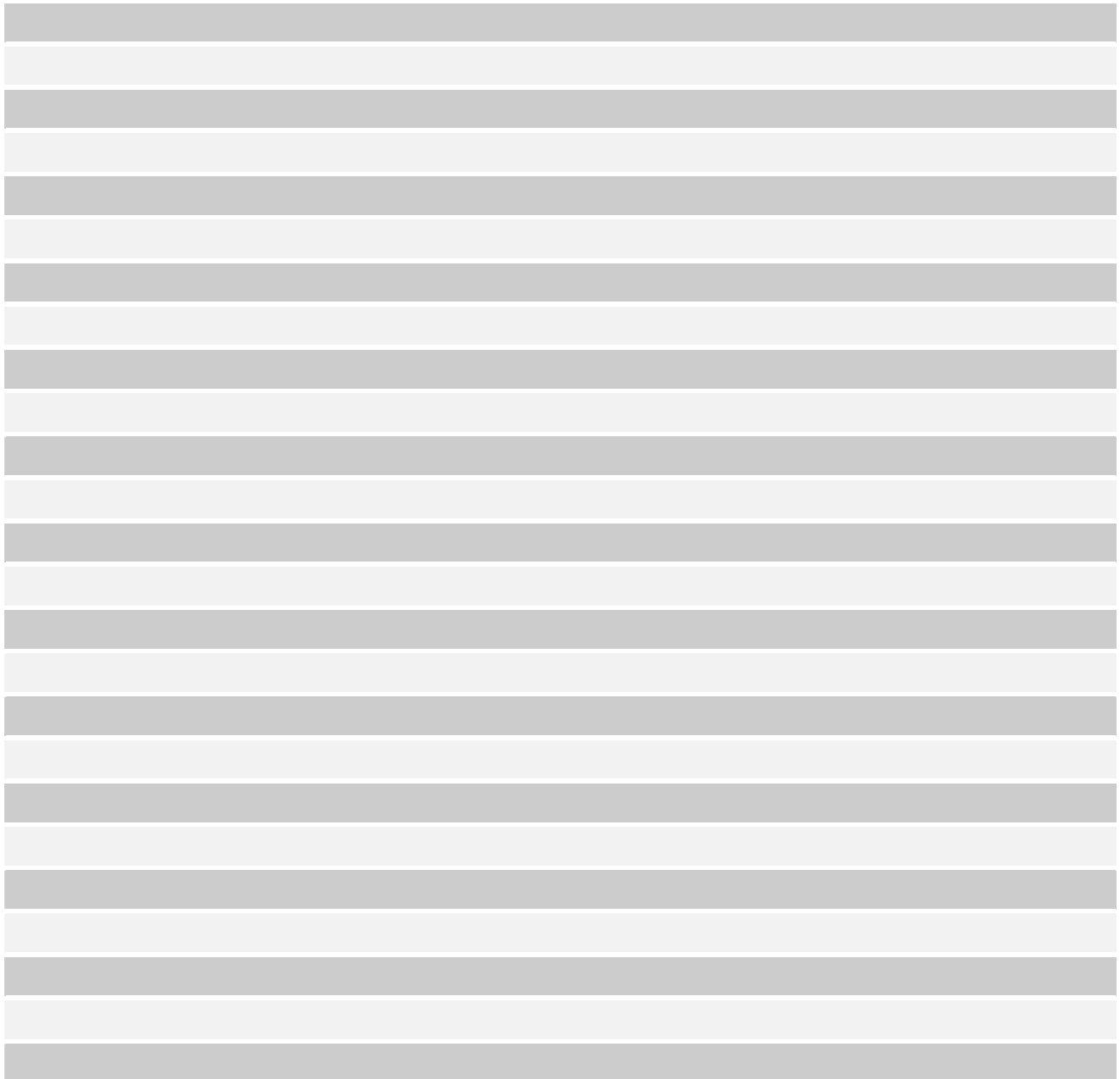
Zama (M) Hadebe, Michael Pillay and Peter Stegmann*

Vaal University of Technology, Vanderbijlpark, email: mzamosehadebe@gmail.com, mpillay@vut.ac.za, peters@vut.ac.za

Seriphium plumosum is a grassland encroacher that causes serious loss of carrying capacity in grasslands in South Africa. The plant produces thousands of seeds that are very light and easily carried by wind over long distances. The success of this plant as an invader has not been addressed in detail. The aim of this project is to identify genetic changes that make this plant a highly successful colonizer of grasslands in South-Eastern Free State.

Plant material was collected from 4 different locations. A method for extraction of DNA from the plant has been established. Random amplified polymorphic DNA (RAPD) studies show that there is intra- and inter-specific variation. The internal transcribed spacer regions were amplified with specific primers. The DNA was digested with two restriction enzymes. DNA variation was observed. Our preliminary investigations suggest that DNA variation is an ideal method to assess variation in *S. plumosum*.

Keywords: *Seriphium plumosum*; invader; RAPD studies; genetic variation





Using Planted Pastures for Rehabilitation and Restoration of Mined and Degraded Areas

SESSION CHAIR: KEVIN P KIRKMAN

Tuesday 12 July 2011, 13:30 – 15:10

Platform and Poster Presentations

PLATFORM PRESENTATION: THE ROLE OF PLANTED PASTURE PRINCIPLES IN THE RECLAMATION OF SURFACE MINED LAND

Wayne F Truter, Johann Olivier, Riaan (A) W Jonker and Poloko Mosebi*

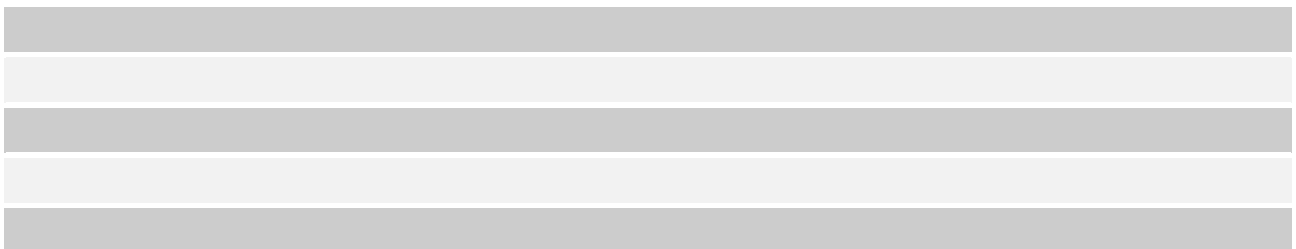
University of Pretoria, Department of Plant Production and Soil Science, Pretoria, email:
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Industrial operations such as surface mining are being regarded as the main cause of many environmental impacts, and are currently receiving much attention in the media. Land reclamation is a discipline which is not well understood, because it has not received the necessary attention it should have in the past. Being a multi-, interdisciplinary field, the reclamation of surface mined land has become a major challenge. Current strategies to address these challenges are primarily based on engineering principles with a few associated agricultural principles. The current status of successfully reclaimed surface mined land in the country raises the question of whether the current reclamation principles being applied are understood and managed properly. By applying the correct principles, and by understanding the interrelationships between soil, vegetation, climate and animals, better ways of addressing associated problems or rather challenges in achieving sustainable land reclamation are possible.

So, are we neglecting the importance of natural and agricultural scientific principles in land reclamation? It is evident from current research that planted pasture principles play an imperative role in sustainable land reclamation, since the larger percentage of reclaimed surface mined land to date is returned to either planted pastures or artificial rangelands. Research over the past few years on land rehabilitation has been fragmented and has prevented the development of a comprehensive, scientifically sound body of knowledge on which to base decisions about best practice in the long-term management of reclaimed mine-land. The absence of a body of knowledge creates pessimism about whether any set of rehabilitation interventions will ever be sufficient to ensure a sustainable rehabilitated system. Unfortunately, there are some industrial stakeholders responsible for the degradation of land through soil excavation (i.e. mining etc.), that are more likely to adopt a conservative, least-cost approach to rehabilitation or reclamation, resulting in land that is of less than optimal value for post-mining use. Where standards are applied, these are frequently in-house minimum standards that may fail to take into account the technical pasture management principles and requirements of post-mining uses.

It is unlikely that the integration of these post-mining uses with the land-use pattern of surrounding areas has been considered; whether they are intensive or extensive agricultural practices such as forage production or grazing. Current soil management and reclamation practices therefore frequently do not result in sustainable end land uses. Until natural and agricultural scientific principles, especially planted pasture principles, are accepted, understood and implemented appropriately, the challenge to achieve sustainable land rehabilitation and reclamation will remain difficult.

Keywords: planted pasture principles; surface mined land; rehabilitation; reclamation





PLATFORM PRESENTATION: ASSESSING THE EXTENT OF DEGRADATION IN THE OLD LANDS AT DUDUMASHE COMMUNAL AREA NEAR NQAMAKWE

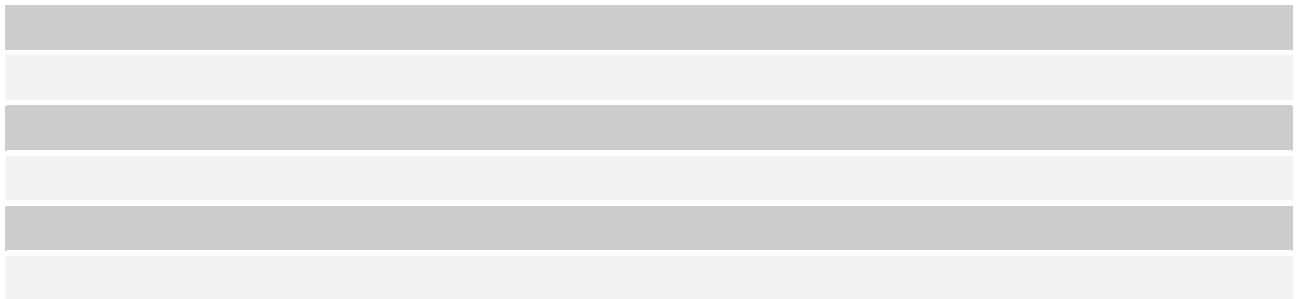
Unathi Gulwa, Nobulungisa Mgujulwa and Siphiwe Dikili*

Eastern Cape Department of Rural Development and Agrarian Reform, Döhne Agricultural Development Institute, Stutterheim, email: ugulwa@yahoo.com, nobulungisam@yahoo.com

Land degradation is common in most areas all over the world. It is defined as the reduction or loss of biological or economic productivity and complexity of rainfed cropland, rangeland, pasture, forest and woodland as a result of land uses or a combination of processes arising from human activities (Coxhead and Oygard 2007). Due to the impact that land degradation has on the environment, a number of methods have been developed to assess the extent of degradation over small and large areas. Therefore, landscape functional analysis (LFA) has been used as a method to measure the extent of degradation in the old lands of the Dudumashe communal area. LFA surveys were done on the old lands where legumes have been planted and on old lands where there are no legumes planted.

These LFA surveys were conducted over a single season. The preliminary results obtained from this data show that incorporation of legumes in the old lands plays an important role in rehabilitating old lands by improving the functioning of the whole landscape whereas there is no improvement in the functioning of the total landscape where there are no legumes planted.

Keywords: degradation; landscape functional analysis; old lands; legumes



POSTER PRESENTATION: MEASURING TRENDS IN LANDSCAPE FUNCTION IN TRANSFORMED SAVANNA LANDSCAPES: A CASE STUDY OF A MINE IN NORTH EASTERN SOUTH AFRICA

Mike J S Peel, M Lukas V Manaka and Hennie S de Beer*

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

This presentation forms part of an initiative reported on last year to assess the functionality of a mine landscape in South Africa where limited rehabilitation has taken place. Landscape Function Analysis (LFA) was used to assess degradation and subsequent recovery of a copper mining operation. The technique examines soil surface processes, habitat complexity and vegetation structure which ultimately allows for an objective assessment of ecosystem function in this transformed environment. The functional status of the landscape is monitored by assessing a combination of organizational structure and field indicators that reflect stability, water infiltration and nutrient cycling (Tongway & Hindley 2004). A framework for data interpretation, essential in aiding management decisions is provided.

As reported previously, Tailings consist of ground rock and process effluents generated during the mining process and are generally unsuitable for the growth of stabilising biota. Based on slope, soil surface properties, vegetation composition and land use there is a tendency for mine sites to plateau after the initial rehabilitation period followed by a rise in landscape function as the biota in general but grass layer in particular establish. Ecosystem processes are thus set in motion and an upper plateau representing the biogeochemical potential of the site is reached. This point is the target as set by 'benchmark' sites determined during the field data collection exercise. We illustrate the trends on four separate dumps and discuss the management implications relating to the results as well as the usefulness of the technique in this situation. Given the length of time that the rehabilitation programme and looking at the preliminary results, it is likely that some of the initial steep improvements are absent yet it is clear that much work is still needed to achieve an overall healthy situation at the mine.



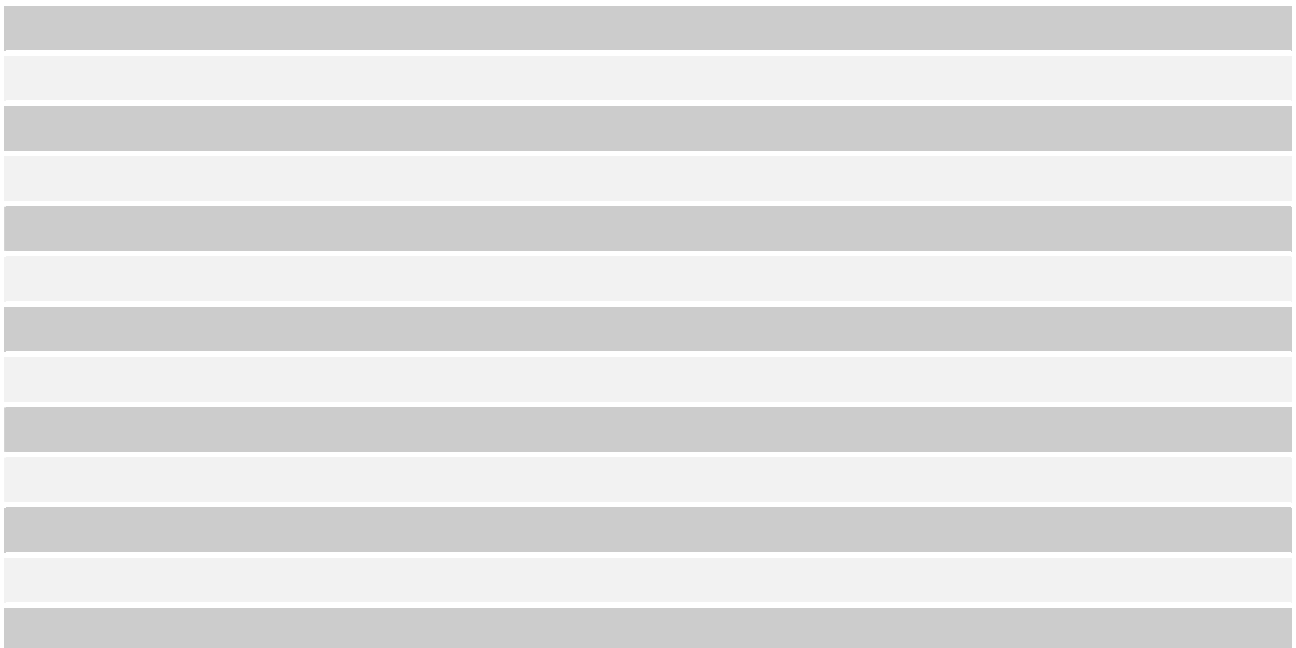
PLATFORM PRESENTATION: THE GROWTH RESPONSE OF DIFFERENT PASTURES SPECIES ON ALLEVIATED COMPACTED MINE SOILS

Johann Olivier* and Wayne F Truter

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Soil compaction is a worldwide phenomenon that causes severe restrictions in the effective rooting depth of plants. In South Africa we have very limited high potential agricultural land, which is competing with another very important industry, surface coal mining. Surface coal mining has a definite negative influence on soil fauna and flora, and causes degradation of these productive soils by means of compaction. In the first study we evaluated the growth responses of 16 different pasture species on previously rehabilitated mine soil, over a period of 18 months. The compaction of the soil was alleviated by means of normal conventional tillage methods, using a single tined ripper to alleviate the soil up to 40cm depth, and winged tine ripper to alleviate the soil up to 80cm in depth. Significant differences were found between the different species and the treatments where compaction was alleviated. The significant difference between the 40cm depth and 80 cm depth treatments was relatively small. The temperate grass species *Festuca arundinacea* (Tall fescue) and *Dactylis glomerata* (Cocksfoot) did exceptionally well, and had an overall survival percentage amongst all treatments of 85.11% and 95.18%, respectively. *Paspalum notatum* (Bahia grass) also performed very well in comparison to the other species, and had a survival rate of 88.48%. Some species, especially the more palatable legumes, like *Medicago sativa* (Lucerne) and *Trifolium pratense* (Red Clover), had a lower overall survival rate due to extensive grazing of these species. In the second study a pot trial was conducted where organic material was added to specific treatments to alleviate compaction. Within this trial different temperate grass species, *Festuca arundinacea* (Tall fescue) and *Dactylis glomerata* (Cocksfoot) were evaluated on two soil types, these being normal agricultural soil as well as soil collected from a rehabilitated mine site. Cattle manure was used as an ameliorant, and was applied to the soil at rates of 20 tha^{-1} and 40 tha^{-1} . In various treatments the soil in the pots was compacted to a bulk density of $\pm 1800\text{kgm}^{-3}$ by means of a vibrating table and a 25kg weight. Significant differences were observed between the treatments and the two different soil types, which justified the fact that organic material added to compacted soil does alleviate and mitigate soil compaction. With this associated soil amelioration is an increase in dry matter production, e.g. *Festuca arundinacea* (Tall fescue) was noted to produce 52% more on soil that was amended with 40 $\text{t}\cdot\text{ha}^{-1}$ of cattle manure, in comparison to the soil that didn't receive any kraal manure. The dry matter yields were also significantly higher in the treatments where the soil was compacted with an organic matter, in relation to the yields produced on soil that was compacted without any organic material. It can thus be concluded that cattle manure can be used in the short term to alleviate and mitigate compaction and enhance the growth and survival of various grasses.

Keywords: surface coal mining; compaction; pasture species; tillage; alleviate; *Festuca arundinacea*; *Dactylis glomerata*; organic material; dry matter yields





PLATFORM PRESENTATION: EVALUATING STOCKING RATES TO OPTIMALLY GRAZE IRRIGATED TALL FESCUE (*FESTUCA ARUNDINACEA*) PASTURES AS A MANAGEMENT TOOL FOR REHABILITATED MINE LAND

Riaan (A) W Jonker^{1}, Wayne F Truter¹ and Marjorie Jansen van Rensburg²*

University of Pretoria, ¹Department of Plant Production and Soil Science, ²Department of Animal and Wildlife Sciences, Pretoria, email: adriaanj@belanet.co.za, wayne.truter@up.ac.za

Rehabilitation of surface coal mines becomes challenging with respect to their post mining land use. Various methods of post mining land use have been adopted with different degrees of success. Agronomic methods include the establishment of different types of pastures as well as economically important crops such as maize and potatoes. The objective of this study is to determine if the establishment of a Tall fescue pasture on rehabilitated mine land, while being irrigated with poor quality, gypsiferous (CaSO₄) water, is a viable rehabilitation option. These pastures are then utilized as grazing for a weaner calf production system.

An objective of the study is to establish the optimal stocking rate at which the Tall fescue pasture can be grazed under irrigated conditions. The rate at which a planted pasture is stocked is perhaps the single most important management factor affecting animal performance and profitability of a livestock system. The stocking rate influences not only animal performance and production, but also the availability of grazing material over a period of time. It is also important to monitor the effect of grazing animals on the compaction level of the soils, as well as the recycling of nutrients on these soils. By determining the production ha⁻¹ as well as the production animal⁻¹, we can determine the optimal stocking rates for these conditions.

During this trial, three different stocking rates over three different seasons, namely early summer, late summer and winter, were monitored on a regular basis. By determining optimal stocking rates, the Tall Fescue pastures can be managed in an optimal way to ensure sustainable production of both pastures and animals.

It can be noted from the data that grazing cycles commenced at different times of the year, and this was decided upon once the pasture availability was sufficient. During the first grazing cycle the highest ADG of 350g was achieved with the intermediate stocking rate of 5.03AU ha⁻¹. The second grazing cycle, however, recorded the highest ADG of 190g for the lowest stocking rate of 5.89 AU ha⁻¹.

During the third grazing period the highest ADG of 130g was produced with the intermediate stocking rate of 5.58 AU ha⁻¹ and during the fourth grazing period the highest ADG of 300g was produced with the lowest stocking rate of 5.3 AU ha⁻¹.

From the four grazing periods an ADG of 242g can be achieved with a stocking rate of 5.45 AU ha⁻¹ for Tall Fescue pastures on rehabilitated mine land irrigated with gypsiferous water.

Table 1: Preliminary results

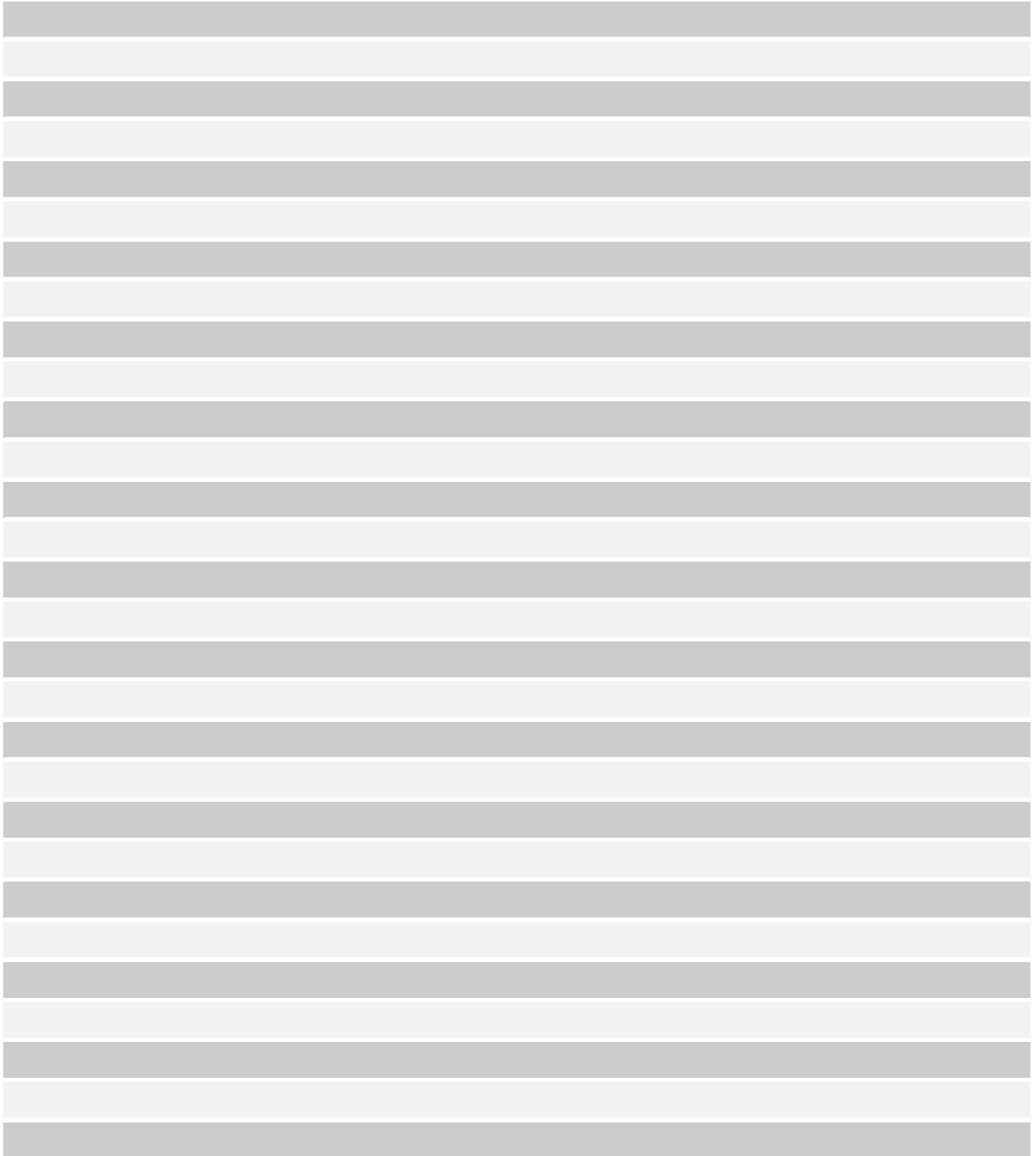
First Grazing Period: 03/06/2008 – 01/08/2008			
Animal Units (AU) ha ⁻¹	6.62	5.03	4.43
Average Daily Gain (ADG) (kg day ⁻¹)	0.234	0.350	0.060
Second Grazing Period: 27/08/2008 – 05/11/2008			
Animal Units (AU) ha ⁻¹	10.25	6.93	5.89
Average Daily Gain (ADG) (kg day ⁻¹)	0.120	0.090	0.190
Third Grazing Period: 26/03/2010 – 16/05/2010			
Animal Units (AU) ha ⁻¹	6.39	5.58	5.32
Average Daily Gain (ADG) (kg day ⁻¹)	0.017	0.130	0.067
Fourth Grazing Period: 26/05/2010 – 16/07/2010			
Animal Units (AU) ha ⁻¹	7.84	7.73	5.3
Average Daily Gain (ADG) (kg day ⁻¹)	0.06	0.2	0.3



From the data obtained from the four grazing seasons, it is evident that the season in which the grazing took place played a significant role in the performance of the cattle in terms of production. Tall Fescue, being a temperate species, has two peak production periods, spring and autumn. The best ADG obtained was from the first grazing period during early autumn and the second best ADG in the fourth grazing period that took place during late spring. During these two grazing periods, the cattle were able to utilise the best quality forage available to sustain optimal growth performance.

Much data has been collected and will be correlated to the aforementioned data, to get a better interpretation. Nevertheless, it is evident from the data that if conditions for production are optimal, the production of not only the planted pasture, but also the animal production, increases.

Keywords: surface coal mines; tall fescue pasture; rehabilitation; weaner calf production; irrigated; optimal stocking rate





Rethinking Approaches to Communal Rangelands I

SESSION CHAIR: M IGSHAAN SAMUELS

Tuesday 12 July 2011, 08:30 – 10:30

Platform Presentations

PLATFORM PRESENTATION: SUSTAINABILITY IN COMMUNAL SOCIO-ECOLOGICAL SYSTEMS (SUCSES) - CHARACTERISTICS OF RURAL HOUSEHOLDS MOST VULNERABLE TO ENVIRONMENTAL CHANGE

Wayne C Twine

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Concern has been expressed about the vulnerability of rural African households to environmental change, particularly climate change. Land-based livelihood strategies such as livestock farming, crop production, and harvesting of wild natural resources play an important role in rural society in the communal areas of South Africa. Although seldom the mainstay of rural livelihoods, such activities provide basic household needs, enable cost savings, generate supplementary income, and serve as a safety net during times of crisis. However, the extent of reliance on local ecosystem services and the relative contribution of land-based livelihood strategies to the household economy and well-being vary between households and communities. This is influenced by household livelihood capital endowments (financial, physical, human and social capital) and the community's environmental endowment. Vulnerability to environmental degradation and climate change is thus heterogeneous within and between communities. Understanding the characteristics and prevalence of households which are potentially most vulnerable to environmental change is important for informing policy and interventions aimed at mitigating these impacts and improving livelihood resilience in rural communities. This is one of the aims of the SUCSES project.

This longitudinal panel study involves a cohort of 591 rural households randomly sampled from nine villages along a rainfall gradient in the Bushbuckridge local municipality in the central lowveld of South Africa. Household composition, livelihood capital, activities and production, as well as key well-being outcomes (food security and body mass index of children 1-5 years old) were quantified for all of these households in 2010. This will be repeated annually for at least the next five years. Permanent vegetation monitoring plots have been established in the communal lands around the study villages to track degradation, and rainfall data is collected daily in each village. This paper reports on the baseline data collected in 2010, and presents an ordination classification of households based on household characteristics, capital and activities. This forms the basis for an assessment of potential vulnerability of households to environmental change. It is hypothesised that households which rely more heavily (absolutely and relatively) on a wider range of land-based strategies and resources, and which have lower levels of financial, physical, social and human capital, are most vulnerable to environmental change. Such households are also predicted to become decreasingly resilient to other shocks and stresses (e.g. death of a breadwinner) with environmental change. This is predicted to be most pronounced in households living at the dryer end of the rainfall gradient (<600 mm/year) compared to those at the wetter end (>700 mm/year). These hypotheses will be tested by tracking household livelihoods and the environment over the next five to ten years in communal rangelands.

Keywords: SUCSES; livelihood resilience; well-being outcomes; environmental change; communal rangelands



PLATFORM PRESENTATION: IS RANGELAND CONDITION A REFLECTION OF MUNICIPAL COMMONAGE POLICY? - THE CASE OF TWO NAMA KAROO TOWNS

Doreen Atkinson¹, Clement F Cupido^{2}, M Igshaan Samuels² and Loraine van den Berg³*

¹University of the Free State, Centre for Development Support, Bloemfontein, ²Agricultural Research Council – Animal Production Institute, Rangeland and Nutrition Unit, Cape Town, email: ccupido@uwc.ac.za, isamuels@uwc.ac.za, ³Department of Agriculture, Forestry and Fisheries, Grootfontein Agricultural Development Institute, Middelburg, email: lorainevdb@daff.gov.za

Before 1994, municipal commonages were almost exclusively rented to private farmers, but due to the land reform process in the country, municipal commonages now serve three other important functions. Firstly, they provide the necessary opportunity for poor people to practice subsistence farming; secondly, they serve as stepping stones for emerging farmers to accumulate livestock and capital in order to become commercialized; and, thirdly, they generate revenue for local municipalities who rent the land out to subsistence farmers or farmer groups. However, before these functions can be carried out effectively, there should be appropriate policies in place as well as good working relations between the local municipality, commonage committees and land users. Furthermore, the type of commonage policy and management system could have a direct impact on vegetation. This study assessed the impact of different commonage management systems on rangeland condition in the Nama Karoo biome. The towns of Carnarvon and Williston, which respectively fall within Kareeberg and Karoo Hoogland local municipalities, represent typical Karoo towns with commonage land under different types of management.

Results of our study indicate that the commonages of Carnarvon are better managed by local government than those of Williston. Various institutional factors are relevant: the capacity of the municipality; the effectiveness of commonage users' committees; the relationships between users and the municipality; the role of the provincial Department of Agriculture; local agricultural markets; and the economic environment which may place different degrees of pressure on local livelihoods. All these factors are complex in their own right. The fieldwork showed that the Carnarvon commonage appeared to be in better condition than that of Williston. However, in both municipal commonages, grazing capacities of farms closer to town tend to be lower than those which are located further away. Due to a lack of transport, farmers prefer to keep their animals closer to home, which thus results in high stocking densities.

The paper also suggests policy interventions which should be considered by the National Department of Land Reform, the provincial Departments of Agriculture, and the Department of Co-operative Governance and Traditional Affairs (COGTA). We argue that commonage ground offers huge developmental potential for biodiversity management, livelihoods and land reform, but this will require inter-sectoral and intergovernmental synergies, support and funding.

Keywords: commonage; policy; management; capacity; rangeland condition

PLATFORM PRESENTATION: THE GROWING INDIFFERENCE OF YOUTH TOWARDS AGRICULTURE IN AGRO-PASTORAL SYSTEMS IN NAMAQUALAND

Melvin B V Swarts, M Igshaan Samuels and Clement F Cupido*

Agricultural Research Council – Animal Production Institute, Rangeland and Nutrition Unit, Cape Town, email: mswarts@uwc.ac.za, isamuels@uwc.ac.za, ccupido@uwc.ac.za

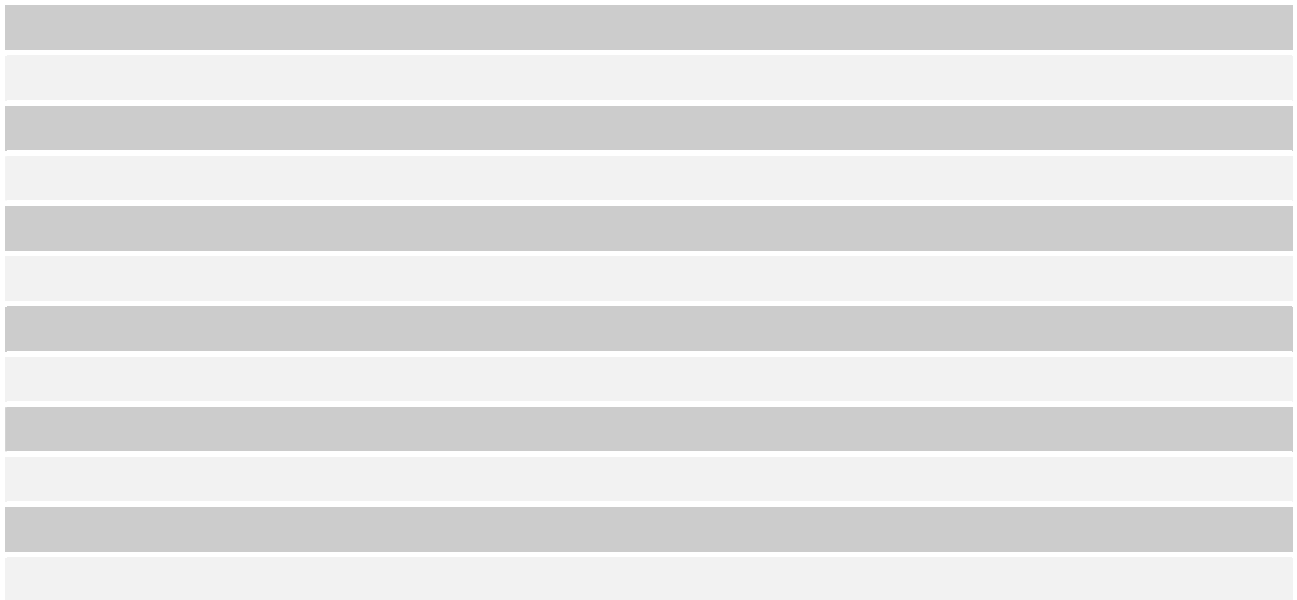
Livestock keeping on the commons of Namaqualand has generally been viewed as an activity for the elderly. Opposing views exist as into why there is a lack of interest in farming from the youth in the communal areas. Due to this dichotomy, we investigated whether this indifference grew from ignorance on the side of the youth or whether the elders neglected to transfer their farming knowledge. By using semi-structured questionnaires, we interviewed youth aged between 17 and 35 from the Leliefontein communal area in Namaqualand to determine why they are not actively involved in livestock rearing.



Several reasons exist why the youth are increasingly reluctant to pursue agriculture –based livelihoods. Firstly, it appears that formal education created a generational gap in terms of the transfer of local farming knowledge. We observed that youth find the knowledge they acquired in school more trustworthy than that of their parents and grandparents. This is because traditional farming knowledge has for many years been regarded as backward and unproductive. Secondly, differences exist between the use of modern, innovative and untested farming methods which the youth want to apply and traditional ways of farming that adapt to changing environmental conditions. There exists a growing fear among the elderly that modernization of traditional farming practices might erode the cultural identity of the indigenous Nama people. Thirdly, the notion of farming as a ‘sukkel bestaan’ (struggle) as locals call it, is a vital underlying factor for this growing indifference and dislike for farming amongst youth. Most of the youth emphasized the low status associated with agriculture-based lifestyles. The youth generally sees farming as an outdated and downright dull practice and a pastime that adequately fits the older community members. The youth feel that the continuous reference to them as the ‘lost generation’ belittles them and hinders their ambitions to become ‘agents of change’ in their societies.

Options that could address these problems and which could serve as an antidote to the apathy among the youth include the role of researchers as mediators since they are more objective in terms of which farming methods to use. Researchers could also demystify their scientific findings and make them easily accessible and readable to the local community. Communication channels need to be restored because the future success of farming in Namaqualand depends on the transfer of farming knowledge and active involvement of youth in decision-making processes.

Keywords: Namaqualand; communal areas; traditional; cultural identity; farming knowledge



PLATFORM PRESENTATION: SMALL SCALE FARMING AND THE PERSPECTIVE OF GRAZING MANAGEMENT IN THE TOWNSHIPS OF SOUTH AFRICA

Jabulani G Mashiya

Tshwane University of Technology, Pretoria, email: mashiyajg@tut.ac.za

Around the major metropolitan areas in all nine provinces of South Africa, there are townships. Most of the inhabitants of these townships are originally from rural areas where farming is a common practice. In most of these townships, different kinds of animals such as cattle, goats, sheep, pigs and indigenous chickens are kept. All these animals have been brought in to the townships with a clear purpose that can be explained by their different owners.

This paper addresses the perspective of grazing management surrounding this township farming. It is noted that there is a clear understanding by these animals where they can find their daily food. It would appear that the condition of these animals is well maintained through all the seasons. The owners of these animals also have the underlying knowledge of where available feedstuffs are.

Keywords: grazing management; feedstuffs



PLATFORM PRESENTATION: RETHINKING HERDING AS A LIVESTOCK MANAGEMENT STRATEGY IN SOUTH AFRICA?

Clement F Cupido, M Igshaan Samuels and Melvin B V Swarts*

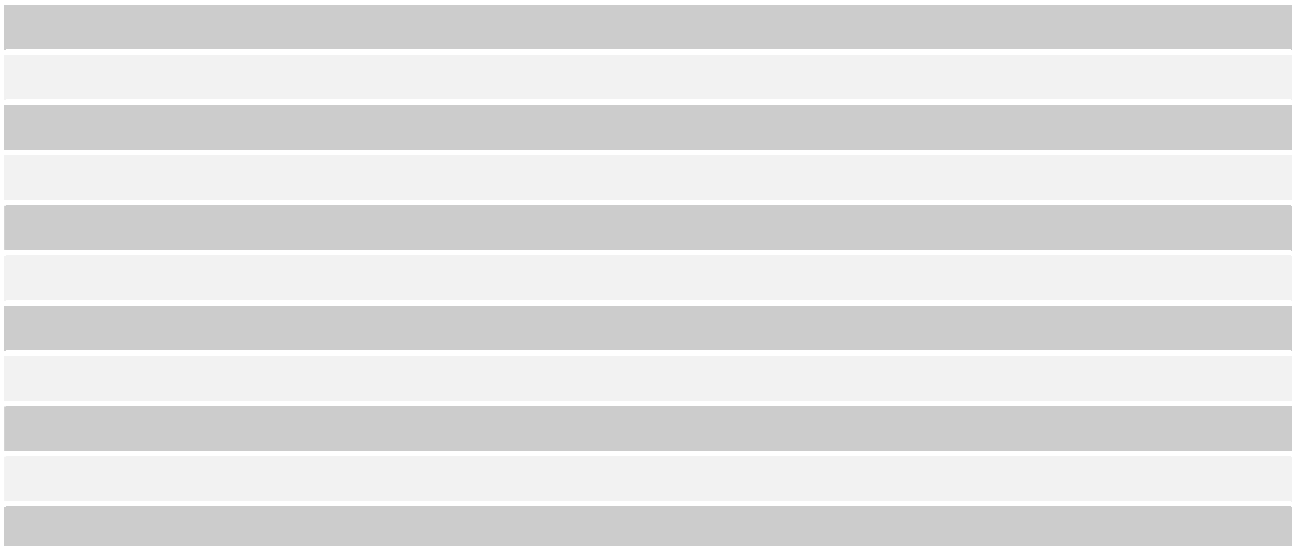
Agricultural Research Council – Animal Production Institute, Rangeland and Nutrition Unit, Cape Town,
email: ccupido@uwc.ac.za, isamuels@uwc.ac.za, mswarts@uwc.ac.za

In many semi-arid and arid African countries pastoralism has been and still is in the form of a transhumance with pastoral regions limited by natural boundaries, the availability of water and fodder. Traces of these transhumance patterns can still be observed in the Northern Cape Province in the Kamiesberg Region and the Richtersveld where herders move with livestock in search of key seasonal resources over large areas. After colonization of these areas and the subsequent introduction of Apartheid legislation, the grazing land of indigenous tribes shrank and became limited to so-called 'Coloured' reserves. On a national level private white-owned farms were fenced off and a camp system was introduced under the Fencing Act (Act 17 of 1912). The subsequent Drought Investigation Commission of 1923 primarily blamed the traditional transhumance and 'kraaling system' for the deterioration of the rangelands. This marked the introduction of the rotational grazing systems and signified a decline of pastoral herding as a livestock management strategy in most parts of the South African arid and semi-arid livestock producing regions.

In the Leliefontein Communal Region in the Kamiesberg, herding is still part of the daily lifestyle. In this region of about 192 000 hectares the majority of herders from ten villages follow a seasonal transhumance between villages, respecting agreed boundaries between grazing areas. The introduction of fenced-off 'economic units' by government in the 1980s was rejected by inhabitants of this region, therefore herding as a form of pastoralism was kept alive. Results from semi-structured interviews with livestock owners indicated that the main benefits of employing herders include (1) stock theft is almost nullified, (2) the loss of livestock to predators is significantly reduced and (3) the benefits of early detection of illness. In studies on private farms and municipal commonages where camp systems are employed stock theft and predation are considered to be the biggest obstacles for livestock farmers. Annually commercial farmers suffer enormous economic losses due to these factors.

The system of rotational grazing using multi-camps is imposed upon emerging farmers on Land Redistribution for Agricultural Development (LRAD) farms. Studies on such farms have indicated that the use of fences to manage livestock is ineffective due to a lack of infrastructural support. This paper argues for the reintroduction of herding on LRAD farms, established commercial farms and municipal commonages in the semi-arid and arid regions. We suggest that it would be more economically viable for government to consider a change in policy by promoting and subsidising herding rather than fencing under the new Rural Recapitalisation and Development Plan. Reintroducing herding as a livestock management strategy could address the issue of stock loss commercial farmers are dealing with and could contribute to social and economic upliftment through job creation in rural areas plagued with poverty.

Keywords: pastoralism; herding; livestock management; fencing; LRAD farms





PLATFORM PRESENTATION: PEOPLE, CATTLE, AND THE COMMONS. THE CASE OF ENHLANOKHOMBE, WESTERN KWAZULU-NATAL

Monique L Salomon^{1}, J Mphumzeni Chonco¹, Nicky Allsopp², Mike K McCall³, Akke J van der Zijpp⁴, Terry M Everson¹ and Rob Fincham¹*

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In this paper, findings are presented of a study as to why cattle keepers in Okhombe, western KwaZulu-Natal, South Africa, did not adopt a rotational resting system to improve the management of cattle grazing. Despite having been designed in a participatory manner, the rotational resting system was not applied by cattle keepers.

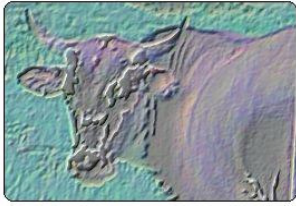
A survey in Enhlanokhombe, one of the sub-wards of Okhombe, showed that people are keeping fewer cattle than in the past. A 24% decrease in cattle numbers was recorded between 2001 and 2008. Cattle keepers perceive stock theft as the most important threat. Yet, figures of stock losses showed that cattle disease resulting in death is an equally pressing problem.

The decline in authority of traditional leaders and the view that herding is a family task have compounded the dominant management practice of continuous grazing by cattle. Rotational resting was found unsuited to the majority of cattle keepers who want to keep a close watch on their herd as they graze on the lower hill slopes. People in Okhombe disagreed about the condition of the range and what comprised appropriate grazing management.

This does not, however, mean that the current situation in Enhlanokhombe is a tragedy of the commons scenario. Rather, it is the result of a clash between traditional governance based on norms and democratic governance based on rules. Community action has emerged in the form of a cattle patrol to address stock theft. If successful, it may further enhance collective action.

Keywords: rotational resting; stock losses; grazing management





Workshop: Communal Rangelands and Policy - Aligning the Realities of Livestock Keepers with Government Priorities

SESSION CHAIR: MONIQUE L SALOMON

Tuesday 12 July 2011, 11:00 – 12:30, 13:30 – 15:10

This workshop provides a platform for researchers, policy makers, and development workers to dialogue on issues emerging from policy and practice in communal rangeland management in South Africa.

Researchers will present policy recommendations emerging from their research. A draft position paper on new paradigms in communal rangeland management will be presented and discussed. A status update is presented on the draft Range and Forage Policy and further input elicited.

WORKSHOP PROGRAMME

11:00-11:10	<i>Opening and welcome</i>	Monique L Salomon
11:10-11:25	<i>Knowledge-to-policy: voices from the field I - The perceptions of communal livestock keepers on veld condition, veld degradation and options for improving livestock production: A synthesis of studies from Sterkspruit in the Eastern Cape</i>	Wiseman Goqwana
11:25-11:40	<i>Knowledge-to-policy: voices from the field II - Understanding commonage policy: A challenge for pastoralists in the semi-arid regions of South Africa</i>	M Igshaan Samuels
11:40-11:55	<i>Knowledge-to-policy: voices from the field III - Facilitating bottom up policy development in communal rangelands in the uKhahlamba-Drakensberg</i>	Monique L Salomon
11:55-12:15	<i>Position Paper: New paradigms in communal rangeland management</i>	Susi Vetter
12:15-12:30	The Rangeland Monitoring Programme	Alan D Short
12:30-13:30	LUNCH	
13:30-13:45	The Draft Range and Forage Policy	Kedibone B Chueu
13:45-15:10	Workshop Discussion and Way Forward	

DRAFT: POLICY FOR THE SUSTAINABLE MANAGEMENT OF VELD (RANGE) AND FORAGE RESOURCES IN SOUTH AFRICA

Directorate: Animal and Aquaculture Production

Revised 1 November 2007



agriculture

Department:
Agriculture
REPUBLIC OF SOUTH AFRICA

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6. Policy to Address the Problem
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9. Main Policy Areas
10. Reference Documents
11. Policy Owner



1. INTRODUCTION

1.1 Background – Veld and Forage Resources Utilisation in South Africa

Almost 80% of the land available for agriculture in South Africa is predominantly classified as semi-arid; with erratic and low rainfall patterns as well as high temperatures. 13% of this agricultural land is used for crop production (arable land), while 87% of this land is used by the animal production (livestock and wildlife) sector. This implies that the animal production sector is mainly natural resources dependent, with the veld (rangeland) resources as its main source of fodder.

The veld and forage resources contribute a greater proportion towards the country's food security through herbivore conversion of these resources to food for human consumption; and these resources also provide a wide array of goods and services (such as turf, biofuel, and medicinal purposes) far beyond just animal production. Therefore, it is important to foster efficient and effective usage of these resources through sustainable management in order to ensure the long-term stability of the animal production sector.

The interaction of climatic and ecological factors has created a number of biomes with a variety of natural veld types, while veld and forage production units determine the amount of animal products that can be produced from a given source. Within the natural ecological system, a veld that is in good condition (in terms of fodder production) is the core determinant of a more sustainable animal production. Therefore, a complete understanding of the dynamics of the ecological system, time and spatial inter-relationship between veld, pastures, climate, soil and animals is essential for sustainable animal production.

1.2 Rainfall Variation and Veld Productivity

South Africa is characterized by low, erratic rainfall pattern, with droughts as normal recurring phenomena. For each climatic region, the total seasonal rainfall contributes to the production potential of veld while the seasonal rainfall distribution determines fodder flow within a given season. Hence, a variable fodder supply is experienced from veld every year. The condition of veld plays an important role in stabilising this variation in fodder supply. Thus, the better the condition of veld, the smaller the variation of fodder supply from that veld, and the more stable and sustainable animal production will be.

As the capacity of the veld to meet the fodder production demand depends on the integrity of soils and ecological processes, a veld in a good condition is not only more efficient in converting rainfall into dry matter but it is also important to ensure a more stable basal cover; preventing soil erosion as well as offsetting the risks associated with agricultural disasters such as droughts, especially in respect to the intensity and frequency of seasonal droughts.

1.3 Veld Condition and Animal Productivity

The economic viability of many of the animal production systems in the country mainly rely on the veld and sustainable animal production will only be possible when the veld and soil conditions are in productive and stable state. Furthermore, farm size is more likely to have major bearing on the economic viability of a production system when the veld within the farm is in good condition, when no additional feed sources are provided.

Veld degradation in many parts of South Africa is regarded a major factor that is limiting the productivity of the animal production sector.

1.4 Stocking Rate and Animal Productivity

In an animal production system, the applied stocking rate is the single farmer-dependent variable that has the greatest influence on the biological output of saleable animal products (economic return to the farmer) and the long-term condition of the veld.

Stocking rates should fulfil both economic and ecological benefits from the veld, while injudicious and unrealistic stocking rates will ultimately have adverse effects on long-term productivity of the veld and animal productivity.



1.5 Management of South Africa's Veld and Forage Resources

South Africa's veld resources can be classified either into veld types on the basis of the general structure and composition of the vegetation in the ecological system, or into seasonal use classes on the basis of the seasonal quality and quantity of the forage it produces. Both classifications are used in defining the value of veld for animal production.

Classification into veld types provides valuable information on the types of animals, to which the veld and forage is suited, whereas classification based on seasonal quality and quantity of veld and forage influences the type of animal production system to which the area is most suited.

The form and function of veld and forage resources in an area varies, and as such the management of those resources will also vary. Grasslands and savannah in particular, need careful management as they contribute substantially to the agricultural economy by supporting large numbers of animals.

The many initiatives in attempt to address the characterisation, evaluation and management of the veld and forage resources in the country include:

- Drought Investigation Commission Report in 1920 to 1923: paved the way for the categorisation of veld degradation.
- The classic work on the Classification of Veld types of South Africa by J. P. H. Acocks since the 1940's.
- Legislation aimed at protecting the natural agricultural resources of South Africa were developed at regular intervals; from Forest and Veld Conservation Act (Act 13 of 1941), the Soil Conservation Act, 1946 (Act 45 of 1946); and the Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983).
- National Grazing Strategy (1985): the first action plan from the White Paper on Agricultural Policy (tabled by government in May 1984) aimed to address the alarming deterioration of the natural veld.
- Research and Development Centres were established to show commitment to veld and forage research: Agricultural Research Council's Range and Forage Institute (ARC-RFI) and the Research and Development Stations under the ordinance of various provincial Departments of Agriculture (PDA's).
- The Grassland Society of Southern Africa (GSSA): a platform for interaction of veld and forage scientists, researchers, and technologists.
- Land Degradation in South Africa (2001) - T. Hoffman and A. Ashwell: A report that represents the first stage in the development of South Africa's National Action Programme to Combat Desertification (under the United Nations Convention to Combat Desertification (UNCCD)).

Despite all these attempts, veld degradation still remains a serious problem that pose a threat to sustainable animal production in many of the country.

1.6 Veld and Forage Support services

South Africa has a wealth of support services and infrastructure to cater for the animal production sector, with established veld and forage research and development (R&D) centres in all the main biomes as well as numerous academic institutions that champion veld and forage research studies. While it would appear as though more than adequate provision has been made to provide biome-linked and production area-linked services, the centres areas are not confined to provinces and this creates a problem as far as integrated service-delivery is concerned (more details appear in the problem statement).

At present, support services directed at the sustainable management of veld and forage resources are fragmented, and research and development functions are spread amongst the nine PDoA's, the DoA and the research and academic institutions. This situation weakens the impact and effectiveness of research and extension services.



1.7 Legislation

1.7.1 Legislation administered by DoA

The main Acts controlling the use of veld and forage resources that are administered by DoA:

(i) *Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)(CARA)*

This act makes provision to prescribe control measures with regard to:

- controlling the utilization of natural agricultural resources;
- the grazing/browsing capacity of veld and the maximum number and the kind of animals which may be kept on veld;
- promoting the conservation of the soil, the water sources and the vegetation
- the prevention and control of veld fires; the utilization and protection of veld which has burned;

The Act makes provision for the Minister of Agriculture and Land Affairs, with the concurrence of the Minister of Finance, to establish a scheme (by notice in the Government Gazette) in terms of which assistance, out of moneys appropriated by Parliament for this purpose, may be granted to land users by means of the reduction of the number of animals being kept on land in order to restrict the detrimental effect of drought on that land.

(ii) *Subdivision of Agricultural Land Act, 1970 (Act 70 of 1970)*

The Act is aimed at controlling the subdivision of agricultural land and, in connection with, the use of agricultural land to prevent the fragmentation of this land into uneconomic units as well as the sale of this land without the approval from the Minister of Agriculture and Land Affairs.

(iii) *Fencing Act, 1963 (Act 31 of 1963)*

The purpose of the Fencing Act is to consolidate the laws relating to fences and the fencing of farms and other holdings. It regulates the fencing of boundaries of land on which farming operations are carried on.

1.7.2 Legislation administered by DEAT

DEAT administers two key Acts that control the use of natural resources, namely:

(i) *Biodiversity Act, 2004 (Act 10 of 2004)*

This act provides the management and conservation of biological diversity within the Republic and to give ratified international agreements relating to biodiversity. The biodiversity act will protect critical endangered ecosystem as a result of human intervention.

(ii) *National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA)*

The NEMA regulations are important as they impact on a number of veld and forage farming operations. Section 24 of NEMA requires that the environmental impact assessment of any listed activity that needs authorization by any organ of state must be considered prior to the implementation of those activities.

1.7.3 Legislation administered by DWAF

DWAF administers:

(i) *National Veld and Forest Fire Act, 1998 (Act 101 of 1998)*

The Act provides for sustainable utilization of forest and woodlands, and also protects certain tree species through its regulation. The act impacts on veld management, particularly where fires may be used for bush control purposes and other veld management practices.

**2. DEFINITIONS / GLOSSARY OF TERMS****2.1 Terms**

Terms	Definitions
Animal	Any kind of herbivore animal (wildlife and livestock) used in a production system. This includes an animal of a specified breed of such kind of animal which has in terms of section 2 been declared as an animal for the purposes of the Animal Improvement Act, 1998 (Act No 62 of 1998).
Biomass	Total amount of living material (plant and animal) present in a particular area at any given time- kg/ha.
Browsing	Utilization of woody vegetation by animals.
Carrying capacity	Potential of an area to support an animal through grazing and/or browsing over extended number of years without deterioration to the overall ecosystem- ha/AU or AU/ha, this will include planted pastures and additional fodder supply.
Community	Means any group of persons or a part of such a group who share common interests, and who regard themselves as a community.
Conservation	In relation to the natural agricultural resources, includes the protection recovery and reclamation of those resources.
Degraded	In relation to veld and forage, means that which has lost its production potential as a result of over utilisation, erosion and other factors.
Department	Department of Agriculture in the national government
Fodder	Animal feed that includes forage, hay and silage.
Grazing	Utilization of herbaceous vegetation by animals.
Grazing/ browsing capacity	Productivity of grazeable/browseable portion of a homogenous unit of vegetation expressed as the area of land required to maintain a single animal unit over an extended number of years.
Grazing/Forage value	A combination of palatability, food value and bulk of the relevant vegetation in relation to the grazing/browsing animal.
Herbivore	In terms of this policy, any animal using veld and forage as a primary source of food.
Large Stock Unit	An animal with a mass of 450 kg and which gains 0.5 kg per day on forage with digestible energy percentage of 55 %.
Planted pastures	Dryland or irrigated pastures that have been cultivated with the specific purpose of providing fodder for herbivores.
Regulation	Any regulation made in terms of the relevant Acts.
Stocking rate	An area of land in the system of management which the operator has allocated to each animal unit in the system, and is expressed per length of grazeable and/ or browseable period of the year- ha/AU or AU/ha.
Sustainable development	The integration of social, economic and environmental factors into planning, implementation and decision making so as to ensure that development serves present and future generations.



Sustainable use	The management of veld and forage resources for animal production in an environmentally sound way that does not compromise the ability of future generations to meet their own needs from the same resources.
Veld	Indigenous vegetation used as grazing and/or browsing which may be composed of any of a number of plant growth forms and need. The word “veld” is used interchangeable with the words “range” and “rangeland”.
Veld condition	Condition of the vegetation in relation to some functional characteristic, normally maximum forage production and resistance to soil erosion.
Veld type	Unit of vegetation whose range of variation is small enough to permit the whole of it to have the same farming potentialities.

2.2 Acronyms

AGIS	Agricultural Geo-referenced Information System
ARC	Agricultural Research Council
CARA	Conservation of Agricultural Resources Act (Act No. 43 of 1983)
DEAT	Department of Environmental Affairs and Tourism
DLA	Department of Land Affairs
DoA	National Department of Agriculture
DPLG	Department of Local Government and Provincial Government
DWAF	Department of Water Affairs and Forestry
GSSA	Grassland Society of Southern Africa
ITCA	Interdepartmental Committee on Agriculture
NAFU	National African Farmers Union
PDoA	Provincial Departments of Agriculture
R&D	Research and development
SUPAR	Sustainable Utilisation and Protection of Agricultural Resources Act
WRSA	Wildlife Ranching South Africa

3. PROBLEM STATEMENT

3.1. Continuing deterioration of the veld and forage resources

The productivity of veld and forage resources in many parts of South Africa has been degraded over many years. In particular, the veld in many parts of the arid environments have been transformed to a less desirable state as a result of disturbances such as high grazing pressure, resulting in desertification, bush encroachment and loss of palatable species. Should this deterioration be allowed to continue, sustainable animal production and long-term economic growth will be stifled.

3.2. Lack of understanding of the role and vulnerability of veld and forage resources

Despite the fact that there is a wealth of information on the management of veld and forage resources of South Africa, including ways to evaluate and classify the resources in every biome, there is however, still some lack of understanding of the critical role of veld and forage management in sustainable animal production.

There is a need to explore the dynamics of climatic and ecological interaction in order to understand the underlying forces that shape veld communities. This need is reinforced by the realisation that natural recovery of veld does not occur in a time frame acceptable to land users.

3.3. Past actions have been ineffectively implemented

While there have been a number of in-depth studies, investigations and strategies to address the erosion of veld and forage resources in the past, veld degradation is still continuing in many parts of South. This clearly shows that many of the research and extension efforts and strategies that



evolved from national investigations have either been ineffectively implemented or inappropriately translated to end-user (farmers) management practices.

3.4. Inadequate and potentially conflicting legislation

While the CARA makes provision for control measures such as grazing capacity and stocking rates, deterioration of the natural vegetation continues to remain one of the largest agricultural and environmental problems in South Africa. Some success stories have however been realised and this can be used as reference for future interventions.

The multifunctional use of veld and forage resources necessitates that current legislation be amended to adequately cater for both economic and ecological benefits of these resources for sustainable animal production as well as to make more specific provision for the monitoring, conservation, improvement and sustainable use of South Africa's veld and forage resources. It is also important that wildlife ranching/farming be generally adopted as a bonafide agricultural activity and subjected to similar legislative measures as livestock ranching/farming as far as the use of veld and forage resources is concerned.

3.5. Need for Continuous Technology Development and Technology Transfer

DoA, PDoA's, academic institutions, and the relevant R&D institution such as the ARC must contribute towards research that foster sustainable management of the veld and forage resources for animal production. There is a need for continuous development of economically sustainable technologies, technology transfer and application, and integrated management strategies that are based on fundamental knowledge of ecological processes, to ensure the sustainability of veld and forage resources.

3.6. Insufficient and uncoordinated human resources

The complexity of solving a comprehensive problem such as vegetation deterioration requires inputs from a range of researchers and expertise from the integration of a number of relevant disciplines, from social to science. At present, the required scientific and technical community for sustainable management of veld and forage resources for animal production is compartmentalized and seldom function as a unit. These constraints must be addressed in order to ensure a common focus towards the sustainable management of veld and forage resources.

3.7. Fragmented and uncoordinated support services and uncoordinated

Support services directed at the sustainable management of the veld and forage are currently fragmented. The R&D functions are spread amongst the nine PDoA's, DoA, the ARC and other R&D institutions. This fragmentation weakens the effectiveness and efficiency of research and extension efforts mainly because there seem to be an uncoordinated focus across provincial boundaries, regardless of the fact that the biomes (grazing/browsing areas) are not confined to provincial boundaries. It is important to establish a national focus that foster collaboration amongst the various support structures across provincial boundaries. The purpose of this is to strengthen the effectiveness of research and extension services and, eliminate duplication.

3.8. Complexity of land tenure system

South Africa has a complex history of land tenure system, which comprises mainly of communal and commercial land tenure. The land practices differ markedly between the two land tenure systems. Since, property rights are the foundation of the natural resources management and conservation, there is a need to understand the functionality of land tenure management system, particularly communal land tenure management, in order to produce data and analyses studies that will assist in development of veld management strategies that will benefit end-users.

4. OBJECTIVES

The objectives of the policy are to:

- 4.1 Provide a framework and guidelines that promote and facilitate the sustainable use of South Africa's veld and forage resources for animal production.



- 4.2 Provide a framework and guidelines for effective veld and forage monitoring and improvement with the capacity to support compliance to the relevant legislation/regulations regarding the sustainable use of these resources.
- 4.3 Provide guidance and motivation for the amendment of legislation on the sustainable management of veld and forage resources, as well as more effective and consistent regulation thereof.
- 4.4 Support and facilitate the revival of existing R&D structures within biomes and across provincial boundaries.
- 4.5 Assist with poverty alleviation and food security through the sustainable use of veld and forage resources for an economically viable animal production sector.

5. POLICY TO ADDRESS THE PROBLEM

5.1 The various policy options available to the department and Policy option recommended to address the problem.

In developing an effective Policy on Sustainable Management of Veld and Forage Resources, attention must be given to the following:

5.1.1 Norms and Standards for the sustainable management of veld and forage resources

All existing norms and standards should be revised and consolidated, taking all the relevant legislation (such as the CARA and the NEMA regulations) and Biome-linked technical issues into consideration. This information must be used to develop an integrated set of Biome-specific Norms and Standards for sustainable management of veld and forage resources.

These norms and standards should address issues such as provision of artificial water supply systems, fencing considerations, infrastructure and various veld management practices aimed at an ecologically and economically viable farming enterprise.

5.1.2 National Veld and Forage programme, Strategy and Implementation Framework

Using the previous National Grazing Strategy and National Livestock Development Strategy for South Africa as guidelines, a National Veld and Forage Strategy- Programme and Implementation Framework should be developed as a product of this policy. This initiative shall include practices that deal with issues of both communal and commercial veld and forage management practices, taking cognisance of previous work done on the subjects.

The National Veld and Forage Strategy- Programme and Implementation Framework should be endorsed at Cabinet level as a national priority with sustainable management of the natural resources as basis of food safety and security, and it will link all the activities to be discussed below.

5.1.3 National Veld and Forage Databank

A central databank using the DoA-AGIS system should be developed and maintained as a key component of the National Veld and Forage Strategy- Programme and Implementation Framework. This databank should include information on access to veld and forage resources for emergency situations such as disaster veld fires and droughts.

5.1.4 National Veld and Forage Working Group

A National Veld and Forage Working Group (NVFWG) should be established as a sub- group under the National VeldStock Working Group. NVFWG will serve as a stakeholder-driven approach aimed at fostering a national focus towards sustainable management of veld and forage resources. NVFWG will comprise of representatives from all the relevant stakeholders in the relevant Departments (DoA, PDoA, DEAT, DWAF, DPLG and DLA), research and development institutions such as ARC, GSSA, animal producers organisation, and other relevant institutions; and it will be used to guide and inform all veld and forage policy issues.

5.1.5 Interdepartmental Technical Working Group (ITWG) on the sustainable management of veld and forage resources



Consideration should also be given to the establishment of an Interdepartmental Technical Working Group on the management veld and forage as agricultural resources. The ITWG should be established as a standing committee under the ITCA structure; and should deal with issues relating to integrated monitoring, improvement and evaluation of veld and forage resources, as well as regulation to ensure service-delivery to both the livestock and wildlife sectors. This ITWG will comprise of representatives from DoA, DEAT, DWAF, DPLG and DLA over and above the normal agricultural role players.

5.1.6 National Veld and Forage Monitoring and Improvement Programme

Although the country has a number of veld monitoring programmes, these programmes currently are functioning as separate units. There is a need to establish a National Veld and Forage Monitoring and Improvement Programme through an integrated participatory approach from the relevant stakeholders. This programme will be designed to meet national regulatory requirements such as the National Status of Veld and Forage Resources Report and, it will comprise of the follow components:

(i) Veld and Forage Monitoring and Improvement Scheme

A “Veld and Forage Monitoring and Improvement Scheme”, similar to the Animal and Plant Improvement Schemes, should be established to ensure efficient animal production within the constraints of the natural resource, without degradation of the ecosystem. This must include a national veld and forage assessment, improvement and monitoring system to relate veld and forage condition to animal productivity, efficiency and risk management.

(ii) Veld and Forage Monitoring and Improvement System

There is a need for a system to enable farmers at all levels to effectively monitor and evaluate the condition of their resources. This should be linked to a decision support system to reduce the risk of environmental degradation and animal mortality by managing the climatic impact on animal production.

(iii) Veld and Forage Technical Capacity Building

Suitably qualified graduate will be trained and deployed as Veld and Forage Officers to all the biomes/production areas to provide technical support to extension officers and inspectors appointed in terms of CARA. The deployment of these Veld and Forage officers should be linked to veld and forage research and development centres in the respective areas, under the joint management of the ARC- Range and Forage Institute (ARC-RFI) and Grootfontein Agricultural Development Institute (GADI). These officers will assist with veld monitoring, improvement, and evaluation, and farm planning strategies.

5.1.7 Biome Centres of Excellence and Central Centre of Excellence

Centres of excellence that work across provincial boundaries need to be established using the existing structures (in Fig.2.). The ARC-RFI should be recognised as the central centre of excellence for veld and forage R&D in South Africa as it is uniquely positioned with its various research institutes representing the major climatic regions and major biomes located across the country. The distribution of these research institutes and their histories of scientific investigation in veld and forage research are of great importance towards veld and forage research capacity building.

5.1.8 Veld and Forage Research and Development needs

The research agenda for veld and forage must address veld degradation, the loss of biodiversity, cover and species, bush encroachment and invasion of alien plants. The government, R&D institutions, and animal producer organisations should allocate more funds towards veld and forage R&D if the degradation of these resources is to be reversed. Attention should also be given to the following:

- (i) Veld degradation and climate change
- (ii) Long-term veld monitoring and communal veld management
- (iii) The use of legume and indigenous grass species
- (ii) The use of alternative fodder crops including drought tolerant fodder crops



5.1.9 Land tenure and farmer settlement issues

- (i) Farmers need to have secured rights to resources to ensure viable production systems. In particular, this implies changes to the tenure system in rural areas.
- (ii) Tenure security can only be successful if there is appropriate institutional support that should be supported by government. Functional and well-supported local institutions will be in a better position to manage local resources, and liaise with extension services to ensure proper information management channels. As part of DLA's mandate to reform the land tenure system, Communal Land Rights Act, (Act No. 11 of 2004) (CLRA) was introduced for the reform and upgrading of the land tenure system that pertains in the communally owned areas. The process for the formulation and registration of community rules are dealt with in Section 19 of the CLRA.
- (iii) A serious constraint is the weak researcher-extension-farmer linkage, which amongst others, impedes full understanding of the complexity of the communal land tenure system. Researchers and extension personnel must work closer together to curb this problem.
- (iv) A service to determine the current condition of the veld and forage and to advise on carrying capacity, stocking rate, stocking suitable species, breeds and combinations as well as production systems should be made available to all existing and prospective farmers. Where applicable, farmer settlement initiatives involving livestock and/or wildlife should be subject to evaluation and planning prior to necessary farming activity.
- (v) There is a need for a national register for all farms and their main activities, and where necessary, they must be an evaluation and permit prior to some changes in land use in accordance with Subdivision of Agricultural Land Act (Act 70 of 1970).

5.1.10 Farmer support services

(i) Mentorship/Stewardship programmes

A program linked to the National Mentorship Programme but aimed at sustainable management of veld and forage resources should be initiated, using voluntary and contracted mentors. A register of both livestock and wildlife ranchers/ farmers that practice sound veld management practices should be established as a reference database.

(ii) Involvement of Non Governmental Organisations (NGO's)

Various NGO's have specific roles to play as strategic partners on issues such as training, policy inputs, management advice, and R&D initiatives. For example, GSSA is a key partner in terms of veld and forage R&D issues, while producer organisation such as WRSA and NAFU are key partner as far as the animal production is concerned. Therefore, close cooperation with relevant NGO's is of critical importance for promoting the implementation of guidelines for recommendations of stocking rate, and the enforcement of legislations such as CARA and NEMA regulations for sustainable management of veld and forage resources.

(iii) Incentives for veld and forage farmers

Since sound veld and forage management practices can be costly (such fencing, and water points), some farmers cannot afford it. Therefore, attention should be given to support those who practice sound veld and forage management. A system to assist and encourage veld and forage users to practice sustainable management of these resources shall also be developed within the framework of DoA's Disaster Relief Scheme.

5.2 **Justification of the recommendation in terms of efficiency, effectiveness, social effects, environmental impact and technical feasibility of the option.**

Policy option

In addition to the key components above, the existing CARA or future SUPAR Act, should be used to establish a National Veld and Forage Monitoring and Improvement Scheme along with specific regulations for sustainable management of South African's veld and forage resources.



Justification of the Policy

As Veld and Forage management is a critical factor in all animal production systems, it is important to give urgent attention to the following issues:

- A National Veld and Forage Programme and scheme that will include ways to promote more sustainable use of veld and forage resources, particularly communally grazed.
- National Veld and Forage Working Group that will act as a stakeholder participatory approach to establish a national effort towards sustainable management of veld and forage resources.
- Revised Norms and Standards, and Guidelines for Veld and Forage management (to provide information on assessment, grazing/browsing capacity, stocking rate, etc).
- Biome-linked R&D centres of excellence

These issues will be driven within the framework of the CARA and other relevant legislation and aligned with recommendations emanating from the National Livestock Development Strategy. It is also clear that this will only be possible as a joint initiative involving relevant government departments and all role players involved in the utilisation of veld and forage resources to ensure consensus on the shared responsibility of caring for the natural resource base.

5.3 Institutional implications

The establishment of a NVFWG and ITWG (Closer Corporation with DEAT and DWAF) on the management of veld and forage resources, and the reactivation of Biome-linked Veld and Forage Centres as facilities of joint responsibility, indicate the acceptance of the principle of shared responsibility amongst all role players.

5.4 Legislative and regulatory implications

- 5.4.1. Declaration of a National Veld and Forage Monitoring and Improvement Scheme in terms of CARA.
- 5.4.2. More effective use of Legislation to enforce compliance where necessary.
- 5.4.3. Finalisation of the draft SUPAR Act or possible amendment of a more specific legislation for the management of veld and forage resources in South Africa.
- 5.4.4. Close cooperation with DEAT to link the NEMA regulations with this policy.

6. INDICATORS OF PERFORMANCE

- 6.1 Adoption of this policy- 'Policy for the Sustainable Management of Veld (Range) and Forage Resources in South Africa'.
- 6.2 Functional National Veld and Forage Working group.
- 6.3 Functional Interdepartmental Technical Committee on Veld and Forage Resources Management.
- 6.4 Published integrated set of Biome-specific Norms and Standards.
- 6.5 Functional Veld and Forage Monitoring and Improvement programme (that includes a program for the communal veld management) as is linked to the National Livestock Development Strategy.
- 6.6 Functional Biome-linked Research and Development Service centres.
- 6.7 Positive response from all those using veld and forage resources; a paradigm shift towards a culture of sustainable management of the veld and forage resources.
- 6.8 Documented progressive Veld and Forage Monitoring and Improvement programme.

8. THE MAIN POLICY AREAS

The main policy areas concerning the department are clustered around the inherent needs of those engaged in agricultural activities, namely:



- 8.1 Access to and sustainable utilisation of natural resources such as land, water, flora and fauna.
- 8.2 Capacity to optimally utilise the resources dependent on infrastructure, finance, technology, services and skills development.
- 8.3 Competitiveness of the individual enterprises and the entire sector relative to that of similarly endowed or competing economies to be addressed through improved efficiency and productivity, free and fair markets and innovation.
- 8.4 Confidence and stability brought about by objective and effective regulation, by risk alleviation measures, sound customer relations and effective governance of the sector.
- 8.5 Responsibility underpinned by the sector's strategic role as society's basic food provider, employer of the less skilled, and as social safety net for rural society.

9. REFERENCE DOCUMENTS

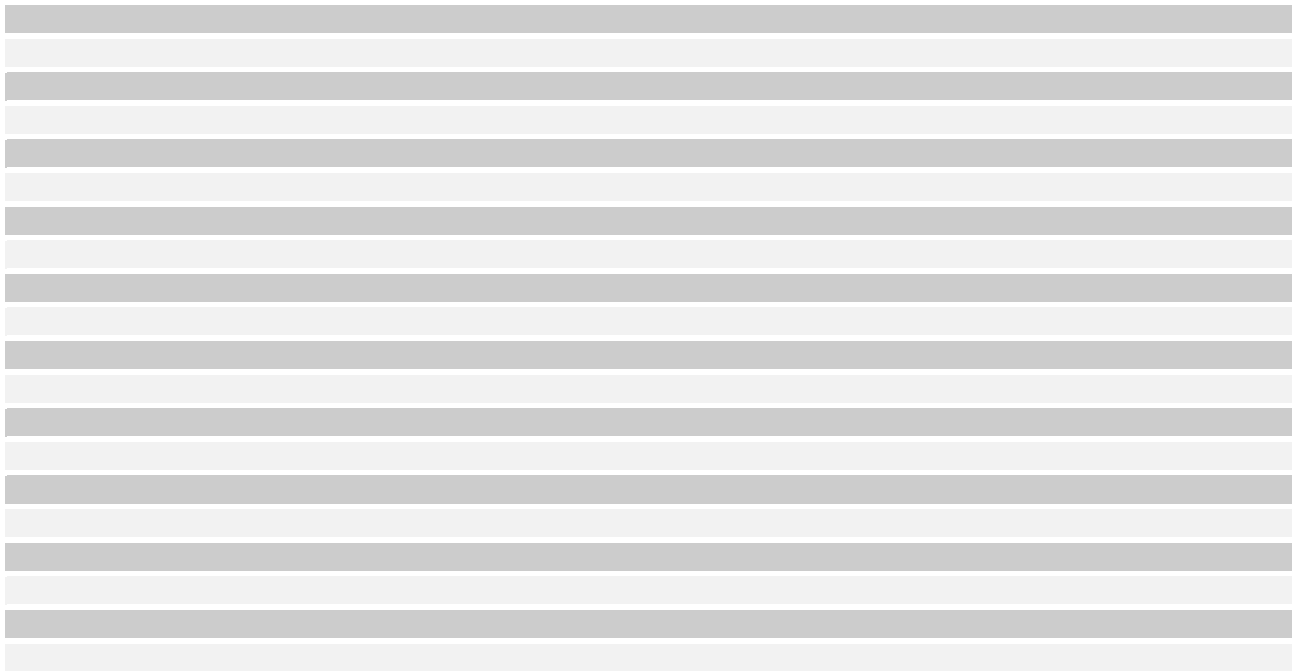
- 9.1. National Livestock Development Strategy
- 9.2. National Grazing Strategy
- 9.3. Animal Improvement Policy
- 9.4. Natural Agricultural Sector
- 9.5. Draft SUPAR Act
- 9.6. Land Degradation in South Africa
- 9.7. South African Legislation (various legislations as referred in this document)

10. POLICY OWNER

This policy is owned by DoA.

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ABSTRACTS: WEDNESDAY 13 JULY 2011

Applying Remote Sensing to Rangeland and Pasture Management

SESSION CHAIR: JAMES R PUTTICK

Wednesday 13 July 2011, 08:30 – 09:50

Platform Presentations

PLATFORM PRESENTATION: MODELLING EVAPOTRANSPIRATION IN THE KRUGER NATIONAL PARK USING THE PENMAN-MONTEITH EQUATION AND MODIS LAI TO APPROXIMATE CANOPY CONDUCTANCE

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Accurate estimates of evapotranspiration (ET) are essential if we are to derive reasonable estimates of production and water use for natural rangelands. Global pressure is mounting to improve the performance of landscapes to capture carbon, and there have been examples of rangeland water use being equated to that of more water demanding crops and land cover types. Defending the sustainable functionality of natural rangelands as compared with other land-use options (e.g. carbon sequestration and biofuel production) requires improved evidence-based methods for estimating ET. Estimates of ET are also important in defining the health of an ecosystem and the quantity of water used by the vegetation when preparing a catchment-scale water balance. Using a study site within the Kruger National Park, we derived ET_0 from a weather station near Skukuza (Malekuta), and then used the MODIS leaf area index (LAI) to approximate the stomatal conductance component of the Penman-Monteith equation. The resultant ET_{actual} was compared with ET measurements from an eddy covariance (EC) system and the large aperture scintillometer (LAS). The modelled daily ET compared favourably with the measured data and enabled us to model total annual ET_{actual} for 2007 in the absence of a complete year of eddy covariance data. The model predicts an annual ET at the Skukuza flux site in 2007 of 253 mm, when mean annual rainfall was 530 mm. The approach also has the potential to quantify the comparative benefits of natural rangeland against other competing land-use scenarios, including carbon sequestration and biofuel production.

Keywords: evapotranspiration; leaf area index LAI; MODIS; rainfall; canopy conductance

PLATFORM PRESENTATION: MODELLING TRENDS OF EVAPOTRANSPIRATION USING MODIS LAI IN THE CATCHMENTS OF THE EASTERN CAPE

Andiswa Finca^{1*}, Tony (A) R Palmer¹ and Vincent Kakembo²

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Water in South Africa is a limited resource and it is supplied to the dams by catchments that are predominantly grasslands. In the Eastern Cape these grassland catchments are often inappropriately managed by the communities that depend on them for their livelihoods, resulting in overgrazed lands with either low biomass or invasion of alien species. The short green grass that is maintained by the continuous grazing policies of many communities results in high storm



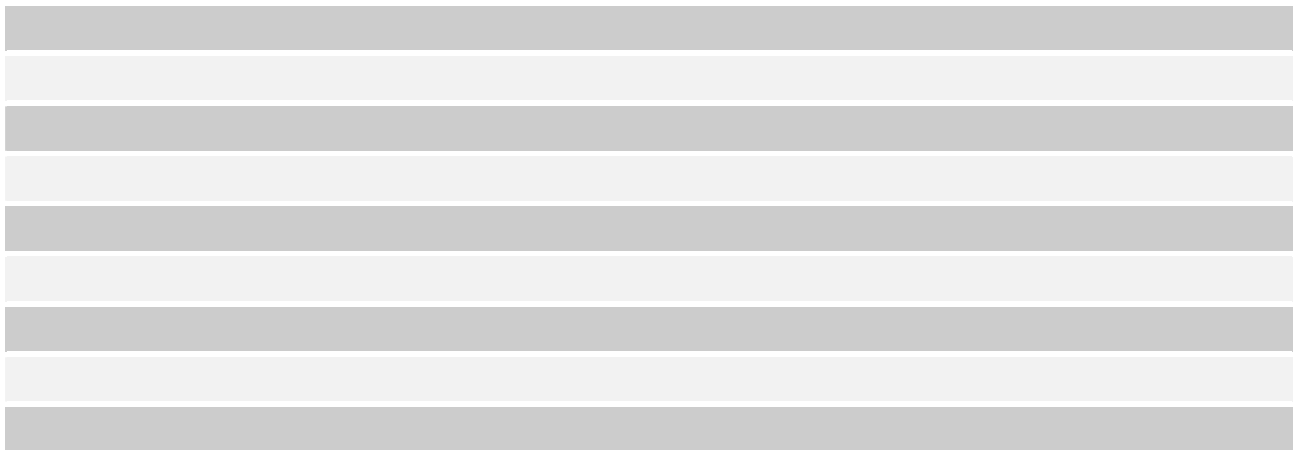
flows and rapid erosion. It is unclear how these grazing strategies affect the rate and quantity of evapotranspiration (ET).

The aim of this study was to explore the effect of two different grazing strategies on ET. Two quaternary catchments were selected for this purpose within the Kat River Primary Catchment: a high biomass catchment (S50E) predominantly under freehold tenure and a low biomass catchment (S20C) under communal tenure. Using GIS and the MODIS leaf area index (LAI) product, three land use scenarios were created for each catchment to reflect potential changes in the standing above-ground biomass.

For Scenario 1, the *status quo* was maintained; for Scenario 2, MODIS pixels representing 28 km² in each catchment were selected and the LAI of these pixels was doubled; and for scenario 3, LAI was halved. Actual annual ET was calculated for each scenario by adjusting the potential evapotranspiration data from a nearby automatic weather station with the MODIS LAI product. We showed that the estimated annual ET obtained from the high biomass catchment was 111 mm greater than that obtained from the low biomass catchment. When comparing between the scenarios, the annual ET obtained from scenario 2 was the highest of the 3 scenarios for both sites.

These results confirm that increased leaf area results in higher annual ET. This has a positive long term impact on stream flow, as high grass biomass allows the rainfall to infiltrate the soil and be gradually released to the dams with reduced magnitude of storm flows. This approach has the potential to quantify the benefits to down-stream water users of improving above-ground biomass in catchments.

Keywords: evapotranspiration; grazing strategies; GIS; MODIS; leaf area index (LAI); above-ground biomass



PLATFORM PRESENTATION: USING MODIS NDVI AS A MEASURE OF GRAZING CAPACITY ON A REGIONAL SCALE

Theunis L Morgenthal

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Morgenthal *et al.* (2004) showed that long-term NOAA (AVHRR) NDVI data correlated well ($r^2 = 0.76$) with the initial grazing capacity map used as norm before 1994 (1993 Grazing Capacity Norms Map). In that study the influence of slope and tree cover were investigated and preliminary methods for correcting the influence of tree cover were proposed. A follow-up study to evaluate the use of MODIS NDVI to estimate grazing capacity conducted by Morgenthal *et al.* (2007) investigated the correlation between the 1993 grazing capacity map and average NDVI values generated from zonal statistics per grazing capacity norm instead of a set of randomly selected point data. The study found that six years of MODIS NDVI data correlate strongly ($r^2 = 0.97$) with the 1993 grazing capacity norms map below a grazing capacity of 40 ha/LSU. Above 40 ha/LSU forage palatability and tree cover become overriding factors in determining the grazing capacity (Figure 1). The study by Morgenthal *et al.* (2007) also illustrated that the 1993 Grazing Capacity Norms for Fynbos, Succulent Karoo, Thicket and Arid Bushveld are outliers in the regression between the 1993 grazing capacity norms data and MODIS NDVI (Figure 2). Furthermore the use of a correctional factor based on VEGMAP vegetation type boundaries was proposed.



The aim of this study is to:

1. Give a summary of the work done so far.
2. Evaluate the regression model approach using a time series of MODIS NDVI data from 2000 -2010.
3. Compare the uncorrected MODIS derived grazing capacity data against known norms for selected research stations and land use types.

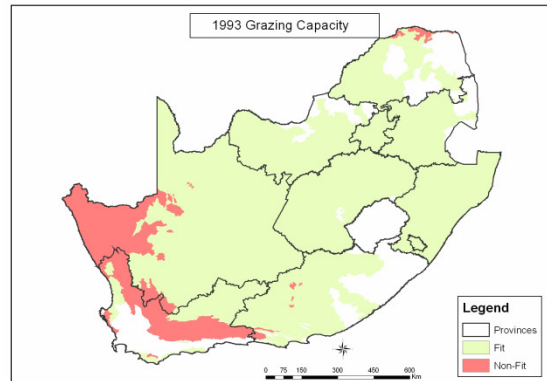
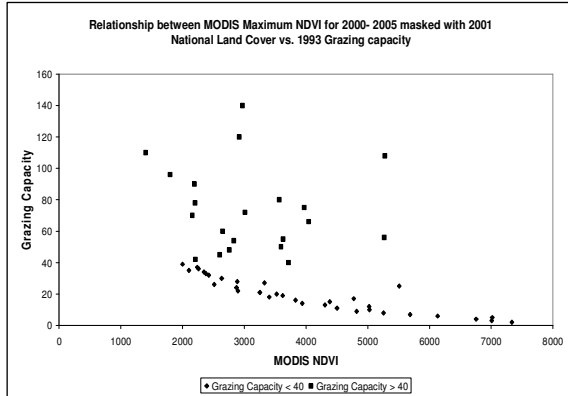


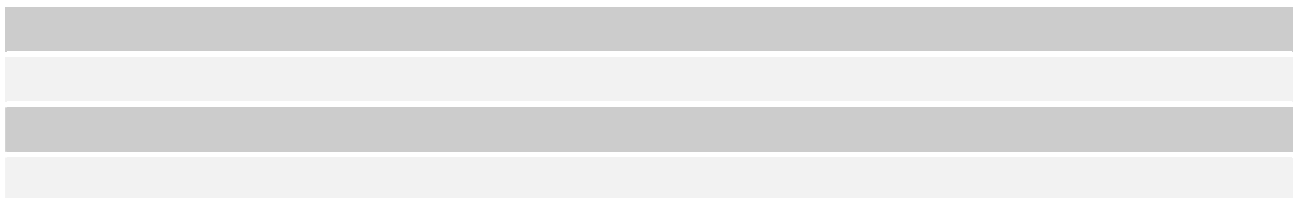
Figure 1: Relationship between average NDVI and 1993 Grazing Capacity Norm (left) and Map of areas of fit and non-fit when NDVI is correlated with the 1993 Grazing Capacity Norms (right)

References

Morgenthal TL, Newby T, Smith HJC, Pretorius DJ. 2004. Developing and refinement of a grazing capacity map for South Africa using NOAA (AVHRR) satellite derived data. Report GW/A/2004/66. ARC-ISCW, Pretoria.

Morgenthal TL, Malherbe J, Van Zyl D, Newby TS, 2007. Evaluation of MODIS satellite data as an assessment tool to audit the state of agricultural resources. Report GW/A/2006/72. ARC-ISCW, Pretoria.

Keywords: grazing capacity; MODIS NDVI; forage palatability; tree cover; regression model



PLATFORM PRESENTATION: QUANTIFYING EVAPORATION AND BIOMASS OF KIKUYU AND RYEGRASS PASTURES USING REMOTE SENSING TECHNOLOGIES

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¹University of KwaZulu-Natal, School of Bioresources Engineering and Environmental Hydrology, Pietermaritzburg, email: eversonc@ukzn.ac.za, jarmainc@ukzn.ac.za, ²South African Sugar Association, Mount Edgecombe

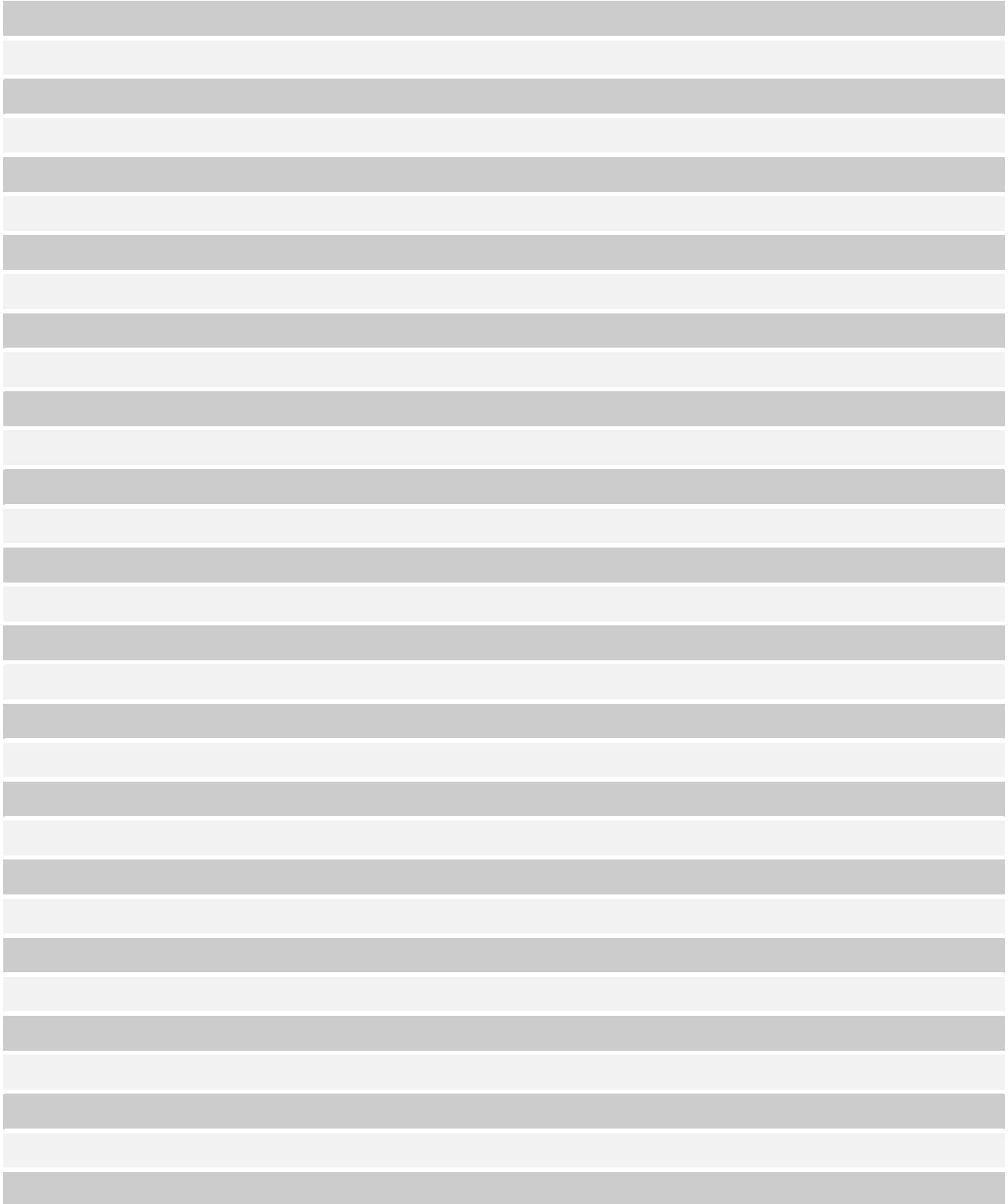
Remote sensing techniques can provide information on a variety of water resources and land-use issues. The remotely sensed estimation of evaporation and biomass at field scale offers the opportunity for irrigation scheduling and biomass prediction in near real time in irrigated pastures. Better managed irrigated pastures will ultimately result in savings in both water and energy while simultaneously reducing the leaching of nutrients (especially nitrogen) and input costs (fertilisers).

Kikuyu (*Pennisetum clandestinum*) is the most commonly used irrigated pasture species for summer and autumn milk production in the Eastern Cape region of South Africa. Botha *et al.*, (2008) published the results of trial studies and pasture measurements undertaken on the Outeniqua Research Farm near George (33° 58' 38" S and 22° 25' 16" E) in the Western Cape and we therefore selected this site for remote sensing studies using SEBAL modelling. The aim was to evaluate the suitability of using remote sensing technologies to improve the spatial monitoring of pastures including estimates of evaporation and biomass.



Estimates of daily evaporation and total biomass simulated by the model during winter and summer showed consistently lower mean winter values when compared to summer results, with a mean daily evaporation during winter of $2.04 \pm 0.07 \text{ mm.d}^{-1}$ compared to summer mean values of $6.79 \pm 2.13 \text{ mm.d}^{-1}$. Mean daily biomass during winter was $148.64 \pm 9.15 \text{ kg.ha}^{-1}$ compared to summer mean values of $472.07 \pm 69.13 \text{ kg.ha}^{-1}$. Results from the pasture trial studies undertaken by Botha *et al.*, (2008) showed that the growth rate of kikuyu during winter (July 2000) was $\leq 10 \text{ kg.DM.ha}^{-1}.\text{d}^{-1}$ which was over-sown with ryegrass. We conclude that the surface energy balance modelling provides good estimates of evaporation but the biomass models are currently too high and require further investigation.

Keywords: evaporation; biomass; kikuyu; ryegrass; SEBAL; remote sensing





Rangelands – Both Sides of the Coin

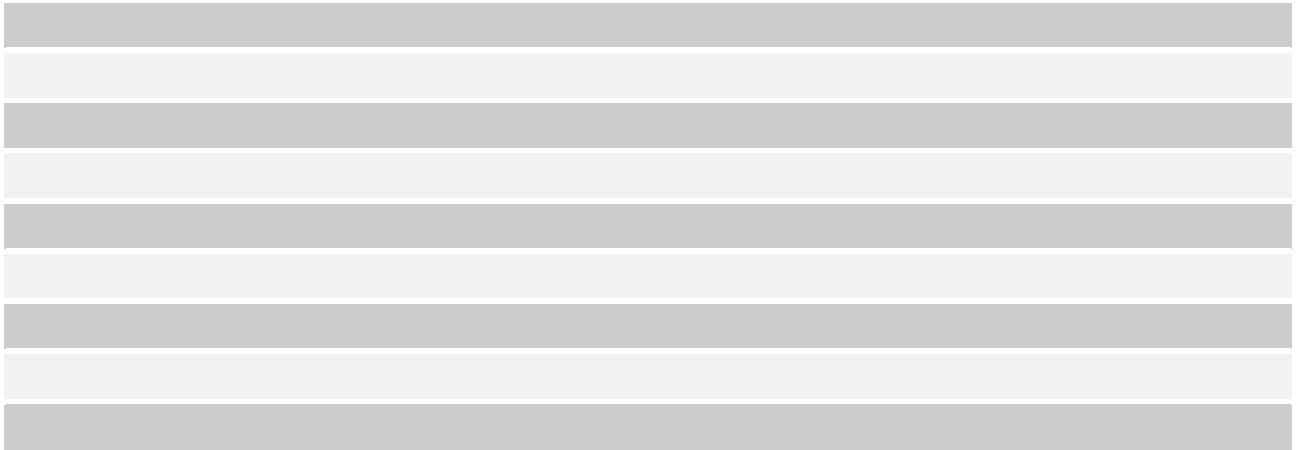
SESSION CHAIR: LORAINÉ VAN DEN BERG

Wednesday 13 July 2011, 10:30 – 12:30

KEYNOTE ADDRESS: TO BE CONFIRMED

Mike Norton-Griffiths

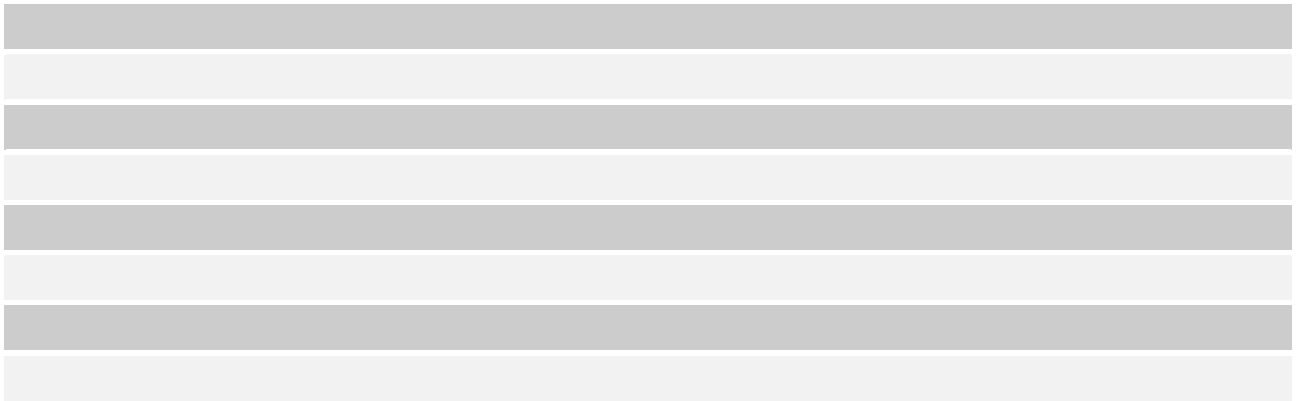
PO Box 15227, Langata, 00509, Kenya, email: mng5939@gmail.com



PLATFORM PRESENTATION: LAND REFORM - LESSONS FROM THE PAST

Gerdie Landman

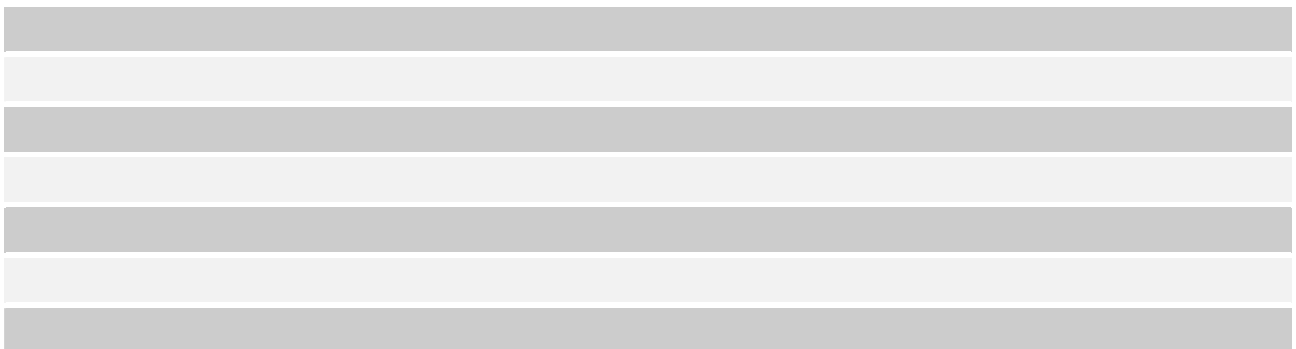
Mooimelk Koeihotel, Cookhouse, email: gerdie@koeihotel.co.za



PLATFORM PRESENTATION: LAND REFORM – A SUCCESS STORY

Trevor Elliott

Grasslands Agriculture, Tsitsikamma, email: trevor@grasslands.co.za

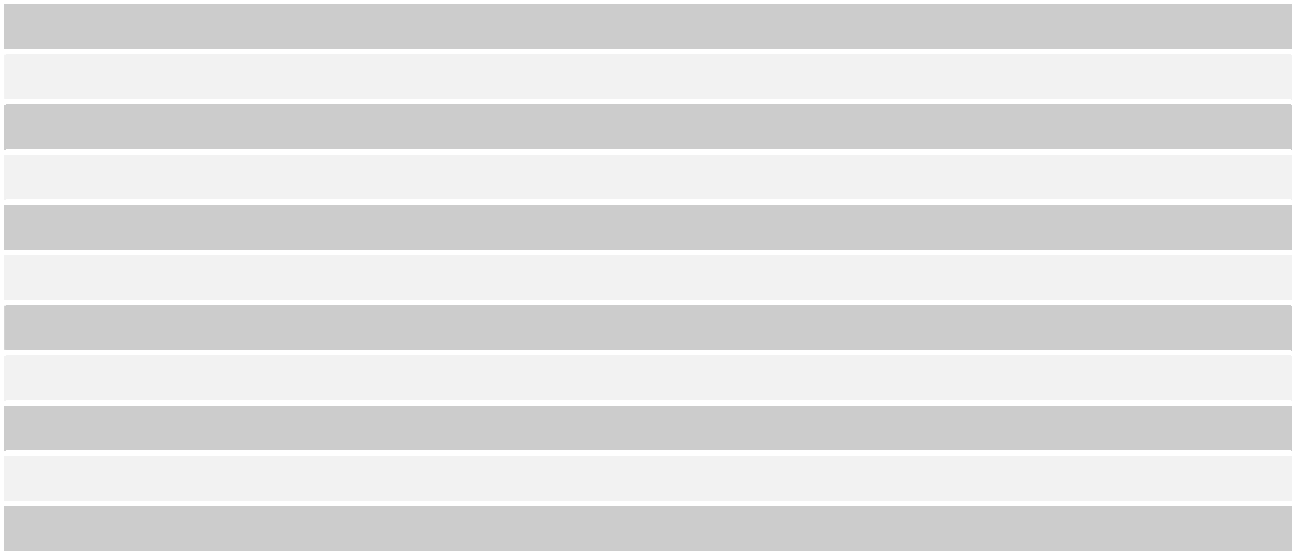




PLATFORM PRESENTATION: GRAZING MANAGEMENT PERSPECTIVES FROM A FARMER

Chris Hobson

Roodeburg, Graaff-Reinet, email: hobson@intekom.co.za



PLATFORM PRESENTATION: BLAZING AND HIGH INTENSITY GRAZING IN SOUTHERN AFRICAN SAVANNAS - MORTAL ENEMIES OR INSEPARABLE WORKMATES?

Mike J S Peel¹, Winston S W Trollope², Allan Savory³ and Pete J K Zacharias⁴*

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Two field days held in the eastern Lowveld sparked enthusiastic debate as to the question of the use of fire and/or high intensity planned grazing as management tools in southern African savannas. Two schools of thought were presented:

- 1) Three things lead to desertification, these being too few animals overgrazing plants, over resting the land and/or fire (Savory); and
- 2) Fire is critical in herbivore management and is necessary for ecological well-being of biotic/abiotic components of savanna ecosystems (Trollope).

What works best – fire or animals or both? Savory contends that a brown revolution is needed stating that modern soil conservation techniques are failing and that despite de-stocking of livestock millions of hectares of rangeland are turning into deserts. He further states that fire is damaging, emitting pollutants and exposing soil, and that desertification can be reversed using cattle. Landscape Function Analysis was used to compare two areas in Zimbabwe, one practicing high intensity planned grazing and a neighbouring communal rangeland with no fixed grazing plan. Preliminary results indicate significantly higher soil stability ($P < 0.0126$), infiltration ($P < 0.0328$), and nutrient cycling ($P < 0.003$) in the area of planned high intensity grazing when compared to the communal rangeland.

Results from Phinda Game Reserve in KZN South Africa show that a prescribed burning regime based on veld condition has improved these rangelands by 30% in terms of the grazing capacity and dominance of productive and palatable grass species for utilization by wild ungulate species.

Both of these approaches yield positive results and yet we sit in different camps. Is the fundamental problem that human decision making is based on setting objectives to reach a multitude of 'linear' goals that are suitable for technological situations but not for natural systems where we deal with very complex systems? By thinking in a new way will we not be more likely to come up with the appropriate management strategies for different situations?

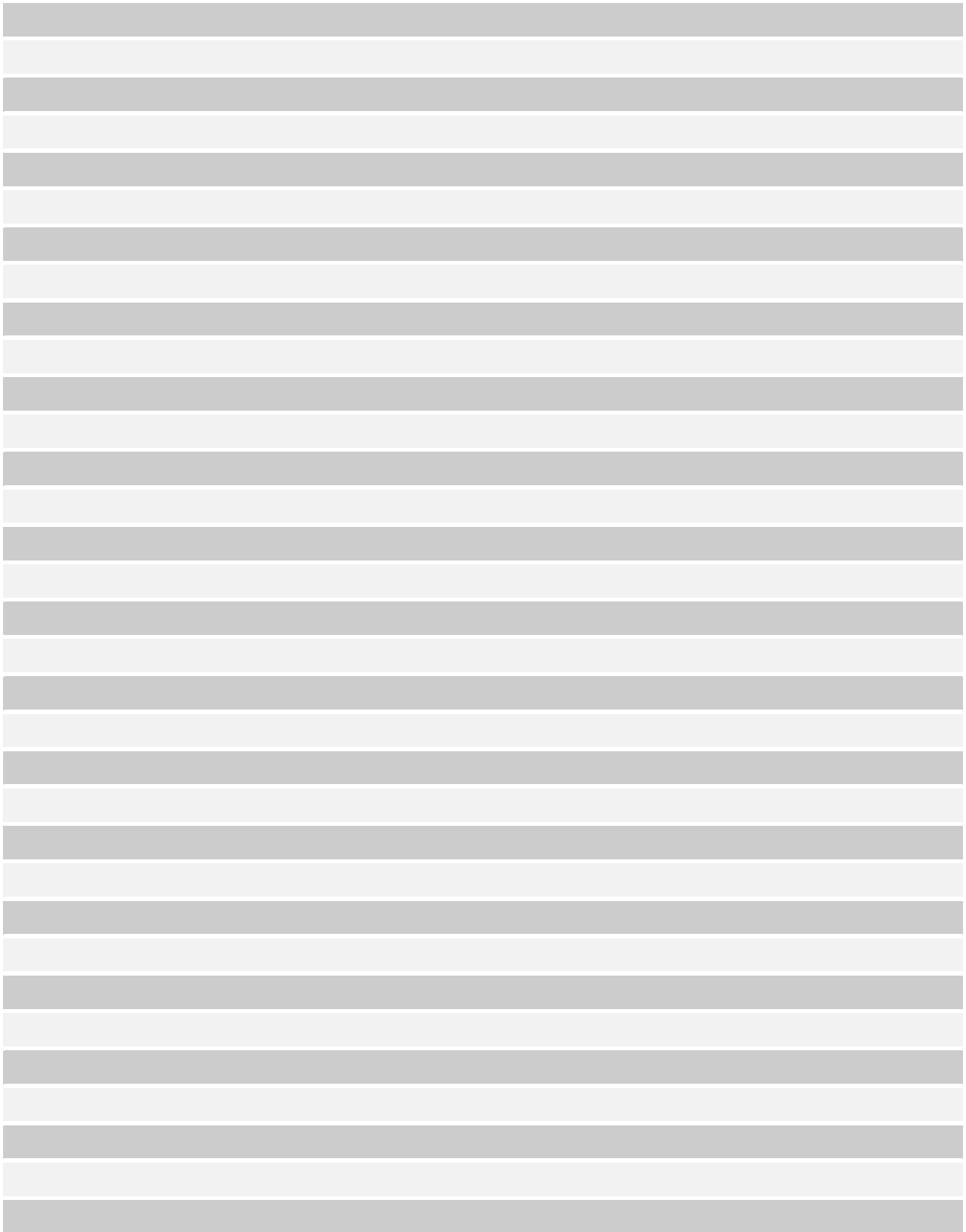
Keywords: fire; high intensity planned grazing; soil conservation; Landscape Function Analysis; communal areas; rangeland



PLATFORM PRESENTATION: RESEARCH AND EXTENSION – WHAT DO FARMERS NEED?

Willem Looek

Platberg, Middelburg





Past and Future Trends in Vegetation Change

SESSION CHAIR: SUE VAN RENSBURG

Wednesday 13 July 2011, 13:30 – 14:30

POSTER PRESENTATION: DEGRADED VEGETATION IN BETHLEHEM, SOUTH AFRICA - A REVISIT AFTER FOUR DECADES

Mamokete N V Dingaan^{1}, Sue Walker¹, Mitsuru Tsubo² and Terence S Newby³*

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In South Africa, the demand for animal production is rising together with population growth, so overgrazed areas of grasslands could be increasing. The present study aimed to evaluate the change in plant diversity due to overgrazing and the effect of grazing pressure on vegetation.

We visited three sites of the study area examined by Scheepers (1975: The Plant Ecology of the Kroonstad and Bethlehem Areas of the Highveld Agricultural Region, DSc thesis, University of Pretoria) in Bethlehem, eastern Free State in early December 2010. The sites are currently distinguished with high, medium and low grazing pressure (HG, MG and LG, respectively), i.e., HG in a communal land, MG in a 1-week grazing and 3-week non-grazing private farm land, and LG in a little-grazed private farm land, respectively. We surveyed vegetation following the Braun-Blanquet phytosociological method and measured aboveground biomass separating green alive part from the whole. We further measured reflectance of spectral irradiance of plant canopies using a spectroradiometer to calculate ground-based Normalized Difference Vegetation Index (NDVI) defined as $(IR-R)/(IR+R)$ where IR and R are reflectance of infrared and red irradiance, respectively.

The species richness recorded in Scheepers' survey, which was carried out in February and March 1969, is on average 24.5, 11.5 and 29.0, respectively, at the revisit sites of HG, MG and LG, which had been identified in December 2010. Compared with the Scheepers survey, the species richness was low in our survey (Table 1). The ratio of species richness in 2010 to that in 1969 was lower at the HG site (0.33) than the MG site (0.46) and the LG site (0.47). Both total biomass and green biomass is negatively associated with grazing pressure (Table 1). The proportion of the green biomass was low at the HG site (23% of the total biomass) and the MG site (33%), compared with the LG site (39%). This was confirmed with the result of NDVI; the ground-based NDVI was observed to be lower at the HG and MG sites than the LG site (Table 1).

The results show that plant diversity has decreased in the study area, particularly the HG site, after four decades. The HG site was originally fenced in so as to be well managed but this is no longer the case. The decrease in the species richness at the HG site indicates that communal use of grazing land degrades vegetation (well known as the Tragedy of the Commons). Compared with the LG site, the green part of the biomass at the HG site is quite low so that fresh forage available to livestock is limited. Grassland vegetation degraded by overgrazing therefore results in reduced carrying capacity of livestock. In such degraded vegetation, the stocking rate should be controlled for sustainable grazing capacity.

**Table 1:** Species richness, aboveground biomass and NDVI at three sites with different grazing pressure in Bethlehem in early December 2010 (Note: Different letters indicate significant difference at $p = 0.05$ (Tukey HSD test))

Grazing pressure	High	Medium	Low
Location	28°09'12"S, 28°20'54"E	28°00'34"S, 28°25'57"E	28°05'34"S, 28°13'25"E
Species richness	8.0 ± 1.0 ab	5.3 ± 2.1 a	13.7 ± 3.2 b
Total biomass (g/m ²)	364.8 ± 204.5 a	588.0 ± 87.0 a	767.0 ± 141.1 b
Green biomass (g/m ²)	84.4 ± 47.3 a	194.9 ± 45.4 a	295.7 ± 54.4 b
Ground-based NDVI	0.366 ± 0.040 a	0.407 ± 0.026 a	0.556 ± 0.075 b

Keywords: plant diversity; grazing pressure; Scheepers; species richness; Tragedy of the Commons; carrying capacity

PLATFORM PRESENTATION: THE EXTENT AND RATE OF VEGETATION CHANGE IN SOUTHERN AFRICA'S RANGELANDS OVER THE LAST 100 YEARS: USING HISTORICAL TRAJECTORIES TO INFORM FUTURE PROJECTIONS

M Timm Hoffman, Rick F Rohde, Mmoto L Masubelele and James R Puttick*

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Southern Africa's rangelands have changed substantially over the last 100 years in response to land use and climate drivers and are projected to change significantly in the future. However, there is very little documented evidence of the extent and rate of these changes against which future responses can be assessed. Some researchers describe a collapse in productivity of southern African rangelands while others suggest that their agricultural and ecological health has improved significantly in recent decades. Furthermore, 21st century climate change projections, which are based largely on species or biome distribution models, portray a gloomy future of biome contraction and no-analogue vegetation for most rangelands in the region. This synthesis will draw on evidence primarily from repeat photography to document the extent and rate of vegetation change along a 1,500 km aridity gradient from the Namib Desert and Succulent Karoo biomes in the west to the Grassland and Savanna biomes in the east. More than 650 sites, primarily in South Africa and Namibia have been located and re-photographed and the major changes in vegetation have been described. Results show firstly that the western, arid part of the sub-continent has been relatively stable over most of the 20th century. In semi-arid Namaqualand, however, there have been more substantial changes which can be explained largely by changes in land use. In particular, the collapse of a subsistence economy, under both private and communal land tenure regimes, which in the past was associated with high stocking rates and extensive cultivation, has meant that vegetation cover has increased over much of Namaqualand. Significant structural changes in riparian areas are also evident in the region with *Acacia karroo* and several alien tree species increasing significantly in ephemeral streams. Towards the eastern part of the country grass cover has generally increased in response to lower stocking rates, rotational grazing systems and earlier summer rains particularly within the semi-arid ecotone between the Nama-karoo and Grassland biomes. Tall shrubs have also increased substantially over the last 50 years in this region, particularly on rocky slopes while tree cover has increased along river courses. In the Savanna biome there has been a substantial increase in woody cover at both the arid and mesic end of the gradient. Evidence suggests that while land use has an important effect on the rate of encroachment, other factors such as CO₂ enrichment are also important. Social changes such as rapid urbanization as well as rural development initiatives have also had a significant impact on rangelands in the east. Historical trajectories of change along regional gradients provide a benchmark against which future changes can be assessed. Far



greater appreciation of the extent and rate of change over the last 100 years is needed in order to plan appropriately for the future.

Keywords: vegetation change; rangelands; repeat photography; *Acacia karroo*; CO₂ enrichment; rural development

PLATFORM PRESENTATION: ARE THERE REGIME SHIFTS IN GRASSLAND PLANT COMMUNITIES OF THE EAST COAST HINTERLAND?

Rob C Scott-Shaw

Ezemvelo KZN Wildlife, Biodiversity Research and Planning Division, Pietermaritzburg, email: robss@kznwildlife.com

The aim of this study is to provide insights into the ecological integrity of grasslands that have been subjected to heavy selective grazing regimes. Sampling was restricted to virgin grassland in the adjacent and endangered vegetation types Midlands Mistbelt Grassland and KwaZulu-Natal Sandstone Sourveld. 162 sites were sampled from Nkandla in the north to Flagstaff (Eastern Cape) in the south. Plots were selected that were comparable based on attributes such as soil type, soil depth, slope and fire frequency. A wide range of grazing pressures is represented. Plant diversity (Shannon Weiner Diversity Index) of each site was calculated. This was converted to an inverse percentage scale to provide a depletion score or a percentage diversity loss. Recently derived data on the ecological grazing response groups and flowering phenology of approximately 100 forbs were used. Plots were grouped into four classes of percentage diversity loss: Class 1 = 0–24%; Class 2 = 25–49%; Class 3 = 50–74%; Class 4 = 75–100%. The grass composition was analyzed separately using 200 point veld condition assessment data. Class 1 and Class 4 were compared.

The 99 forbs were classified into five ecological grazing response types: Low Grazing Intolerant; Inter-mediate; High Grazing Intolerant; Grazing Generalist; Grazing Increaser. In the Class 1 community the species were represented as 33; 34; 17; 12; 0 respectively whereas in Class 4 the trend was the opposite with a loss of Low Grazing Intolerant and Intermediate species and a gain in Grazing Generalist and Grazing Increaser species (0; 0; 6; 56 and 38 respectively.) In Class 1 total species richness is 304, density is 8219 and the number of pollination guilds exceeds 64 compared to 47; 742 and 7 in Class 4.

The flowering phenology of the classes differed in that Class 1 has a strong spring flowering guild with multiple short flowering events in spring, and winter, summer and autumn guilds are well represented. Class 4 has no spring flush; species are mostly summer flowering and non-seasonal with no winter and autumn flowering species.

The grasses showed similar trends: Class 1 community has 4 key Decreaser species and 4 key Increaser I species. The proportions of the species composition in groups Increaser I : Decreaser : Increaser II and III are 19 : 51 : 20. None of the above species persist in Class 4 and they are entirely replaced by six encroaching Increaser II and Increaser III species which do not naturally occur in this plant community. The proportions of the species composition in groups Increaser I : Decreaser : Increaser II and III are 1 : 1 : 87.

Most of the forb species in the Class 4 plant community flower over long periods and across seasons. They are competing with the grasses which dominate during the summer and autumn so weakening their ability to attract pollinators and dispersers. The grasses have switched from a Decreaser and Increaser I guild to an Increaser II and III guild with super-dominance of usually two encroaching species *Aristida junciformis* and *Paspalum scrobiculatum*. Class 4 community has undergone a regime shift.

Keywords: ecological integrity; grazing pressures; Shannon Weiner Diversity Index; phenology



Piospheres as Indicators of Rangeland Condition

SESSION CHAIR: MICHELLE J TEDDER

Wednesday 13 July 2011, 08:30 – 9:50

PLATFORM PRESENTATION: PRELIMINARY INVESTIGATION ON PIOSPHERE FORMATION AROUND DIP-TANK AREAS IN THE SEMI-ARID COMMUNAL GRAZING LANDS OF SWAZILAND - GRASS SPECIES DISTRIBUTION, SOIL NUTRIENTS AND RANGE CONDITION ASSESSMENT

Solomon B Tefera^{1*} and M W Mabuza²

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In the communal areas of Swaziland, ticks are controlled chemically through a compulsory programme of dipping cattle and by livestock movement controls. The dip-tank sites can have significant ecological effects in their surrounding ecosystems. The objectives of this study were to investigate the ecological effect of dip-tanks on the surrounding grass and soil layer as well as on the condition of the rangelands in the communal grazing areas of Swaziland. Dip-tank sites were selected from the Lowveld (LV – three sites) and lower Middleveld (LMV – two sites) ecological zones. At each dip-tank site, a 1000m transect was established and divided into five sub-transects at 100m, 300m, 500m, 700m, and 900m away from the dip-tank points to record vegetation and soil data. For range condition assessment, an approach that integrated data from soil and herbaceous, woody plants was followed. A total of 20 grass species were identified in both study areas. In the LV area, notable piosphere formation includes greater frequencies ($P < 0.05$) of *Brachiaria deflexa*, *Bothriochloa radicans* and *Sporobolus africanus* in the most distant sites, and *Cynodon dactylon* and *Eleusine coracana* in the sites nearest to the dip-tank. In the LMV area, *B. deflexa*, *C. dactylon* and *E. coracana* responded significantly ($P < 0.05$) to the piosphere, generally increasing with proximity to dip-tank points, while *B. radicans* and *Urochloa mosambicensis* responded conversely. Generally, in both ecological zones, highly and moderately palatable species groups formed the piosphere with a general decreasing trend in moving away from the dip-tank. Most soil nutrients, except P and N, did not respond significantly to the piosphere. This study concluded that not all grass species and soil variables formed piosphere in response to grazing disturbance. Those variables that responded could serve as key indicators of degradation in range monitoring. Lower values ($P < 0.05$) of grass composition and basal cover scores, and higher values of grazing capacity were displayed closer to the dip-tank areas of both ecological zones. Generally, seedling density and age distribution were rated poor to good condition. The density of woody plants was rated low to moderate, while the woody plant canopy cover was rated moderate to extremely high condition in the two study areas. Soil erosion varied between low to high levels. In both ecological zones, the overall rangeland in the near or middle sites was in fair condition, that is, in the transitional state. This trend may shift to poor condition and show expansion to the farther sites if it is not reversed. Management to remedy the lowering of condition of the rangelands should first consider the vicinity of the dip-tank points as vulnerable areas, and placement of structures that aggravate the degradation should be avoided. Future management should also consider adherence to the rotation of the dip-tank points rather than using a fixed dip-tank point. The current study also recommended that if restoration of the rangelands is intended, this should focus primarily within a radius of 300 m from the dip-tanks.

Keywords: basal cover; Lowveld; Middleveld; palatability; rangeland; woody plants



PLATFORM PRESENTATION: IMPACTS OF LARGE HERBIVORES ON VEGETATION STRUCTURE, COMPOSITION AND DIVERSITY AROUND WATER POINTS IN WATERBERG PLATEAU PARK, CENTRAL NAMIBIA

Wellencia C Mukaru^{1} and Isaac Mapaure^{1, 2}*

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Provision of artificial water points to large herbivores without proper management may lead to range deterioration and degradation, especially in semi-arid and arid ecosystems. This is a cause for concern in both protected and private lands in Namibia and elsewhere. This study investigated the impact of large herbivores on vegetation structure, composition and diversity around water points in the Waterberg Plateau Park (WPP). Five artificial water points were selected for the study. Four line-transects radiating from each water point were surveyed. Along each transect, trees and soils were assessed in five 20m x 20m plots demarcated at 0m, 100m, 200m, 300m and 500m from the water points. Grasses and forbs were inventoried in 1m x 1m plots while shrubs and saplings were assessed in 5m x 5m plots, the smaller plots being nested in the larger ones. All trees, shrubs and saplings were identified and their heights measured. Basal circumferences of trees were also measured and total woody cover was estimated using the line-intercept method. Forbs and grasses were identified and their total cover was visually estimated. Densities, basal areas, Shannon-Wiener diversity indices and species richness were calculated for each plot and statistically compared along the distance gradient. Hierarchical Cluster Analysis (HCA) was used to test for differences in species composition using binary data while Detrended Correspondence Analysis (DCA) and Canonical Correspondence Analysis (CCA) were used to explore gradients in vegetation data. As expected, plant densities, vegetation cover, basal areas, species diversity and species richness were significantly lower closer to water points than further away. This was a result of high degradation by large herbivores through trampling, browsing and grazing around water points. Woody height class and basal area frequency distribution patterns depicted higher than expected proportions of shorter woody plants, a pattern attributable not only to herbivore impacts but also to the effects of fires that occasionally occur in the area. HCA classified the vegetation plots into 10 main clusters while DCA indicated a complex interaction of gradients which influenced the patterns in species composition. CCA confirmed the degradation gradient and further indicated that soil phosphorus, CEC and clay also accounted for significant variations in species composition. Phosphorus has been introduced into the soils near water points by large herbivores through dung and urine. It was concluded that trampling and over-utilization of vegetation by large herbivores significantly degraded rangelands and negatively influenced vegetation structure, composition and diversity around water points in the WPP but the overall patterns are a result of a more complex interplay of factors than just herbivore impacts. We recommend a well-planned and systematic system of strategically closing and opening water points in order to spread out impacts and allow vegetation recovery and ecosystem heterogeneity.

Keywords: artificial water points; vegetation structure; Waterberg Plateau Park; Hierarchical Cluster Analysis; Detrended Correspondence Analysis; Canonical Correspondence Analysis; species richness

PLATFORM PRESENTATION: CHANGES IN VEGETATION COMPOSITION, RICHNESS AND DIVERSITY MEDIATED BY LARGE HERBIVORES ALONG A DISTANCE-GRADIENT AT SELECTED WATER POINTS IN ETOSHA NATIONAL PARK, NAMIBIA

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Chronic water shortage is a major challenge in semi-arid and arid rangelands which forces ranch and park managers to construct supplementary water points for their animals. This practice leads to prolonged animal occupancy around water points resulting in rangeland degradation and loss of biodiversity. In Etosha National Park, animal numbers have steadily been



increasing and their impacts around water points seem to have correspondingly risen. This research was carried out to determine the extent to which large herbivores have impacted on floristic composition, richness and diversity around water points by comparing 3 functional ('wet') water points with 3 'dry' water points that were closed more than 20 years ago. Vegetation inventories were done in plots demarcated at 50m, 100m, 200m, 400m, 800m and 1600m along four transects radiating from each water point. Two-way ANOVA was used to test for differences in species diversity and richness between wet and dry water points along the distance gradient. Hierarchical Cluster Analysis (HCA) was used to test for differences in species composition while Detrended Correspondence Analysis (DCA) and Canonical Correspondence Analysis (CCA) were used to elucidate gradients in vegetation data. Species richness did not differ significantly among distances for both wet and dry water points while species diversity did not differ among distances at dry water points. At wet water points, species diversity was significantly lower at 50m than other distances ($F = 2.48$, $p < 0.05$). HCA separated the plots into two major clusters where wet water points were largely separated from dry water points with up to 80% dissimilarity. As expected, vegetation change along the distance gradient (particularly within 400m) was evident at wet water points, confirmed by ordination analyses ($F = 1.64$, $p < 0.01$), indicating differential herbivore pressure with distance from the water point. Each major wet water point cluster comprised a number of sub-clusters, which largely conformed to the individual water points. This suggests that differences in vegetation are not only due to impacts of herbivores but also due to other determinants such as inherent differences in edaphic and topographic factors. We also hypothesize that the differences may be related to differences in herbivore functional types and their relative abundances, seasonal patterns of water point use and herbivore residence times at each water point. Vegetation close to wet water points was dominated by r-selected, weedy, invasive species such as *Tribulus terrestris* and *Datura innoxia* while such zones at dry water points were mostly dominated by sub-climax species such as *Eragrostis nindensis*. This is evidence for vegetation recovery at the latter water points. Dry water points temporarily hold water during the rainy season; hence, herbivore pressure is limited to short periods of occupancy compared to perennial water points. A system of systematically closing and opening water points in given seasons in specific areas, guided by the hypothesized factors above, should be considered to allow degraded sites to recover.

Keywords: water points; degradation; Etosha National Park; large herbivores; species diversity; distance gradient

PLATFORM PRESENTATION: HERBACEOUS SPECIES ABUNDANCE AND COMPOSITION AROUND OPERATIONAL VS. NON-OPERATIONAL WATER POINTS IN A SMALL SEMI-ARID SAVANNA GAME RESERVE

S Wilfred Seitlhamo^{1,2} and Francesca Parrini¹*

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The widespread provision of water points in protected areas in semi-arid savannas has supported associated increases in cumulative grazing pressure. This study addresses the management implications of artificial water provision which causes the development of grazing gradients of increasing herbivore impact at artificial water point sites. The aim of the study was to quantify herbaceous species composition at operating and non-operating water point sites in a 4 600 ha semi-arid savanna game reserve (Mafikeng Game Reserve in the North West Province, South Africa). To quantify the herbaceous species abundance and composition, the frequency of occurrence of species at water point sites was measured along four 100 m transects following cardinal directions (north, east, south, west) using the plot-less step-point technique for both the dry and wet seasons.



Operating water points that are situated away from the river were characterized by Increaser II species. Increaser I and Decreaser species characterized both operating and non-operating water points which are situated near the river. Species composition was influenced by environmental variables such as soil type and depth and the spatial location of water points in relation to a natural water source. The results of the study suggested changes in plant composition and soil cover that are probably related to accumulated long-term impacts around water points, with emphasis on operating water points that are situated away from the natural water source. In order to minimize degradation in the areas surrounding operating water points in the central part of the reserve, the rotational opening and closing system of water points situated away from the river should be implemented. Also, one of the non-operating water points near the natural water source should be opened in an attempt to attract animals to underutilized areas in the reserve.

Keywords: water points; species composition; soil factors; game reserve





Strategies for Animal Nutrition

SESSION CHAIR: NTUTHUKO R MKHIZE

Wednesday 13 July 2011, 13:30 – 14:30

PLATFORM PRESENTATION: GROWTH PERFORMANCE OF GROWING PIGS FED A CONCENTRATE DIET AND AD LIBITUM KIKUYU GRASS

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The current study investigated the growth performances of pigs fed concentrate together with *ad libitum* kikuyu grass (*Pennisetum clandestinum*). Twenty five Large White X Landrace pigs (27 ± 3.8 kg) were randomly assigned to five treatments (A, B, C, D and E) of five animals each and were given 100, 90, 80, 70 and 80% respectively, of a basal concentrate ration. Animals in treatment A were fed the concentrate only. Animals in treatments B, C and D were fed concentrate plus harvested *P. clandestinum ad libitum* while animals in treatment E were fed concentrate and housed outdoor in Kikuyu camps. Growth performance was assessed for the 29 day trial. Forage intake was recorded and also estimated using a pair of n-alkane markers in a 5-day collection period. The average daily gain (ADG) was similar between treatments and unrelated to concentrate and grass intake or the animals' weight.

Keywords: pig, kikuyu, growth performance

PLATFORM PRESENTATION: OVERNIGHT SUPPLEMENTARY FEEDING OF INDIGENOUS GOATS IN MOIST MIDLANDS MISTBELT OF KWAZULU-NATAL

Zandile D Ndlovu

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In communal areas, goats browse for the day and are kraaled at night without any supplementary feeding. This trial examined different supplements available to communal farmers to feed goats at night for improved performance; kikuyu (*Pennisetum clandestinum*) can be used as a potential pasture for supplementary feeding overnight. The trial was conducted on Cedara, in the Midlands Mistbelt of KwaZulu-Natal from November 2009 to March 2011.

The veld condition was assessed using the standard step-point method. The veld was divided into two transects. The first camp was 2.5ha, with a grazing capacity of 11.78ha/AU for domesticated animals over 250 days. The dominant species was *Aristida junciformis* at 44%. The second camp was 3.4ha with a grazing capacity of 4.48ha/AU. The average grazing capacity was 8.13ha/AU.

The trial consisted of four treatments and replicated twice. Each treatment was stocked with five goats with six kids i.e. both singles and twins. The mean weight of the does at the start of the trial was 42.5 kg. All goats grazed together on the veld from approx. 08:00-15:00 and were kraaled at night. The treatments were (1) 400g of semi-complete feed goat pellets per goat daily (2) 25kg of cut fresh kikuyu (3) kraaled on kikuyu pasture at a stocking density 42goats.ha⁻¹ (4) Control: goats kraaled in handling facilities with no supplement. All goats were watered and treated according to standard animal science and veterinary recommendations. A mineral lick was available on the veld *ad libitum*.



ABSTRACTS: THURSDAY 14 JULY 2011

Fire Effects in Rangelands

SESSION CHAIR: WINSTON S W TROLLOPE

Thursday 14 July 2011, 08:30 – 10:00

Platform Presentations

PLATFORM PRESENTATION: FIRE IN THE TARCHONANTHUS VELD – FIRE EFFECTS ON SOILS, GRASSES, AND BUSH CLUMPS

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The Tarchonanthus Veld of the Ghaap Plateau north of Kimberly, South Africa, comprises patches of bush clumps within an open semi-arid grass layer. Bush thickening is a problem in the area as it reduces the carrying capacity of the veld for grazing livestock. Fire has been used widely across southern Africa to control bush encroachment, although its efficacy in this environment has been questioned because 1) woody species here are not killed by fire, and 2) there are concerns that the grass sward and soil layer will be damaged. A high-intensity, uncontrolled fire that burned through part of the Koopmansfontein Experimental Station in September 2010 allowed us to investigate the effects of high-intensity fire on 1) soil chemical and physical properties, 2) grass sward composition, 3) colonization patterns under the canopies of bush-clumps, and 4) bush clump structure. Bush clumps were razed in the fire leaving a bare area apparently devoid of living sub-canopy species. After seven months, most woody plants in the bush clumps had coppiced. The concentration of soil cations, in general, differed between bush clumps and grassland, and between calcrete and dolerite parent materials ($P < 0.05$); burning had no effect except on Potassium levels which were slightly higher on burned areas ($P < 0.01$). This general trend was similar for pH, resistance, carbon, and nitrogen (NH_4). Permutation ANOVA showed that soil properties differed between bush clumps and grassland and between dolerite and calcrete ($P < 0.001$), but not between burnt and unburnt areas. Within the grass layer, grass cover, species composition, and species richness were not related to fire treatment. The species composition of plant communities under burnt canopies was a subset of, and not different from, the wider variation of composition of communities under unburnt canopies. The volume and surface area of burnt bush clumps were 2.7 and 9.5% that of unburnt bush clumps, respectively. We conclude that the Tarchonanthus Veld is not fire-sensitive and even high-intensity fires do not change soil or grass sward characteristics, but do reduce the phytomass and coverage of woody species significantly; bare patches formed by the fire are colonized relatively quickly. Controlled burning programmes are therefore a tenable management option to investigate for bush control.



PLATFORM PRESENTATION: HEAD VS BACKFIRES IN THE EASTERN KALAHARI

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The impact of head fires and back burns has been investigated before and we know that the implementation of these two different fire types in a fire management plan can have very different implications over the long term. It is therefore important to understand the effects of these different fire types on the structure of the vegetation community. A back and a head fire were applied in the same area under the same conditions within a week of each other. The results were monitored at the end of the growing season and the results from the two fires were very different. With the head fire, 71% of woody individuals were either dead or had all their aboveground parts killed, compared to only 22% of woody individuals with a back fire. With the back burn, 48% of individuals had more than three-quarters of their aboveground material still alive, compared to only 6% observed with the head fire. As to be expected from these results, the reactions of the plants were therefore very different. After the head fire 64% of woody individuals coppiced from the base only, with sprouting from the stem, primary and secondary branches making up the difference. With the back burn it was seen that 33% of sprouting was from the primary and secondary branches while coppicing from the base only was seen in 23% of individuals.

Height of the plants played a very definite role in how the trees survived. With the head fire, 100% of trees smaller than 1m and 94% of trees smaller than 2m had all their aboveground parts killed, while none were completely killed and all coppiced from the base. Deaths only occurred in trees larger than 2m, with the majority of deaths in the 4-5m height class. With the back burn, the only deaths were in the 0-1m size class, even though only 59% of trees in this size class had all their aboveground parts killed. More than 90% in each of the 3-4m, 4-5m and 5m+ size classes had more than 75% of their aboveground parts still alive. The effect of the different fire types and how they affect the structure of the vegetation community is very clear, and depending on the objectives, must be considered when controlled fires are implemented.

Keywords: head fires; back burns; fire management plan; plant height

PLATFORM PRESENTATION: LONG-TERM EFFECTS OF BURNING FREQUENCY ON HERBACEOUS SPECIES COMPOSITION IN THE FALSE THORVELD OF THE EASTERN CAPE, SOUTH AFRICA

Keletso Mopipi¹, Kevin P Kirkman² and Craig D Morris³

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The long-term effects of fire frequency on herbaceous species composition was examined from a trial at the University of Fort Hare research farm which is located in Alice (32° 47' S; 27° 01' E). The trial was established in 1980 on 100m x 50m plots, and treatments comprise annual, biennial, triennial, quadrennial and sexennial early spring burns and a no burn control. The plots are arranged in a Completely Randomized Design with two replications per treatment. Species composition was determined each year before burning using the nearest species method, and the data collected for herbaceous species between 1980 and 2008 was used in this study. A total of 20 grass species, several forbs and karroid species were recorded. Nonmetric Multidimensional Scaling and the Bray-Curtis Dissimilarity tests were used to test compositional variation between burning treatments over time using CANOCO 4.5. There was a highly significant dissimilarity in species abundances between 1980 and 2008 (P<0.01) and the species abundances were also significantly influenced by burning frequency (P<0.05), while their interaction was not significant (P>0.05). In general, compositional change increased with fire frequency. Frequent burning (annual and biennial burns) resulted in a less variable species composition, and the dominance of fire-tolerant herbaceous species, primarily *Themeda triandra*, but reduced or eliminated fire-



intolerant species. The sexennial and no burn treatments promoted the abundance of fire-intolerant species such as *Melica decumbens*+. The triennial and quadrennial burns exhibited the highest compositional variation, with the co-dominance of both fire tolerant and fire-intolerant species. These appear to be the most suitable burning frequencies to apply in the False Thornveld of the Eastern Cape.

Keywords: fire frequency; False Thornveld of the Eastern Cape; species composition; Nonmetric Multidimensional Scaling; Bray-Curtis Dissimilarity

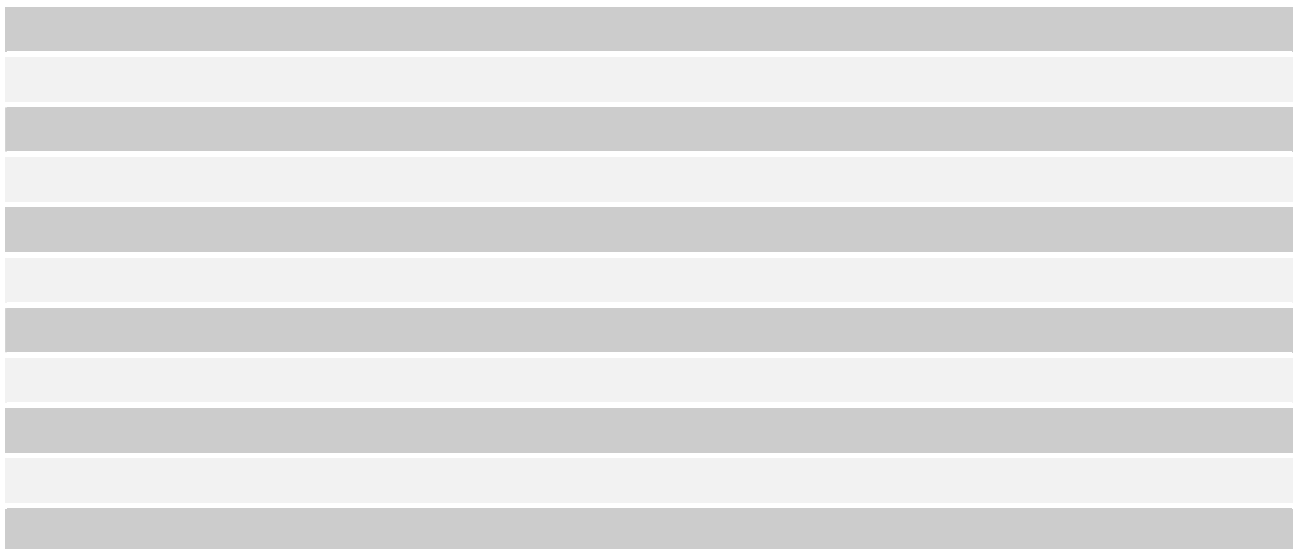
PLATFORM PRESENTATION: INVESTIGATING LONG-TERM EFFECTS OF SEASON OF BURN ON SPECIES COMPOSITION, BASAL COVER AND PLANT DENSITY IN THE DÖHNE SOURVELD OF THE EASTERN CAPE, SOUTH AFRICA

Zamukulunga Ndovela^{1*} and Keletso Mopipi²

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A study was conducted in the long-term fire trial at Döhne Agricultural Institute of Development in 2010 to investigate the effects of season of burning on species composition, plant density and basal cover. The trial was set up in 1988 and treatments comprise July, August, September, October and November burns applied between 15 July and 15 November. Each treatment is replicated 3 times in Randomised Block Design. Species composition was determined by a wheel point apparatus whereby 150 points per plot were identified and recorded. The basal cover was determined using the same apparatus for species composition, where 10 points per plot were recorded using fingers to estimate the distance to the nearest herbaceous plant. Plant density was determined by placing 1m² quadrats randomly in each plot and counting all rooted plants enclosed. A two-way ANOVA was used to test treatment effects on species relative abundances, and a one-way ANOVA was used for plant density and basal cover. LSD test was used to compare treatment means. The species relative abundances were significantly different ($P < 0.05$), but treatments did not have significant effects on the relative abundances ($P > 0.05$). There was no significant interaction between treatment and type of species ($P > 0.05$). Treatments had significant effects on plant density ($P < 0.05$), but did not significantly affect basal cover ($P > 0.05$). There were 30 plant species recorded, comprising 17 grass species, 12 forbs, 1 sedge and no bush. *Tristachya leucothrix* was the most abundant species across all treatments ($\pm 32\%$), while the least abundant were *Hibiscus aethiopicus* and *Senecio coronotus* with 0.28% abundance. *Themeda triandra* had the highest relative abundance (20.55%) in the August burning but lowest in the July treatment (12.78%). Plant densities ranged between 5000/ha (October burn) to 7500/ha (September burn), while basal cover ranged between 1.95 cm (October) to 2.96 (November). From these results, burning in the Döhne Sourveld is recommended between mid-July to mid-September when the grass is dormant so that the least damage is done to the grasses and the leaf canopy will recover in the shortest possible time after the burn.

Keywords: Döhne Sourveld; season of burning; species composition; basal cover; plant density





Natural Resource Monitoring and Management Programmes

SESSION CHAIR: WAYNE F TRUTER

Thursday, 14 July 2011, 10:00 – 10:30

Poster Presentations

POSTER PRESENTATION: CHALLENGES AND OPPORTUNITIES FOR LIVESTOCK-ENVIRONMENT AND FEED OPTIONS IN DEVELOPING COUNTRIES

Sikhalazo Dube

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It has been claimed that livestock are a leading source of greenhouse gases, contributors to today's most serious environmental problems (LA Times 15/10/2007; Henning Steinfeld, 2009). Whilst there is an element of truth to these allegations 1.3 billion people (19% of the world and 77% of Africa) are dependent on livestock for livelihoods (energy, nutrition, organic fertilizer) and a large portion of the earth's land surface is used for livestock production (>30%). In general there has been a significant increase in the numbers of key livestock.

The key challenge is finding a balance between feeding the poor, improving livelihoods and being environmentally friendly. This challenge is further confounded by climate change, policies and management options, livestock marketing, literacy and inadequate support services. In this poster I explore these challenges from the developing nations and poor communities' angle. Climate change is seen as enhancing the erratic nature of some key drivers of forage production (e.g. rainfall and temperature), causing potential shifts in availability and quality of forage, therefore increasing scarcity of forage. This leads to increasing complexity of livestock farming (adaptability of some breeds, reduced productivity, emergence of new diseases or increased incidences of diseases). Inappropriate policies and inadequate livestock management contribute to the deterioration of grazing resources. One of the major challenges in livestock production in developing countries is marketing. This is a result of a number of reasons such as a lack of strong policies to develop and secure markets (large corporations vs smallholders), poor marketing infrastructure, poor road and communication networks, incapacity of the local markets to absorb livestock, unclear/multilayered ownership of livestock and diseases (red zones).

Low literacy levels and inadequate support services within production areas hamper productivity and management of these areas; the learned live in urban areas leaving the illiterate to look after their livestock. There is a decline in the number of students studying agriculture at all levels and a reduction in technical staff numbers to support smallholder farmers.

Despite these challenges there are opportunities for enhanced livestock productivity. The demand for livestock products exists; with appropriate policies and strategies, opportunities exist for livestock producers to cash in. The question is how are we going to feed the increased number of livestock, driven by the general increase in the demand for livestock products from the increasing urban middle class? The answer, in part, lies in our ability to develop or improve the quality of the genetics of the animals found in these environs and in the development of feeds and feeding strategies (sustainably) that will enhance productivity. To do this, scientists, in partnership with local communities (Indigenous Knowledge), will need to identify key resource areas and develop tracking strategies for use of these areas. Boundaries might have to be redefined, broader negotiations among communities on access and use of resources is needed, proper accounting of the grazing/feed resources, and mapping such resources for strategic planning and use (Spatial Sciences) is required.

Feeding strategies have been challenged by a lag in technological development which has contributed to under utilization of resources. Whilst this might be viewed as a tragedy, it provides an opportunity to engage such communities for the development of sustainable utilization strategies. Most livestock systems in developing countries are closely linked to cropping systems; opportunities, therefore, exist for development of technologies for conservation and use of some crop residues for feeding. Use of indigenous breeds of livestock which are adapted to local conditions can alleviate the need for increased feed requirements.



I therefore conclude that the livestock sector is an extremely important component of livelihoods. Concerns about climate change are prompting increased dialogue about the role and importance of livestock. This gives opportunities to develop cleaner production strategies. There is a need to train scientists, extension personnel and farmers in the livestock sector who will be able to meet challenges posed by climate change and demand for healthier/cleaner livestock products. A drive towards securing markets should be accelerated to increase off-take and improve livelihoods. Finally, and most importantly, we need to enhance the capacity of livestock keepers.

Keywords: climate change; livestock; developing countries

POSTER PRESENTATION: THE KALAHARI-NAMIB PROJECT - ENHANCING DECISION-MAKING THROUGH INTERACTIVE LEARNING AND ACTION IN THE MOLOPO-NOSSOP RIVER BASIN: A COLLABORATIVE PROJECT BETWEEN SOUTH AFRICA, NAMIBIA AND BOTSWANA

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The Molopo-Nossob region in the southern Kalahari experiences continued land degradation, loss of biodiversity and primary productivity, and ultimately a loss of ecosystem functioning. This is mainly due to inappropriate land use practices (water availability, livestock densities and related management practices), lack of knowledge, limited access to markets and inappropriate policies. The ecosystem straddles three countries, each with its own specific policies. Poverty levels vary dramatically within and between countries, affecting the ability of households to control and manage natural resources. Accordingly, land degradation has taken many forms with a variety of impacts. Local decision makers are often caught between the nexus of economic development and resource exploitation.

The Kalahari-Namib Project (KNP) focuses on the different impacts of various land use strategies as determined by country-specific policies, human and animal densities, support structures and available knowledge. This cross-boundary analysis will illustrate appropriate combinations of these factors and allow us to identify best-bet strategies and technologies.

While there is a sound understanding of the biophysical process of land degradation as well as an appreciation of the numerous technologies and improved sustainable land management (SLM) strategies, implementation and replication of these strategies is uncommon. The KNP will support communities and policy makers in Botswana, Namibia, and South Africa to effectively implement and scale up SLM in the Molopo-Nossob basin area. The project will facilitate the sharing of information and knowledge and provide support to decision makers at all levels of natural resource management, including farmers and their institutions, local and national governments, as well as regional bodies such as Southern African Development Community (SADC).

The KNP will conduct a complete baseline assessment using existing literature, local knowledge, and an analysis of the current/baseline scenario. Information requirements and gaps in order to understand capacity building and training requirements will be determined. Appropriate SLM strategies for further scaling-out activities and to establish a cross-boundary forum in order to enhance regional cooperation, decision making, and exchange of best practices will be established. Information to address mutual issues related to socio-economic development and procedures to harmonize policies will be shared.

Support from Global Environment Facility (GEF) will assist in elevating local site-specific efforts and strategies to a planned and coordinated regional approach with greater sharing of information within and across borders. Local capacities will be strengthened and partnerships fostered. Decision makers and other users of natural resources can then collectively determine



their sustainable development pathway and contribute to improving livelihoods and maintaining the integrity and functioning of the greater Kalahari-Namib ecosystem within the three countries. The implementing and executing organisations for the KNP are UNEP and IUCN respectively with in-country contributions by National and Regional Government, Academic, Scientific and Development agencies. The KNP will start in 2011 and be carried out for a period of 4 years.

Keywords: Molopo-Nossob; Kalahari-Namib Project; land use strategies; cross-boundary; sustainable land management

POSTER PRESENTATION: STEWARDSHIP FOR THE ENVIRONMENT

Bradley Gibbons^{1} and Glenn Ramke²*

Endangered Wildlife Trust, African Crane Conservation Project, ¹Middelburg, ²Wakkerstroom, email:
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South Africa has three crane species: Blue Crane *Anthropoides paradiseus*, Grey Crowned Crane *Balearica regulorum* and Wattled Crane *Bugeranus carunculatus*. The Blue and Grey Crowned Cranes are listed as vulnerable and the Wattled Crane as Critically Endangered in the Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland

The main reason for the decline of Blue Cranes has been the loss of grassland habitat although agrochemical poisoning also played a significant role in this decline in the past. Both Grey Crowned and Wattled Cranes utilise wetlands for breeding and many wetlands have been lost or degraded through the building of dams, draining or other agricultural practices such as the cultivation of lands in or near wetlands.

Around 99% of all cranes are found on privately owned farms across South Africa. It is therefore important that landowners are made aware of the status of cranes and are encouraged to conserve the birds by protecting their environment. One of the main aims of the *Endangered Wildlife Trust's African Crane Conservation Programme* is to increase awareness amongst landowners of the requirements of cranes and their habitats and to encourage them to become part of the *National Biodiversity Stewardship Programme*. By committing to the protection of the natural habitat on their farms under this programme, suitable habitat for cranes – and other wildlife – will be ensured into the future.

Bearing in mind that 80% of high value biodiversity land is in the hands of private and communal owners, Biodiversity Stewardship offers the opportunity to secure such land for the benefit of endangered species and prevent indiscriminate (unwanted) developments. Only a natural environment which has a high biodiversity value will be considered for *Nature Reserve* or *Protected Environment* status. These areas are declared under existing National Legislation, namely NEMA; PA, thus offering a high level of security for such biodiversity priority land. The declared areas then fall within Provincial and National Protected Areas Expansion strategies.

The other two categories of land stewardship, *Conservation Area* (lowest level) and *Biodiversity Agreement* do not offer as high a degree of security - the *Biodiversity Agreement* has legal status only by virtue of a legal contract between the landowner and the Agency and is binding under South African contractual law.

We aim to describe and highlight benefits of belonging to a Land Stewardship programme for both the landowners and the species which enrich our environment.

Keywords: cranes; endangered; habitat; land stewardship



POSTER PRESENTATION: LOCAL KNOWLEDGE AND PERCEPTIONS OF ASSESSMENT INDICATORS FOR A PARTICIPATORY EVALUATION OF MANAGEMENT AND RESTORATION PRACTICES TO COMBAT DESERTIFICATION IN SOUTH AFRICA

Klaus Kellner^{1*}, Taryn Kong¹, Yolandi Els² and Hendri Coetzee¹

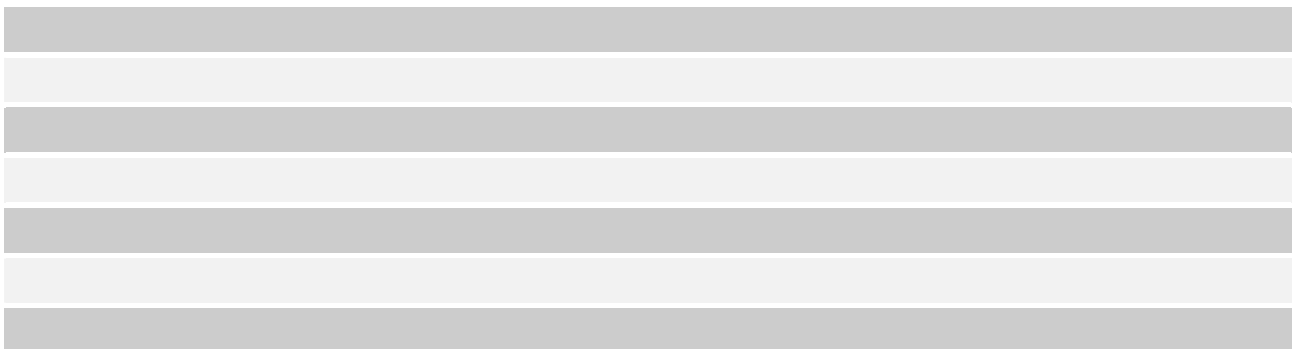
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The School of Environmental Sciences and Development at the North-West University is one of the member organisations that participate in the PRACTICE project (**P**revention and Restoration **A**ctions to **C**ombat **D**esertification. An Integrated Assessment). The project is carried out by 16 institutions in 12 countries over 5 continents worldwide. South Africa is the only country in Africa and a major partner regarding the 2 demonstration sites that are selected for this study, i.e. Molopo area of the North-West Province and the Mier area of the Kalahari in the Northern Cape Province. The project is funded by the European Commission and administered by the CEAM Foundation in Valencia, Spain and carried out over a three year period from 2009 to August 2012.

One of the major problems in the evaluation of practices to combat desertification is the lack of integration of biophysical and socio-economic data, as well as the combination of local and indigenous knowledge with scientific information. The major aims of PRACTICE therefore include the linkage of science to society and to share and transfer evaluation methods and practices between all stakeholders regarding combating of desertification and land degradation. Work package 3 entails the developing of a formative and participatory approach to understand local perceptions about the impact of land degradation and desertification, as well as any control efforts that are taking place or have been applied. Through detailed interviews and workshops with local farmers, managers, extension staff and rangeland scientists, long-term experiences and perceptions of indicators of restoration and sustainable land management (SLM) were collected and assessed. Stakeholders were subdivided into different sub-categories according to their management and land tenure strategies or other involvement, e.g. Communal, commercial (small and large), subsistent (lease), land owner, researcher, extension officer, government official, etc. A total of 29 and 46 stakeholders were interviewed in Mier and Molopo respectively. Although many indicators for assessing restoration and SLM were identified, they were combined into 11 or 12 main characteristics. These included indicators such as in Mier: *grazing capacity, animal condition, biomass production for forage, density of woody plants, water supply and reticulation, soil condition and vegetation cover by different types of vegetation (pioneer, palatable, etc), costs for labor, material and supplement feed, biodiversity and help by government (e.g. through Landcare)*. Other indicators that were identified by the stakeholders in the Molopo study site included aspects such as *control of bush and the affectivity thereof and fire with their risks*. Through a second round of interviews and workshops, the indicators were ranked and weighted according to the importance of each for the different stakeholder sub-categories. The local knowledge and perceptions of assessment indicators will later be combined with quantitative bio-physical surveys.

Through the implementation of an "Integrated Assessment Protocol" (IAPro), PRACTICE will help in building social capital. It will do this by promoting social learning in participatory assessment that will foster knowledge sharing, training and formation of networks by all countries and organisations worldwide regarding combating of land degradation, desertification and SLM practices.

Keywords: PRACTICE; desertification; land degradation; socio-economic; sustainable land management; restoration





**POSTER PRESENTATION: SOUTH AFRICAN ENVIRONMENTAL OBSERVATION NETWORK:
FINAL TWO NODES ESTABLISHED AND OPERATIONAL**

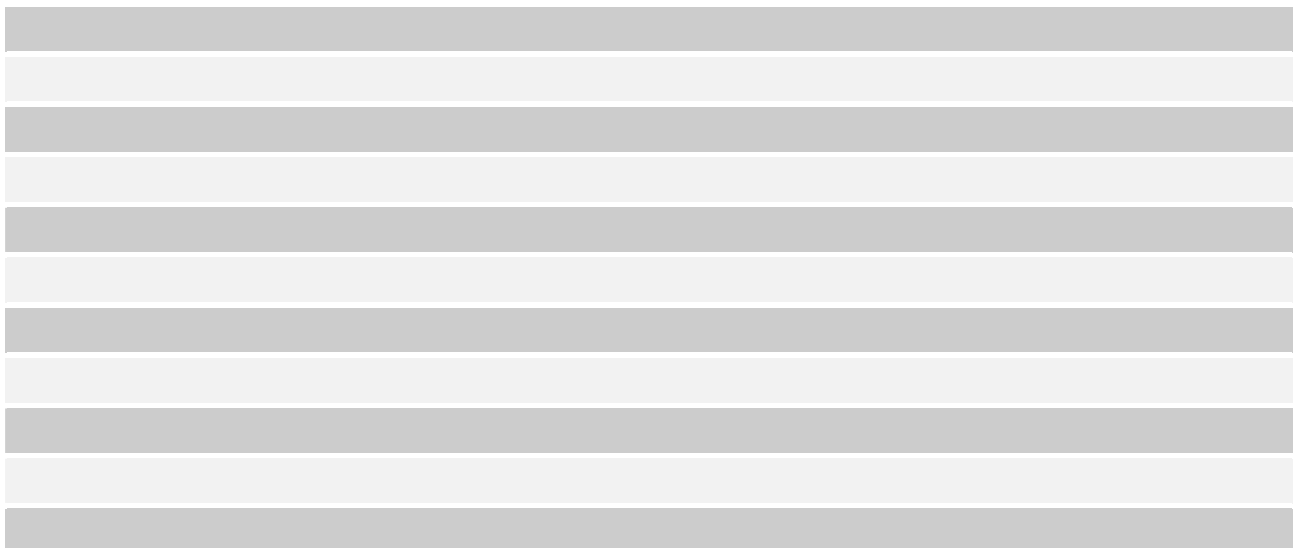
Yolandi Els^{1} and Sue van Rensburg²*

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Earth observation science is urgently required to bring more certainty about environmental change, and to enable formulation of adaptive and mitigating management policies and practices. Following a process of deliberation within the research community to react on this need, the South African Environmental Observation Network (SAEON) was established in 2002 to function as a sustained South African observation network that delivers long-term reliable data for scientific research and informs decision-making for a knowledge-based society and improved quality of life. SAEON's mandate rests upon three pillars - observation, information and education. Funded by the Department of Science and Technology and managed by the National Research Fund, SAEON's observation structure and approach has guided the implementation of SAEON nodes which serve as research and education platforms for long-term studies of ecosystems in order to answer long-term ecological questions relevant to society, particularly those exposing the effects of anthropogenic as opposed to natural change in the environment. Guided by SAEON's core science framework, its observation also strongly focuses on aspects of ecosystem functioning which benefit society. These include biodiversity, hydrology, biogeochemical cycling and production, soils and sediments, and disturbance regimes.

The nodes are designed to provide strategically placed infrastructure (staff, sites, equipment and services) for the coordination of observation and data systems that will be shared by visiting researchers and their students, both local and international. Six SAEON nodes were planned at locations selected for geographical spread. These are hosted by different organisations ensuring organisational spread as well. Considerable effort was spent on identifying potential node hosts and consulting with interested and affected organisations on the location of these nodes. The addition of the two most recently established nodes, namely the Arid Lands node and the Grasslands, Wetlands and Forests (GWF) node, has completed the full complement of planned nodes and will enable the implementation of integrated observation programmes for the main biomes or environments in the country, including the large marine systems, coastal habitats, savanna, fynbos, grassland, wetland, forest, arid ecosystems, and freshwater aquatic environments. SAEON's information management system aims to facilitate the full and open exchange of metadata, data and information products enabling SAEON to ultimately function as the coordinator of a national archive of ecosystems data. This information management system will therefore gradually overcome the inadequacies of fragmented monitoring and research. The newly established Arid Lands and GWF nodes have embarked on the formation of further strategic partnerships with relevant research institutions, thereby enabling the nodes to provide a unique framework for enhancing dialogue and working to leverage for and contribute to the development of comprehensive, coordinated and sustained observations.

Keywords: SAEON; observation science; long-term environmental data





Research Proposals

SESSION CHAIR: SIKHALAZO DUBE

Thursday 14 July 2011, 10:30 – 11:30

POSTER PRESENTATION: THE POPULATION DYNAMICS OF ACACIA NILOTICA IN NORTHERN KWAZULU-NATAL, SOUTH AFRICA

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Thickening by *Acacia nilotica* is an increasing problem experienced by many land owners within KwaZulu-Natal. This expansion is dramatically decreasing the quantity and quality of grazing land in the Province, thereby reducing grazing stocking rates and animal quality. This thickening is aggravated by interferences (natural or man-made) which cause an imbalance in the system. It is important to manage the natural system dynamics to find a solution to this bush encroachment problem. Research into the system dynamics of *A. nilotica* is needed to manage this plant effectively. This understanding will be of great benefit to many land owners within the area.

This study aims to understand aspects of the population dynamics of *A. nilotica* to assist in the more effective management of this plant. Mkuze Game Reserve has been chosen as the study area as it has a well recorded management history. These aims will be achieved through investigating the change in tree density in specific plots within Mkuze Game Reserve over a period of time, and evaluating the role of past management on the density, phytomass and population structure of established populations of *A. nilotica*. Aspects of the reproduction and recruitment biology of *A. nilotica* that may be involved in the processes of thickening of this species will also be studied. With the understanding gained a conceptual model will be developed to guide the management of this species. This poster presents an outline of this study that has recently been initiated.

Keywords: *Acacia nilotica*; expansion; population dynamics; tree thickening

POSTER PRESENTATION: PRODUCTION POTENTIAL OF PASTURES PLANTED WITH TREATED SEED ON DEGRADED AGRICULTURAL AND MINE SOILS

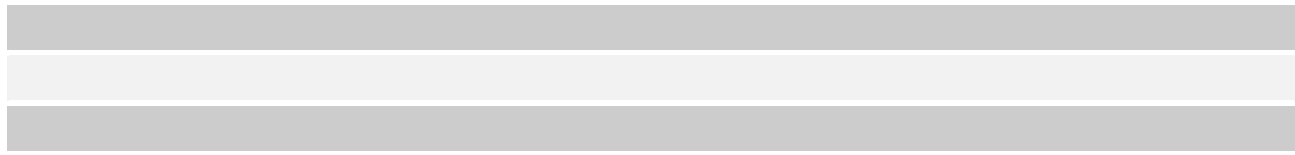
Dirk Coetzee^{1*}, Wayne F Truter¹, Leana Nel¹ and Chris S Dannhauser²

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To utilize pasture as a food source for livestock and in rehabilitation projects is common practice today. For pastures to be successfully planted, ideal conditions for establishment must be created. This can be done by ensuring good planting methods, soil conditions and the use of good quality seed. However, of these factors mentioned, good soil conditions are not always evident, and it is a challenge to cost effectively ameliorate soils properly for good pasture establishment. Recently, seed coating technologies have become available, and these seed treatments can result in an even better establishment. To date, on South Africa's very diverse soil types, many degraded soil conditions exist, and there is very little data on how seed treatments can play an important role in ensuring good establishment under these conditions. Coating or pelleting seeds can compensate for soil shortcomings. Inoculating legumes ensure good growth after establishment as well as priming and drying, are used for physiological enhancements to guarantee good viability and germination. All these seed treatments make establishing pasture possible with less effort needed. They can also possibly contribute to making it financially more favourable for the farmer and the person trying to establish pastures in soils that are being



reclaimed. This study will focus on various seed treatments of various classes of pastures, to understand the benefits of seed treatments under degraded soil conditions. The study will involve measuring parameters that determine the success of pasture establishment.



POSTER PRESENTATION: BIOCHEMICAL LINKS BETWEEN PLANTS AND LARGE HERBIVORES - CONSEQUENCES FOR BROWSE UTILIZATION AND ANIMAL PRODUCTIVITY (A PROPOSAL)

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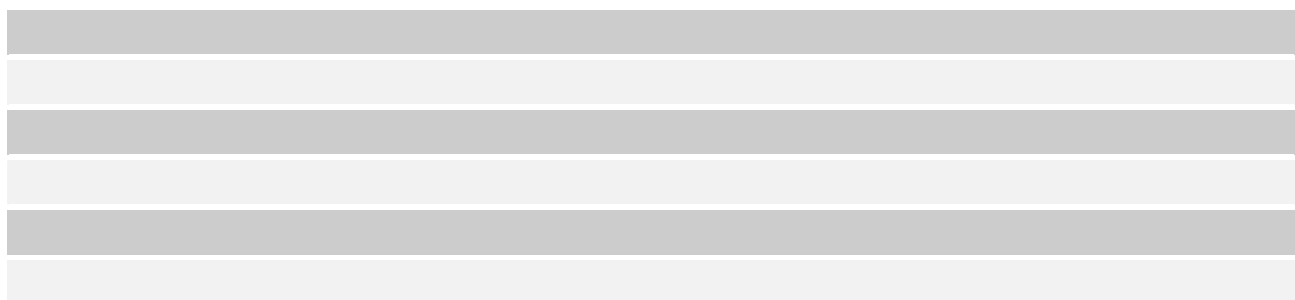
Several short-term experiments with captive animals indicate a number of effects and mechanisms through which plant secondary metabolites (PSMs) might mediate plant-herbivore interactions. For example, condensed tannins (CTs) have been reported to restrict intake/preference of individual woody plants or plant parts by herbivores. However, controlled experiments do not adequately replicate the subtle trade-offs faced by free-ranging animals which must compose nutritious diets while avoiding intoxication from PSMs. Moreover, little is known about the long-term consequences of plant chemical defences on productivity of free-ranging herbivores. This study will use free-ranging goats to investigate the seasonal effects of CTs on consumption (diet selection and intake) of woody plants and on herbivore productivity (body weight gains and blood metabolites).

Three paddocks (1ha each) will be established in Roodeplaat experimental farm, wire-fenced and surveyed to estimate vegetation (grass and woody) cover two weeks before the experiment in each of the dry and wet seasons. Each paddock will then be stocked with 12 male goats of similar age (± 1.5 years). From each paddock, 6 animals will receive daily oral doses of CT, while the other 6 will serve as controls for the duration of the experiment (i.e. 3 months per season). Direct observations of foraging behaviour will be made. Body weights (BW) will be measured and blood samples (for nitrogen and growth hormone analysis) will be collected on weekly basis.

A Generalized Linear Model with Repeated Measures will be used to study the differences between seasons (i.e. wet vs. dry seasons), treatments (i.e. CT vs. control groups), in terms of body weight, blood metabolites, nitrogen excretion and forage intake. Blocks will be used as random variables and initial body weights used as offsets or covariates in the model. Since diet selection is a multi-species variable, one dependent variable (e.g. number of plant species in a diet) will be used as an index for selection or a multivariate statistic will be used.

Results from this study will contribute to our understanding of how chemical characteristics of woody plants interact with browsing herbivores, which is crucial for (i) improved herbivore production and (ii) development of effective vegetation management programs in African savannas.

Keywords: plant secondary metabolites; plant-herbivore interactions; condensed tannins; herbivore productivity





POSTER PRESENTATION: FIRE AND WETLANDS - YES OR NO?

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Water is a very important component of the natural world and human survival but water sources (river systems and wetlands) are becoming increasingly degraded and less functional. In particular the increase of woody C₃ species into wetlands is a cause for concern, as they invade wetlands which are predominantly herbaceous. Woody species use more water than herbaceous species and this impacts wetland function. In moister savannahs and grasslands woody species are influenced significantly by fire, and fire is consequently used widely as a means of reducing woody plant density. However, in wetlands there is uncertainty about the effectiveness of fire in combating woody plant encroachment and the general impact of fire.

The Kwambonambi wetlands of South Africa have been recently experiencing an invasion by woody species which are both indigenous and alien. These wetlands support a rich diversity of herbaceous plant species, including the only known wild population of the critically endangered *Kniphofia leucocephala*. This area was historically herbaceous and experienced frequent natural fires but is now largely under timber plantation and thus fire has been mainly excluded. This has led to a continual increase of woody species into the wetland and has seen a change from mainly herbaceous to a matrix of fern, herbaceous grasses and sedges and an invasion of swamp forest species such as *Macaranga natalensis*. This has now affected ecosystem functions and changed fire behaviour in these wetlands. A search through the literature has revealed the lack of studies which investigate the influence of fire on wetland structure and composition. The few studies available indicate contrasting ideas. Those focusing on hydrology as a driver of vegetation type, propose that burning induces soil crusting, lowering the water table thus allowing woody non-wetland species to invade. Contrasting views propose that fire is an efficient strategy to manage the invasion of woody non-wetland species when the burn timing is correct. This ambiguity highlights the need for more focused research that will influence management decisions.

The objective of the study is to determine the influence of fire on wetland vegetation structure and composition. Five wetlands have been chosen for the purpose of the study. In principle, this study is a space for time substitution obtained from sampling vegetation in plots with differing disturbance histories (fire, alien plant removal and forest clear felling). Vegetation sampling will be carried out across the wetlands to determine species diversity of the herbaceous species and the density of trees within these wetlands. Vegetation composition and structure would be described together with physical descriptors of the wetland including soil type and level of wetness. Based on ordination analysis, the relationship between the different vegetation types and physical descriptors will then be established. To measure the short term effect of fire on species composition and structure, burn experiments will be done. Vegetation sampling will be carried out pre- and post-burning. A change detection analysis will examine the long term influence on fire on these wetlands and relate it back to species composition and structure.

Keywords: fire; wetlands; woody species

POSTER PRESENTATION: REVIEW OF RESEARCH ACTIVITIES IN THE SOUTH LUANGWA NATIONAL PARK AND ITS SURROUNDING AREAS, ZAMBIA

Twakundine Simpamba

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This review considers the research activities that have been undertaken in the South Luangwa National Park and its surrounding Game Management Areas from 1960 to 2010. A search of research articles published in journals listed by the Institute for Scientific Information



was carried out on the internet and also on files available at Chinzombo Research Station. All articles located were categorised as high priority which has 16 topics, medium priority with 6 topics and low priority having 7 topics in line with the ZAWA Research Policy of 2005 into ten (10) year intervals. The review revealed that 42 articles have been published on the park and its surrounding areas since 1960. Topics under high priority accounted for 36 (86%) or the highest number of the total published articles and were listed under eleven (11) of the sixteen (16) topics, medium priority only had four (4) papers published or 10% and lastly two (2) papers were published under low priority representing 5%. The majority of the papers published under high priority topics focused on Community Based Natural Resources Management contributing eight (8) or 19%, while for medium priority there was no main topic dominating since management of fire and its impact on different vegetation communities, wildlife diseases studies and monitoring, tourism monitoring and problem animal control all represented a paper each to the four (4) papers published within fifty (50) years. Two (2) papers published under low priority topics were classified under other studies. During the review period, a single paper was published between 1960-1970, seven (7) papers from 1971-1980, twelve (12) papers from 1981-1990, thirteen (13) papers from 1991-2000 and nine (9) papers were published from 2001-2010. In terms of nationalities of authors, three (3) papers were published by only Zambians, thirty two (32) papers by non-Zambians and seven (7) papers were co-authored by both Zambians and foreigners. The paper also considers the management problems being encountered by the park and relates them to the research that has been carried out over the same period. Lastly, the paper provides guidelines for intended researchers according to the ZAWA Research Policy and makes recommendations for future research work.

POSTER PRESENTATION: A SCIENTIFIC EVALUATION OF THE HOLISTIC MANAGEMENT CONCEPT FOR VELD MANAGEMENT

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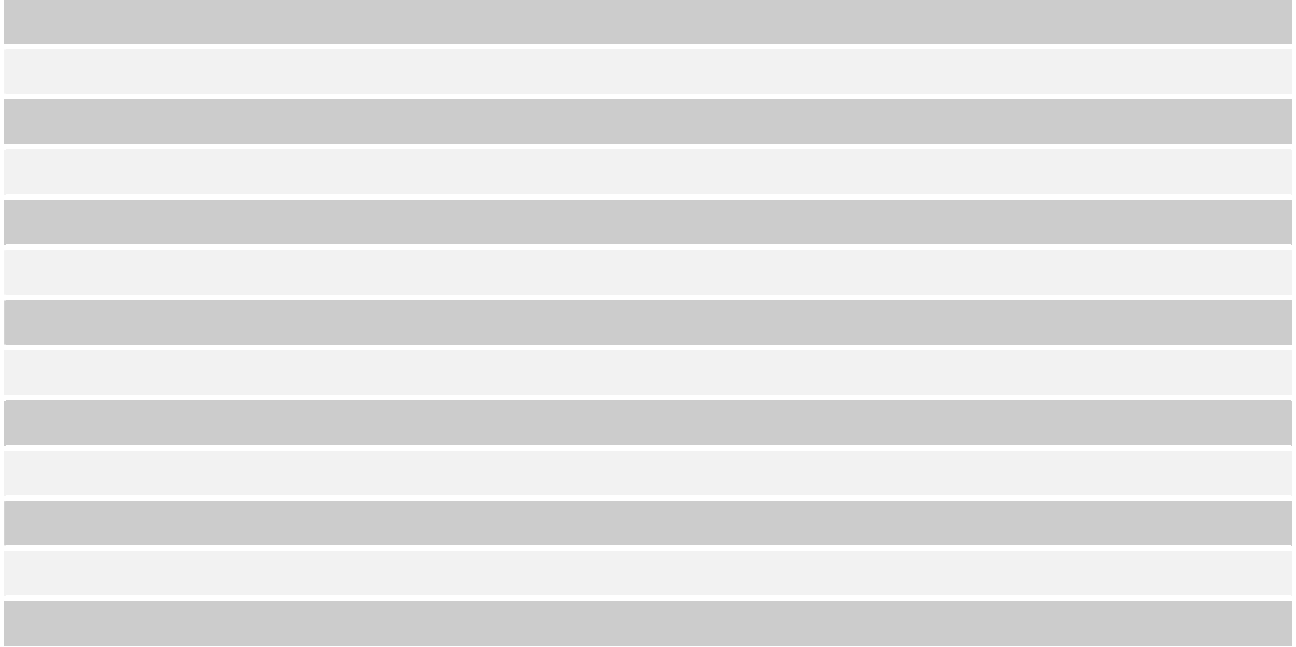
Allan Savory the author of the Savory Grazing Method, also known as Holistic Resource Management, Short Duration Grazing (time-controlled planned grazing), and Cell Grazing has effectively and consistently rebuked the principal laws of range and grassland management, and has led to many heated debates. However credible much of the anecdotal evidence may be due to individual perception/subjectivity and interpretation, the latter relating specifically to assumptions of rotation systems as suggested in Briske *et al's* (2008) influential review of grazing systems, Savory's method of planned and time controlled grazing management has often failed experimentally to produce the objective results it so strongly asserts. Consequently, the repeatability and science behind Savory's arguments have always been questioned by the rangeland management community.

Apart from experimental trials based largely on a small number of camps (four to twelve camps), where rotation is generally inflexible and grazing and subsequent rest periods are shorter, few or no studies have been undertaken on large-scale production units (farms) where the principles of holistic management are rigidly adhered to.

Considering the management required of such principles, we observe the difficulty and therefore neglect the application of such principles in the experimental design. The proposed units are extensive areas with more camps, more cattle and consequently more flexibility/ creativity with regard to grazing/rest periods and animal impact.



We hypothesise that that increased stocking density will increase the efficiency of harvest across all species thereby reducing the amount of ungrazed and over rested plants, and that plant density in fact increases with animal impact. We will measure plant composition along a gradient of animal impact with distance from water, % total litter and %covered surface, and the age structure of grass population, measuring the number of seedlings to small plants to mature individuals indicating improved succession and indicating improved landscape function. This study is aimed at producing practical and applicable answers to the questions raised and principles proposed by the Holistic Management concept.



POSTER PRESENTATION: EFFECT OF MOISTURE AND NUTRIENTS ON COPPICE RESPONSE OF *TERMINALIA SERICEA* STUMPS

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Coppicing is defined as all regeneration that is derived from vegetative sprouting of dormant or adventitious buds and is generally the primary regeneration mechanism after cutting a woody plant, where stem and roots remain in place. The research will investigate the possible interactive effect of increased moisture and nutrient availability on coppice regrowth and seedling establishment of *Terminalia sericea* trees. Since little is known about the effect of moisture and nutrient interaction affecting coppice regrowth in savanna trees, this study will seek to address this gap through experimental trials with harvested trees and transplanted seedlings supplemented with moisture and nutrients. Moisture and nutrient availability have been suggested to be critical determinants of savanna structure. Understanding factors that influence the structure and function of savanna communities is necessary because savannas are anticipated to be among the ecosystems that are sensitive to future climatic changes. The study will offer an opportunity to test the nutrient demands of resprouting trees because plant regrowth is perceived by researchers as an interaction between precipitation and both the ability of the plant species concerned and the soil type to retain moisture. It is important to understand how nutrient and water availability influence tree regrowth, not only to understand the change in coppicing ability of a tree species due to resource availability, but also to evaluate how changes in resources in an ecosystem may impact a community in which species with different regeneration strategies may co-exist. *Terminalia sericea* trees will be harvested at uniform height and supplemented with average monthly long term moisture received and nutrients in the form of nitrogen and phosphorus. Regeneration parameters such as resprouting vigour and number of coppice shoots per harvested tree stump will be monitored. The study will also explore the role played by available nutrients and, more importantly, moisture as it will show possible response of trees in events such as climate change.

Keywords: *Terminalia sericea*; coppicing; moisture; nutrients; regeneration



**POSTER PRESENTATION: EVALUATING RANGE CONDITION AND SOIL CHARACTERISTICS
IN SAKHI AND CANGCA COMMUNAL RANGELANDS OF THE EASTERN CAPE**

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Rangelands represent the valuable source of feed for livestock production in the Eastern Cape province of South Africa. Cattle production is the most important livestock sector, and one of the common indigenous breeds used by communal cattle enterprises is the Nguni Breed. A study will be conducted to assess range condition and soil properties in two communal areas that are the beneficiaries of a development project, the Nguni cattle development project. This was initiated in 1998 by the University of Fort Hare in collaboration with rural development agencies in the Eastern Cape. The project is aimed at upgrading communal herds with Nguni cattle and to empower resource poor communities in the process. It also aims to provide support systems and programmes for the improvement of management, a development programme and a marketing system to facilitate the sale of animals at market-related prices. Range assessment will be conducted seasonally in two communal areas, namely Sakhi and Cangca communal areas, in June 2011, September 2011, December 2011 and March 2012. The range condition and the soil properties surveys will be carried out in four homogenous vegetation units (HVU) in each village which will be identified by visual assessment. In each HVU two belt transects will be established across the HVU and permanently marked for future re-assessments. The transects will be at least 300 m long. Grass species composition and basal cover will be determined using the step point method, between the two transect markers. The plant nearest to the step point is identified and recorded. 300 hundred step point observations will be made per transect. Determination of soil properties at Sakhi and Cangca communities will be based on landscape and altitude and/or gradient. Each study site will be divided into experimental units based on the Homogenous vegetation unit of the particular site. Each of the experimental units, at each community, will be sub-divided into four treatment plots of 100m x 4m transects. Top soil samples will be collected, and the pH of the soil and soil organic content, soil texture, macro and micro nutrients and organic matter content will be determined. The data known to have an impact on range condition under extensive grazing in these communal areas will be analyzed. An analysis of variance (ANOVA) using the GLM procedure of SAS system (SAS Institute, 1999) will be used to compute the variation of vegetation and the soil. Multi variety analysis using CANOCO will be conducted when necessary.

Keywords: range condition; species composition; soil properties; communal rangelands

**POSTER PRESENTATION: DYNAMICS OF THE FEED RESOURCE BASE, NGUNI CATTLE
FEEDING BEHAVIOUR AND NUTRITIONAL VALUES OF COMMON GRASS AND BROWSE
SPECIES IN THE CANGCA AND SAKHI COMMUNAL AREAS OF THE EASTERN CAPE**

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Livestock and crop farming are the major sources of food production and income generation in the rural communities of South Africa. While some farmers may provide feed supplements to their livestock, communal livestock production relies solely on natural rangelands. The South African government has supported rural livestock farming through development projects that introduce indigenous livestock breeds and improved farming practices. One of these projects in the Eastern Cape Province is the Nguni cattle development project. This project was initiated in 1998 by the University of Fort Hare in collaboration with rural development agencies of South Africa. The Nguni cattle project has made significant efforts to increase the productivity and sustainability of cattle production as well as the marketability of the products. However, little in-depth research has been conducted in the project areas to investigate the feed resource base, changes over the seasons and how this affects animal feeding behaviour, diet selection and performance. In addition, the impact of the project and the indigenous knowledge and perception



of the communal people on the above subjects need to be documented. These are the main reasons why the current research project is proposed. The study will be conducted in two communities, Cangca and Sakhi. These communities are the latest beneficiaries of the Nguni cattle project, and are located close to the University of Fort Hare. Data on the characteristics and performance of individual livestock holdings, feed resource bases and indigenous knowledge and perception will be collected using a combination of formal discussions and structured interviews with both male and female adults of the selected households. Feeding behaviour and diet selection of cattle will be studied over five months by observing three cattle selected from each communal area. Based on the results of the above two studies, common grass and browse species will be collected for biomass determination, chemical and *in vitro* fermentation and degradability analysis. Representative soil samples will be collected from both Cangca and Sakhi in the wet and dry seasons. Animal Blood samples will be collected from Nguni cattle at the same time as the soil and plant sample collection. Blood samples from each community will be obtained by jugular puncture from a representative sample of mature male and mature dry female (>2 years) Nguni cattle. Data on indigenous knowledge and perception will be subject to SPSS. Foraging behaviour and nutritive value of forages will be analyzed using ANOVA. Regression analysis will be conducted to investigate the relationships between soils, plants and animal nutrients. Descriptive statistical analysis will be used when appropriate.

Keywords: livestock; rangelands; diet selection; indigenous knowledge nutrient

POSTER PRESENTATION: SOIL QUALITY OF KIKUYU-RYEGRASS PASTURE IN THE SOUTHERN CAPE

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The coastal region extending from the Tsitsikamma in the east to Caledon in the west is the highest milk producing area from pastures in South Africa. The most suitable management systems for pasture-based dairy production systems in this area have been well documented. The systems consist mainly of no-till kikuyu (*Pennisetum clandestinum*) based pastures, over-sown with different ryegrass species (*Lolium* spp.). No-till systems were adopted to be more cost-effective and increase soil fertility by building soil carbon (C) levels. It is commonly observed that pastures that remained undisturbed for more than 7 years have C stocks of 4 - 10%. Carbon stocks this high will have a substantial effect on the soil's quality and should therefore ensure a sustainable system. However, the quality status of soils in the Southern Cape is vague, since it is difficult to predict if a definition and an assessment framework for soil quality have not been developed. This necessitates that soil quality must firstly be defined for dairy-pasture systems. Secondly, an assessment framework to predict the current status of the soil in terms of quality should be developed by re-integrating and optimizing the physical, biological, and chemical components of soils. Cultivation practices influence these three components, which implies that the impact of management on soil quality needs to be examined.

While certain cultivation practices may have beneficial effects on the availability of nutrients to plants, soil quality may be enhanced, remain unchanged or deteriorate. Therefore, the aim of the study will be to develop an assessment framework for soil quality by investigating the effect of cultivation practices on soil quality. This will be achieved by identifying the most sensible indicators, which will allow one to elucidate the quality status of the soil in terms of chemical, physical and biological condition. The parameters that will be tested are shown in Table 1. A soil quality index will consequently be constructed. Relevance of the index on any area within the Southern Cape will also be assessed.

**Table 1:** Parameters that will be examined to develop an assessment framework for soil quality

Chemical	Physical	Biological	Other
Soil organic matter (Loss-on-ignition)	Aggregate stability	Basal soil respiration rate	Soil temperature (various depths)
Active C (Walkley-Black)	Texture (5 fractions)	Glomalin content	Soil matrix potential
Macro and Micronutrients: P (citric acid), K, Ca, Mg, B, Cu, Co, Fe, S, Mn, Al, Zn, Na, C:N, C:S	Bulk density	Nematode community profiling	Continuous soil moisture content
pH(KCl)	Water holding capacity	Micorrhizial root colonization level	Botanical composition
Electrical conductivity	Soil depth	Spore count	Water quality
Cation exchange capacity	Rooting depth and density	C-source utilization profile (BIOLOG®)	Pasture yield
Total N, Ammonia-N	Penetration resistance	Microbial enzyme activity	Climate related parameters
Resistance	Infiltration rate	Microbial count	
Total cations		Microbial biomass-C	

Farmers and agricultural researchers alike realize the importance of managing soil as a non-renewable natural resource that needs to be conserved and maintained. This research will be used to develop management strategies which will ensure sustainability. The scientific knowledge derived from the research conducted will be translated into practice and extended by the Department of Agriculture Western Cape.

Keywords: no-till; soil carbon; soil quality; cultivation practices; Southern Cape; dairy pastures

POSTER PRESENTATION: A PROPOSAL FOR RE-EXAMINING OLD FRIENDS - COMBINING RHODES AND SMUTS FINGER GRASS

Yvette Brits

North West Department of Agriculture and Rural Development, Potchefstroom, email: ybrits@nwpg.gov.za

One of the most commonly used perennial grasses for pasture in the summer rainfall areas is *Digitaria eriantha* (Smuts finger grass). This grass, if managed properly, will provide the farmer with long lasting pastures, as it will produce large quantities of fodder and grow vigorously. It also counters other species as it provides substantial competition, when managed well. However experience led us to believe that Smuts finger grass needs a season, and in some instances three seasons, to establish well as it is a slow starter. Normally land users don't take this into consideration, and the swards are grazed prematurely. Thus, the introduction of rapidly establishing species (e.g. Rhodes grass *Chloris gayana*), which act as a "nurse crop" can be useful during establishment. A huge advantage of Rhodes grass is that the production is good as from the first year of establishment. Later on, the more perennial Smuts finger grass will out-compete the weak perennial Rhodes grass, giving a more sustainable forage supply. Both these grasses are very palatable and considered to be good grazing species. Another aspect advocated is using irrigation in the first three months after establishment, to counteract harsh unpredictable weather conditions. These are logical actions and observations passed on by word of mouth, but are they in essence viable? Are these methods helping the land user or does the cost outweigh the cause? Can we prove that these establishment recommendations are essential to improve Smuts finger sward establishment and make it more sustainable? With the proposed trial, we will look at these questions.

The objectives for the trial, to be carried out at the experimental farm of North West Department of Agriculture and Rural Development, Potchefstroom, are firstly, to determine



whether or not to plant Smuts finger in combination with Rhodes grass and at what ratio. This will be tested by measuring establishment by means of seedling count and density in each plot. The second objective is to compile and fit growth curves for the different treatments, by means of surveying for biomass production at certain time intervals (to be fitted by ARC Biometry Unit, Pretoria). Thirdly, the ecological and economic effect of “nursing” irrigation on the establishment success of different combinations of the two grass species at different time intervals will be determined. Percentage ground cover will be included in the surveys. The regrowth after the time intervals will also be determined.

Pure stands of Smuts finger grass (*Digitaria eriantha*) and of Rhodes grass (*Chloris gayana*), as well as seed mixtures at three different ratios (50 % Smuts finger: 50% Rhodes; 25% Smuts finger: 75 % Rhodes and 75 % Smuts finger: 25 % Rhodes) of both these grasses under irrigation and dry land will form part of the trial material to be subjected to different surveys to meet the set objectives, as mentioned above. For both the homogenic Smuts finger and Rhodes grass establishments, a seeding rate of 5 kg/ha will be used. For the combinations, a seeding density of 5 kg/ha of each species will be planted. The pastures will be established in rows, with a spacing of 0.9 m in between the rows.

The trial will be established in a complete randomised block design (CRBD). The four blocks will form the replications, while the five treatments will be randomized in each block. One block will be 25 m x 15 m, resulting in a total size of 375 m² per block. In turn, each block will be subdivided in 15 plots representing growth on a monthly basis. A control as well as a plot representing the annual growth will form part of each block. Gross plot size will be 5 m x 5 m, and the net plot size will total to 2 m x 2 m, to account for a buffer zone and easy access to the respective plots at the respective time intervals. Irrigation on each block will be done at 25 mm/week, taking rainfall into consideration for the first three months, as normally recommended by the Pasture Division. Rainfall will be recorded.

Soil analysis and amendments will be done before commencement of the trials. Seed bed preparations will also take place accordingly. Weeds occurring during the trial will be controlled by herbicide applications. The initial commencement of the trial is set for September 2011.

Keywords: seed mixtures; Smuts finger grass; Rhodes grass





Plant – Herbivore Interactions on Natural Rangelands I

SESSION CHAIR: YOLANDI ELS

Thursday 14 July 2011, 11:30 – 13:00

Platform and Poster Presentations

PLATFORM PRESENTATION: A GOAT'S EYE VIEW OF VEGETATION QUALITY: INCREASED fPAR IMPROVES GOATS' PERCEPTION OF FORAGING OPPORTUNITIES IN THE RICHTERSVELD

Andrew T C Booth¹, Susi Vetter^{1} and Dawood Hattas²*

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How and to what degree goats can perceive future foraging opportunities is of importance when managing herds, especially in environments with scarce resources. Herds may base their movement and foraging decisions on what resources may be available to them in the future. This paper explores what resource factors best explain such animal foraging decisions in the Richtersveld. Giving up density (GUD) refers to the amount of food left in a feeding patch after a foraging event. The GUD reflects the point at which marginal costs outweigh marginal benefits of foraging from a patch and the forager moves on. This is influenced by predation threat, metabolic cost, competition and missed opportunity cost of feeding in a better patch. We controlled for predation threat and metabolic cost and investigated whether the GUDs of goats feeding on artificial feeding patches in the Richtersveld were affected by competition (herd size) and missed opportunity cost of feeding in a better patch (i.e. the goats' perception of feeding opportunities around the stock post). We predicted that GUDs would increase with forage quantity (green biomass, rainfall) and forage quality (more digestible) but would decrease with competition (herd size). Giving up densities were modelled against a variety of vegetation indexes, including rainfall, fPAR (the fraction of photosynthetic radiation absorbed, indicative of primary production) and faecal indicators (indicative of digestibility). In the models, fPAR alone provided the best estimate of how goat herds perceive their future opportunities. This indicates that the amount of plant growth occurring in the vicinity of where the goats start to forage best predicts their expectations of pasture value.

Keywords: foraging decisions; goats; fPAR; GUD; Richtersveld

PLATFORM PRESENTATION: PASTORAL VALUE IN THE HIGH BASSIN ZONE OF MANDRARE RANGELAND IN SOUTHERN MADAGASCAR

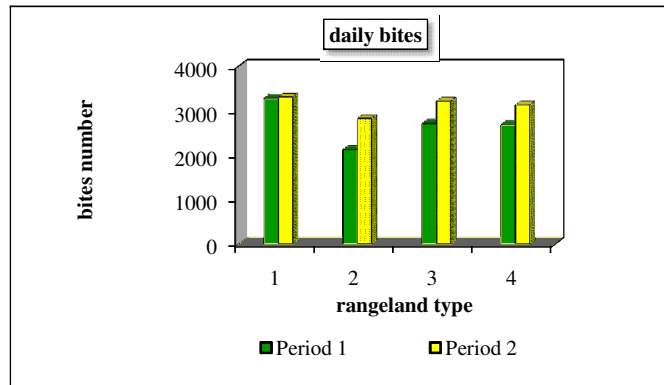
Arsene J M Randrianariveloseheno^{1}, J N Rakotozandriany¹ and R Daccord²*

¹ High School of Agronomical Science, Department of Animal Science, Laboratory of Animal Nutrition, Antananarivo, Madagascar, email: shenorajm1@yahoo.fr, ²Swiss Federal Research Station for Animal Production and Dairy Products, Agroscope Liebefeld Posieux, CH 1725 Posieux, Switzerland

Due to their particular anatomical characteristics, browsing goats consume leaves to satisfy their energy requirements. This study was carried out on goats in the High Bassin zone of Mandrare in Southern Madagascar. The fodder components system allows one to determinate the pasture value in different ranges. Superficial monitoring has been used to determine the floristic formation, the phenological state and the nutritive value of plants to produce a species quality index. With one ram, two castrated goats and three ewes, the feeding behaviour and bite rate were examined and recorded in native pasture over six days during two grazing periods (Period 1 from September to October 2002 and period 2 from July to August 2003). As a result, four pasture areas were classified with dominant browse species as follows: *Acacia farnesiana*, *Poupartia caffra*,



Kigelianthe madagascariensis and *Rhigozum madagascariense*. Their floristic density is low, between 100 and 658 plants per hectare. Most of 37 identified fodder species are available with 12% thorny species. They are high in nutritive value with 14 to 66% Dry Matter (DM); variable Crude Protein between 82 and 227 g / kg DM; Crude Fibre 144 to 488 g / kg DM and with gross energy between 3367 and 4998 kcal / kg DM. The *Acacia farnesiana* range is very heavily grazed with 2476 to 3292 daily bites (Figure 1). The pasture value is very low between 12 and 25% (Figure 2). In this way, these relationships between phytosociology and nutritional parameters are



studied for range management and to enhance understanding of the rangeland.

Figure 1: Relationships between bite rate and rangeland type (1 *Acacia farnesiana*, 2 *Poupartia caffra*, 3 *Kigelianthe madagascariensis* and 4 *Rhigozum madagascariense*).

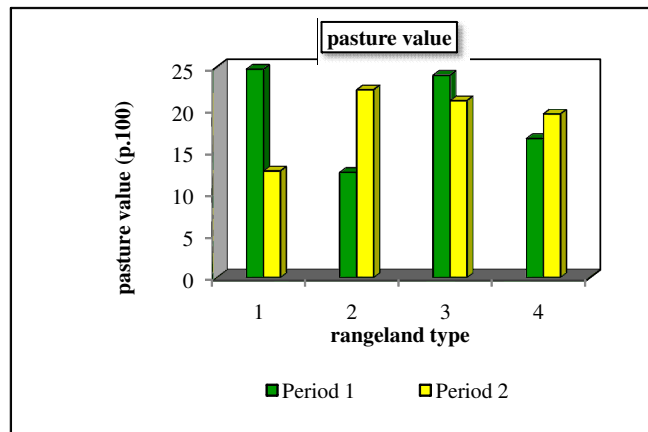


Figure 2: Variations of pastoral value in four rangelands (1 *Acacia farnesiana*, 2 *Poupartia caffra*, 3 *Kigelianthe madagascariensis* and 4 *Rhigozum madagascariense*).

Keywords: pastoral value; goat; browse; Madagascar

POSTER PRESENTATION: ARE ELEPHANTS CAUSING SIGNIFICANT DECLINES IN LARGE TREES IN LOWVELD SAVANNAS?

Mike J S Peel*, John M H Peel and Jakes (A) F Jacobs

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

The effect of savanna trees grass productivity has been well researched with both negative and positive effects having been described (in Ludwig et al. 2008). Trees reduce grass growth by competing with grasses for water, light and nutrients but improve grass production through hydraulic lift, reduced evapotranspiration and increasing nutrient availability. The tree component therefore plays a major role in determining forage quality (higher soil nutrient concentrations under tree canopies) and quantity and consequently has an influence on the



composition of the herbivore assemblage. It is now also accepted that the aesthetic value of large trees is as an acceptable aspiration as the more 'concrete' objectives like preventing biodiversity loss. The 'perceived' decline in tall trees due to elephant is therefore a concern and forms the focus of this presentation.

Elephant can modify habitats rapidly and extensively elephant and as such may precipitate a cascading effect through the ecosystem, affecting many co-existing plants and animals (e.g. Child 2004). It is contended that a manifestation of too many elephant is a loss of large trees and perennial grasses which leads to bush encroachment, a loss of sensitive grazing species like roan, sable and tsessebe, and their replacement by short closed woodland and increased numbers of impala and kudu.

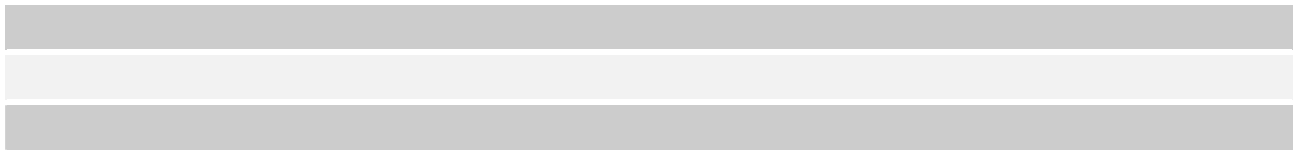
We understand the need to link elephant impact at a range of trophic levels from soils to mammal species (Kerley et al. 2007) and it is within this context that we examine one of the Kruger National Parks Thresholds of Potential Concern, viz. the loss of large trees (Biggs et al. 2007).

In the protected areas adjacent to the KNP, fluctuating tree densities with relatively stable canopy cover suggests that taller trees provide most of the canopy, with smaller less established trees, where most seasonal fluctuations in density occur, contributing less.

In addition to elephant density, it is contended that elephant impact is related to the proportion of males in the population and also the type of season experienced, e.g. a wet seasons with low impact recorded and dry season revealing an increase in impact.

To investigate the impact of elephant in the >5m size class, we marked about 1000 trees taller than 5m in a number of protected areas. We report on 5 years of data focusing on *Sclerocaryabirea* and *Acacia nigrescens* where the primary impact of elephant may: lead to elevated adult mortality through direct impact and reduced recruitment from shrubs, saplings and seedlings; be magnified due to attributes that affect its selection and manner of utilisation which render it vulnerable to mortality; act in synergy with other environmental or biotic factors (O'Connor *et al.*).

The ultimate challenge is to determine whether the rate of attrition due to elephant is quicker than recruitment into the taller height classes.



PLATFORM PRESENTATION: MONITORING OF VEGETATION IN THE NGOMA FOREST OF KAFUE NATIONAL PARK, ZAMBIA

Twakundine Simpamba

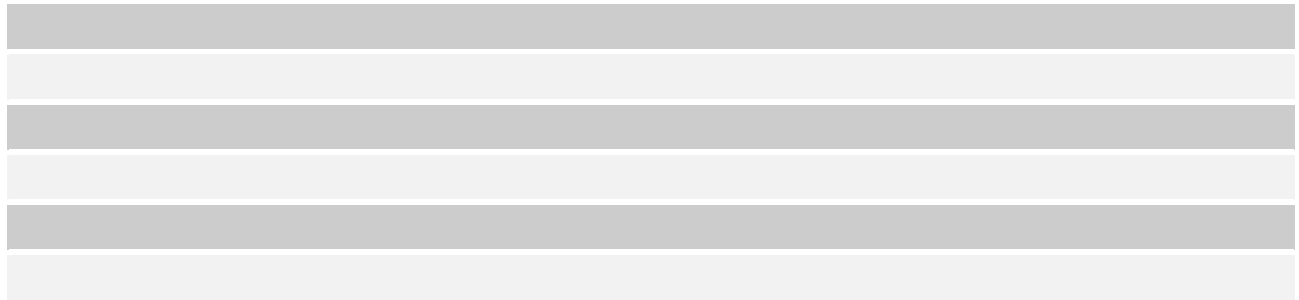
Zambia Wildlife Authority, Directorate of Research, Planning, Information and Veterinary Services, South Luangwa National Park, P.O Box 18, Mfuwe, Zambia

The Ngoma forest is a critical habitat in Kafue National Park of Zambia. In the core of the forest is the baikiaea forest. The Ngoma forest has been prone to disturbances by elephants and fire though fire does not reach the baikiaea forest due to low availability of fuel. No continuous monitoring of the vegetation has been undertaken despite these disturbances though vegetation studies were extensively done during the General Management Planning Project in the late nineties. In the year 2004 the Support to Economic Expansion and Diversification (SEED) project commenced in the Kafue National Park with funding from the Royal Government of Norway and World Bank through Zambia's Ministry of Environment, Tourism and Natural Resources. There are six components under this project and under component 4, the Wildlife Research, Monitoring and Rehabilitation of Critical Habitats and Species, there was a budget for the design and testing of a vegetation monitoring system by consultants. The consultant was procured in 2006 and this was followed by the designing and testing of the vegetation monitoring system within the same year. A number of plots are located throughout the park but in this paper focus is on the Ngoma forest which has six plots. Presentation is made of baseline data collected from only two plots that were sampled in the year 2008 using the area based methodology. Of the two plots, which are 20x20m, one was located within the baikiaea forest and the other was on the outside of the baikiaea forest but within the Ngoma forest. Data collected included the height, diameter at breast



height, species, position of each plant and later on values for species diversity, importance values, shrub biomass, tree biomass and crown cover were calculated for each plot. The plot (08-12) outside the baikiaea forest had a Shannon index of 1.42, total shrub biomass of 1,563.64 tonnes/ha, total tree biomass of 705.36 tonnes/ha and crown cover of 326.92. The second plot (08-13) which was located in the baikiaea forest had Shannon index of 2.31, total shrub biomass of 467.56 tonnes/ha, total tree biomass of 794.28 tonnes/ha and crown cover of 286.49. *Combretum collinum* and *Friesodielsia obovata* had the highest importance values of 12.55 and 43.18 in plots 08-13 and 08-12 respectively. Since these plots have now been established, it will be possible to go back after some years and determine if any changes have occurred and the likely reason for the detected changes.

Keywords: Ngoma forest; baikiaea forest; vegetation monitoring; *Combretum collinum*; *Friesodielsia obovata*



POSTER PRESENTATION: INFLUENCE OF DIFFERENT VELD MANAGEMENT STRATEGIES ON ANIMAL WEIGHT GAIN WITHIN A FOURTEEN YEAR TRIAL IN EASTERN CAPE FALSE THORNVELD

Craig Trethewey^{1}, Theunis L Morgenthal² and Pieter W Conradie³*

Eastern Cape Department of Rural Development and Agrarian Reform, ¹Adelaide Research Station, Adelaide, 5760, email: cat01@telkomsa.net, ²Döhne Agricultural Development Institute, Stutterheim, email: theunis.morgenthal@agr.ecprov.gov.za, ³AZRI, Alice Springs, Australia, email: pieter.conradie@nt.gov.au

The influence of different veld management practices and stocking rate on rangelands remains a lively discussion point. Long-term datasets to test the effects of different rangeland management systems on veld condition and animal performance are critically lacking in South Africa. The long-term grazing trial at Adelaide Research Station, initiated in 1996, is one of the few remaining monitoring trials in South Africa. Danckwerts (1989) proposed a dynamic stocking rate model by which stock numbers are adjusted annually based on veld condition and seasonal rainfall. This model is tested at Adelaide Research Station using three veld management strategies (continuous grazing, 3-camp rotation and a 6-camp rotational system) at the rainfall adjusted stocking rate and a 50 % heavier stocking rate. The aim of this study is to investigate the influence of the different veld management treatments on animal weight gain during the fourteen year trial period in relation to rainfall variability.

The trial consists of seven unreplicated treatments: six camp system at recommended stocking rate, six camp system at a 50% heavier stocking rate, three camp system at recommended stocking rate, continuous grazing system at recommended stocking rate, two camp – continuous grazing system at recommended stocking rate, continuous grazing system at 50% heavier stocking rate, two camp – continuous grazing system at 50% heavier stocking rate. Animal weight gain is monitored monthly and grass species composition is surveyed annually.

Preliminary results from the trial have been reported at a number of occasions at the GSSA congress but no long-term data from the trial has been presented. Results on animal weight gain during the past fourteen years between treatments are compared considering long-term rainfall patterns and vegetation condition. The merit of using a rainfall adjusted stocking rate is discussed.

References:

Danckwerts JE. 1982. The grazing capacity of Sweetveld: a model to estimate grazing capacity in the False Thornveld of the Eastern Cape. *Proceedings of the Grassland Society of Southern Africa*, 17: 94-98.

Keywords: veld management; animal performance; monitoring trials; rainfall

**PLATFORM PRESENTATION: VEGETATION DYNAMICS WITHIN A FOURTEEN YEAR VELD MANAGEMENT TRIAL IN EASTERN CAPE FALSE THORNVELD***Theunis L Morgenthal^{1*} and Craig Trethewey²*

Eastern Cape Department of Rural Development and Agrarian Reform, ¹Döhne Agricultural Development Institute, Stutterheim, email: theunis.morgenthal@agr.ecprov.gov.za, ²Adelaide Research Station, Adelaide, 5760, email: cat01@telkomsa.net

A long-term trial to understand the optimum grazing system and stocking rate for cattle in False Thornveld of the Eastern Cape was initiated in 1996. This trial has been monitored for fourteen years. Since its inception animal weight and species composition have been monitored annually. It was the aim of this study to investigate the contribution of initial habitat differences on species composition differences within treatments and the long-term effect of different veld management strategies on species composition.

The trial investigates the effect of different grazing systems (continuous vs rotational) at two different stocking rates (recommended and 50% over stocked) on veld condition. The vegetation composition was determined annually within 30 x 30 m marked plots situated in treatment paddocks. Descending point surveys were conducted using a wheel point apparatus within the marked plots. Data were analysed using Canonical Correspondence analysis and plotting the frequency occurrence of the dominant and co-dominant species.

The grass sward within the trial paddocks was dominated by *Sporobolus fimbriatus*, *Cymbopogon pospischilii* and *Digitaria eriantha*. Historical grazing patterns and habitat differences had a significant influence on the species composition between treatments. The vegetation of the paddocks used for the trial was at the onset of the experiment in a sub-climax state and this remained so irrespective of the stocking rate or camp system followed (Figure 1).

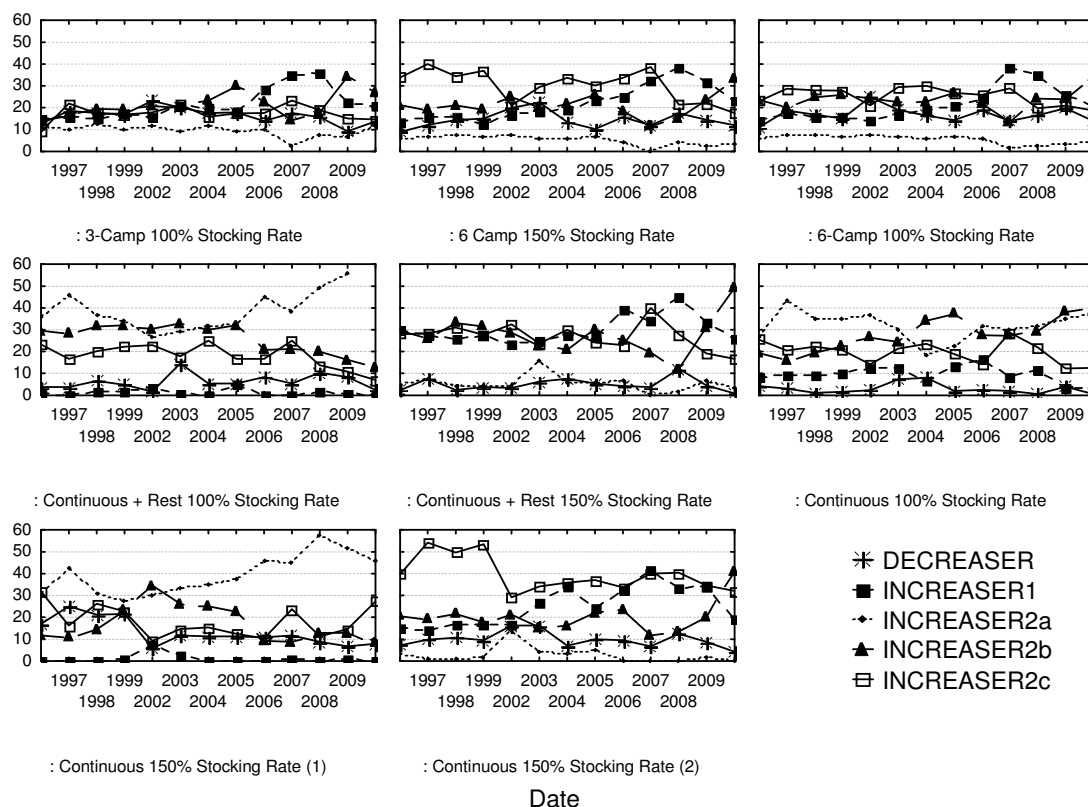


Figure 1: Changes in the abundance of Ecological Species Groups within each of the treatments at Adelaide Research Station for the past fourteen years.

Keywords: False Thornveld; grazing systems; vegetation composition; stocking rate



Plant – Herbivore Interactions on Natural Rangelands II

SESSION CHAIR: LISA HEBBELMANN

Thursday 14 July 2011, 14:00 – 15:00

Platform and Poster Presentations

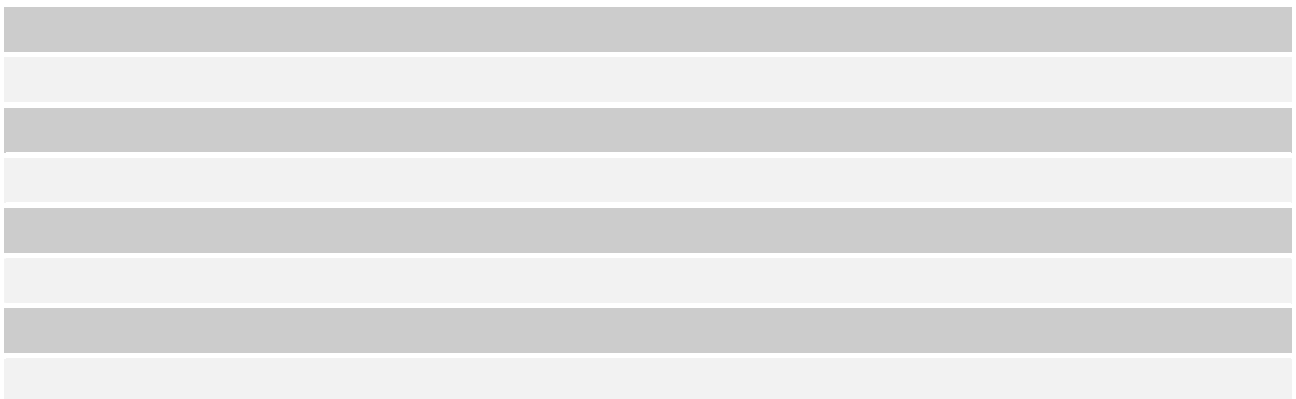
PLATFORM PRESENTATION: GRAZING, GRASS VIGOUR AND SPECIES COMPOSITION CHANGE

Kevin P Kirkman

University of KwaZulu-Natal, School of Biological and Conservation Sciences, Pietermaritzburg, email: kirkmank@ukzn.ac.za

Various mechanisms have been proposed to explain the species composition changes in grasslands in response to grazing. However, many of the mechanisms don't account for the variable responses encountered under different conditions, particularly under different grazing management regimes. Results from several grazing and simulated grazing trials have indicated that defoliation over the period of a summer growing season, whether by grazing or clipping, has a negative impact on the productivity of those tufts during the following summer growing season. This resulted in differential competitive interactions between grass tufts grazed in the previous season versus those not grazed. Previously ungrazed tufts were consequently more productive, competing more effectively for above and below ground resources in relation to those grazed during the previous season. They also tended to produce greater amounts of seed. Highly selective grazing (by sheep) caused a greater depressive effect in grazed species than less selective grazing (by cattle) at the same stocking rate with productivity of previously grazed tufts up to 50% lower than tufts of the same species that were not previously grazed. The productivity of ungrazed species in areas grazed by sheep increased dramatically, apparently as a consequence of reduced competition from the now less productive, previously grazed species. At the same time, cattle grazed a greater range of grass species, resulting in a less dramatic increase in productivity of ungrazed species. Stocking rate studies indicated that even at light stocking rates, grass tufts that were grazed showed the same degree of productivity reduction as seen in tufts grazed in heavy stocking rate treatments with. Intensive grazing simulation trials confirmed the findings that defoliation of grass tufts caused a significant reduction in productivity during the following season, while no defoliation tended to increase the productivity of grass tufts in the following season. This has important implications for grassland management and may partially account for the apparent lack of success of many grazing system approaches that have been promoted. The findings that defoliation has a long lasting impact on productivity and consequently on competitive relations between grass tufts in the season following grazing implies that grassland management can be adapted to promote stability of species composition. Focusing on competitive relations between species implies that grazing should be non-selective to allow all grass species to compete equally, or that where grazing is selective, that extended periods of no grazing should be incorporated to allow previously grazed species to regain productivity and compete effectively with previously ungrazed species.

Keywords: grazing; stocking rates; grassland management; grass tufts; non-selective





PLATFORM PRESENTATION: EFFECTS OF GRAZING, FIRE, NITROGEN AND WATER AVAILABILITY ON NUTRITIONAL QUALITY OF GRASS IN SEMI-ARID SAVANNA

Khanyi R Mbatha^{1} and Dave M Ward²*

¹National Zoological Gardens of South Africa, Pretoria, email: khanyi@nzc.ac.za, ²University of KwaZulu-Natal, School of Biological and Conservation Sciences, Pietermaritzburg, email: ward@ukzn.ac.za

The effects of grazing, fire, nitrogen addition, and watering treatments on the nutritional value of grass in field experiments was ascertained. Added water had no effect on grass quality and biomass in this semi-arid savanna, may be due the above-average rainfall during this study. Nitrogen addition resulted in increased levels of crude protein (CP) and biomass, as well as crude protein and gross energy in the early and late wet seasons, respectively. In the dry season, grazing alone had little effect on grass quality, although in the late wet season, CP and phosphorus (P) levels were high on grazed plots. Grass biomass was greater in fenced plots. During the wet season, there was more CP and P mass per unit area in fenced plots. The grass quality was improved by fire interaction with addition of nitrogen and grazing. Fire had more positive effects on grass quality than grazing. Availability of soil nitrogen emerged as the primary factor enhancing nutrient quality of grass in the wet season in this semi-arid environment.

POSTER PRESENTATION: WAHROONGA FARM: 40 YEARS OF PROTECTION FROM LIVESTOCK GRAZING AND REDUCED FIRE REGIMES – LESSONS LEARNT

Rob C Scott-Shaw^{1} and Isabel Johnson²*

¹Ezemvelo KZN Wildlife, Biodiversity Research and Planning Division, Pietermaritzburg, email: robss@kznwildlife.com, ²Botanical Society of Southern Africa, Pietermaritzburg, email: johnsoni@ukzn.ac.za

This family owned farm in the KwaZulu-Natal Midlands near Howick is situated along the crest of a line of hills. The Kunhardt family has excluded livestock from the grasslands for approximately 40 years and has applied an infrequent fire regime with a burn applied on average every four years. Their neighbour who borders two sides of the property has similarly applied his stocking rate and biennial fire regime consistently over this time and according to provincial recommended levels. The farm has drawn considerable scientific study and conservation interest which is summarized in the poster.

Keywords: fire regime; livestock; grazing

PLATFORM PRESENTATION: ABOVE- AND BELOWGROUND COMPETITIVE INTERACTIONS BETWEEN SEEDLINGS OF THREE GRASS SPECIES AND THE SURROUNDING NATIVE GRASS SWARD ON THREE SITES OF DIFFERING SOIL DEPTH

Michelle J Tedder and Kevin P Kirkman*

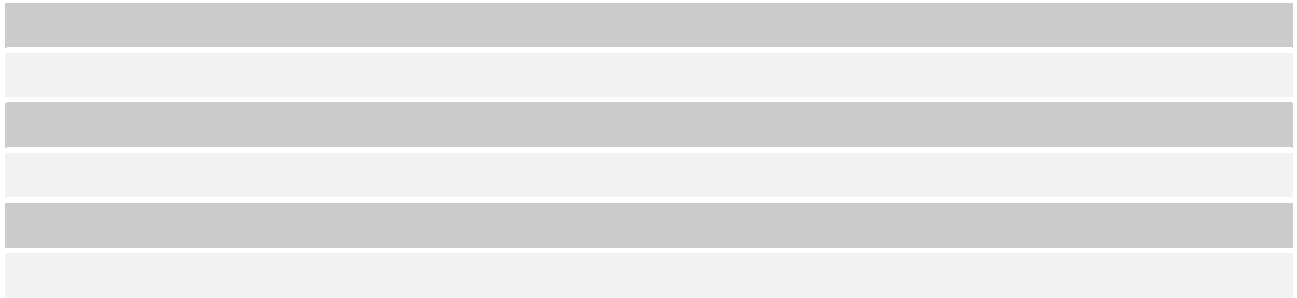
University of KwaZulu-Natal, School of Biological and Conservation Sciences, Pietermaritzburg, email: michelle.j.tedder@gmail.com, kirkmank@ukzn.ac.za

Interactions between mature grass plants and grass seedlings have been found to be both facilitative and competitive. To examine the effects of above and belowground competition on seedling biomass, and tiller numbers as well as the effects of soil depth on competitive interactions, seedlings of three locally common grass species, *Eragrostis racemosa*, *Themeda triandra* and *Panicum maximum*, were planted into a natural grass sward on three different parts of the landscape varying in soil depth. Three aboveground treatments i.e., full light competition,



no light competition and clipping to simulate grazing, and two belowground treatments i.e., full belowground competition and belowground competition excluded by a root tube, were used. On all soil depths the three grass species differed in mean mass, with *E. racemosa* having the least mass and *T. triandra* having the greatest. Results for tiller numbers were more complex as *P. maximum* seedlings were tall but had low tiller numbers. Simulated grazing by clipping the surrounding sward created niches for seedling establishment. This highlights the importance of maintaining stocking rates at a level which promotes seedling establishment.

Keywords: competitive interaction; seedlings; tillers; soil depth; clipping; seedling establishment



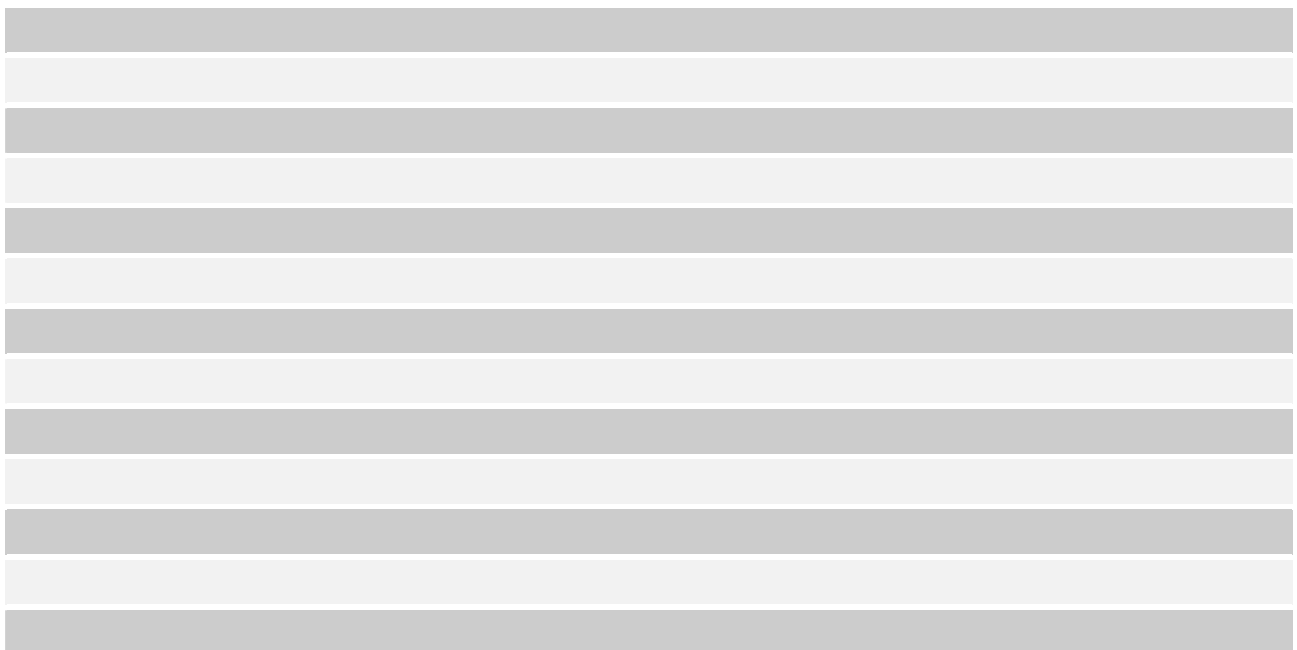
POSTER PRESENTATION: PHYLOGENY AND PHYLOGENETIC DIVERSITY OF TREES AND SHRUBS IN THE KRUGER NATIONAL PARK USING DNA BARCODES

Kowiyou Yessoufou¹, Olivier Maurin¹, Maria Kuzmina² and Michelle van der Bank¹

¹University of Johannesburg, African Centre for DNA Barcoding, Johannesburg, email: kyessoufou@yahoo.fr, olive.maurin@gmail.com, mvdbank@uj.ac.za, ²University of Guelph, Canadian Centre for DNA Barcoding, Guelph, Canada, email: mkuzmina@uoguelph.ca

The use of phylogeny is in covering several areas of ecological investigations. This is due to the fact that it provides a crucial framework to address long-standing ecological questions. Meanwhile the lack of a DNA database for a flora of specific interest can limit the application of phylogenetics especially in Africa. Here we generate a DNA barcode library for woody plants of the Kruger National Park (KNP). The main objectives are to reconstruct the phylogeny of angiosperms occurring in the KNP and investigate habitat effects on phylogenetic diversity (PD) within habitats. We show that the KNP barcode-tree is congruent with the latest angiosperm phylogeny, and that phylogenetic information varies with habitat types. By providing the evolutionary relationships among taxa in a biodiversity hotspot, this study generates a new and modern tool with which to fuel ecological and conservation researches in the KNP and similar reserves in southern Africa.

Keywords: plant DNA barcodes; phylogeny; APG; phylogenetic diversity; habitat types; Kruger National Park





Improving Pasture Dynamics with Legumes and Minimum Till – Techniques and Economics

SESSION CHAIR: T PHILLIP NENGWENANI

Thursday, 14 July 2011, 08:30 – 10:30

Platform and Poster Presentations

PLATFORM PRESENTATION: INCORPORATING ANNUAL LEGUME PASTURES INTO THE CROPPING SYSTEMS OF THE SWARTLAND, WESTERN CAPE – AN ECONOMIC EVALUATION

Mark B Hardy^{1*}, Johann A Strauss¹, Samiel J A Laubscher¹ and Mardé Booysse²

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Rainfed agricultural production systems in the Western Cape have been based on winter cereals since the 1700s. In the Swartland, located in the west coast region of the Province, wheat has been the main crop for the past century and was produced in monoculture with an occasional break of bare fallow or oats pasture. The establishment of annual legume pastures, that are adapted to the moist cool winters and dry hot summers, was encouraged during the land improvement scheme of the 1970s and 1980s with limited success, despite extensive research showing the benefits of including such pastures (annual *Medicago* and annual clover species) into a farming system in rotation with wheat. Benefits include: increased wheat production following medic pasture, better weed control (particularly grass weeds) during the legume phase, lower input costs for wheat production due to factors such as reduced N requirements following the legume phase, and reduced weed control costs. In this paper we undertook an economic analysis (to the gross margin level considering gross income, and direct and indirect allocatable variable input costs) of a large-scale, long-term experiment that compares several crop and crop/annual legume pasture rotation systems. This was done in an attempt to determine the potential economic implications of including sheep production from annual legume pastures into the rainfed grain production systems of the Swartland. No-till production practices are used for all crops in the experiment. Data from the 2002 to 2010 seasons were included in the analysis. Eight rotation systems were compared, each with a 4-year cycle, viz. 1-wheat monoculture (WWWW), 2-WWWC, 3-WCWL, 4-WWLC, 5-WMWM, 6-WMCM, 7-WMcWMc-1 and 8-WMcWMc-2 (where W = wheat, C = canola, L = lupin, M = medic & Mc = medic /clover mixed pasture). Continuous cropping (systems 1 to 4) consistently had the highest input costs except in 2004 and 2006 when there were no differences ($P < 0.05$) in input costs among systems. In four of the nine years, systems 1 and 2 had higher ($P < 0.05$) input costs than all systems that included pastures (systems 5 to 8). System 6 tended to have the lowest input cost over all years. The high cost of fertilizer was a main contributor to input costs for the continuous cropping systems. The highest gross margins were obtained from the crop/pasture systems (systems 5 to 8) in most years although high input costs due to lime and phosphorous applications as well as certain herbicide applications reduced the margins in some pasture systems, in some years. While the monoculture tended to have to lowest gross margin over all years, system 8 tended to have the highest gross margin. The continuous cropping system 3 (WCWL) was most similar in gross margin to the crop/pasture systems in most years. Detailed statistical analyses of gross margin data derived from each treatment plot (camp) and based on 4-year averages for 2004 to 2010, confirmed these trends with system 8 (WMcWMc) having higher ($P < 0.05$) gross margins than system 1 (WWWW) in all cases. Given the lower input costs and higher or similar gross margins and, therefore, lower financial risk, these results clearly illustrate the benefits of including annual legume pastures into the rainfed farming systems practised in the Swartland, Western Cape.

Keywords: annual legume pastures; economic analysis; sheep; no-till; Swartland



POSTER PRESENTATION: SOIL PH IN DIFFERENT SOIL STRATA OF KIKUYU-RYEGRASS PASTURES IN AN 18 YEAR NO-TILL SYSTEM

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Adoption of no-till systems for pastures has a beneficial outcome in terms of soil quality and pasture system sustainability. One of the potential problems that may overtake from no-till systems is sub-optimal pH conditions of deeper soil strata, especially under the high nitrogen fertiliser regime that is applied to maximise pasture yield, while lime is only applied on the surface. The recommended soil pH range for kikuyu-ryegrass pastures is between 5.0 and 5.5. The soil pH of 96 soil samples taken in Katspruit and Westleigh soil forms, selected from no-till kikuyu-ryegrass pastures under similar management practices, were tested in a 1M potassium chloride solution at a dilution ratio of 1:2.5. The soil pH of the Katspruit soil form decreased sharply from an average pH of 4.96 at 100mm depth to 4.18 at 700mm. Values as low as 3.31 have been recorded, which will have serious adverse reactions on the growth of roots. The average soil pH of the Westleigh soil form, however, increased from 5.43 at 100mm depth to 6.26 at 800mm. The pH values of most soil strata of the Katspruit soil form are suboptimal and that of the Westleigh soil form supra-optimal. The effect of management, especially surface application of lime over a long-term period (18 years), had different effects on the different soil forms. Emphasis should be on the importance of adaptive management of different soil forms, since it should be beneficial to productivity and sustainability of the pastures.

Keywords: no-till systems; soil pH; kikuyu-ryegrass; pastures management

PLATFORM PRESENTATION: A MINIMUM-TILL PRODUCTION SYSTEM ON MARGINAL LANDS IN THE EASTERN CAPE PROVINCE

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Abandoned lands at two sites in the Eastern Cape Province South Africa were established to a suite of different pasture legumes during April 2007. The two sites are on a rainfall and temperature gradient, with Lushington at an altitude of 897m, annual rainfall of 728 mm, Tmax average of 19.4°C and a Tmin average of 10°C while Roxeni is at an altitude of 520m, annual rainfall of 579 mm, Tmax average of 25°C and a Tmin average of 11°C.

At each site fourteen different pasture legume species were planted and replicated twice in a randomized block design. The legumes were planted with a no-till pasture seeder in plots measuring 30m X 2.5m. The sites were only grazed annually during the winter months (June – August) starting in 2008.

To determine the survival potential of the different legumes that were planted, plant counts were done during the last week of September 2010 (40 months after establishment). Ten 0.1m² quadrats were set out per plot and all the plants of the relevant species were counted.

With autumn planting an average of six times more plants (1 800 000) per ha survived at Lushington compared to Roxeni (300 000). In the spring planted sites no legumes survived at Roxeni (more harsh climate) while at Lushington an average of 590 000 plants per ha survived. At both sites autumn planting resulted in a higher rate of survival than spring planting could produce.

The rate of survival of all species except Lucerne (*Medicago sativa*) was higher at Lushington than at Roxeni.

Keywords: pasture legume; no-till; survival potential



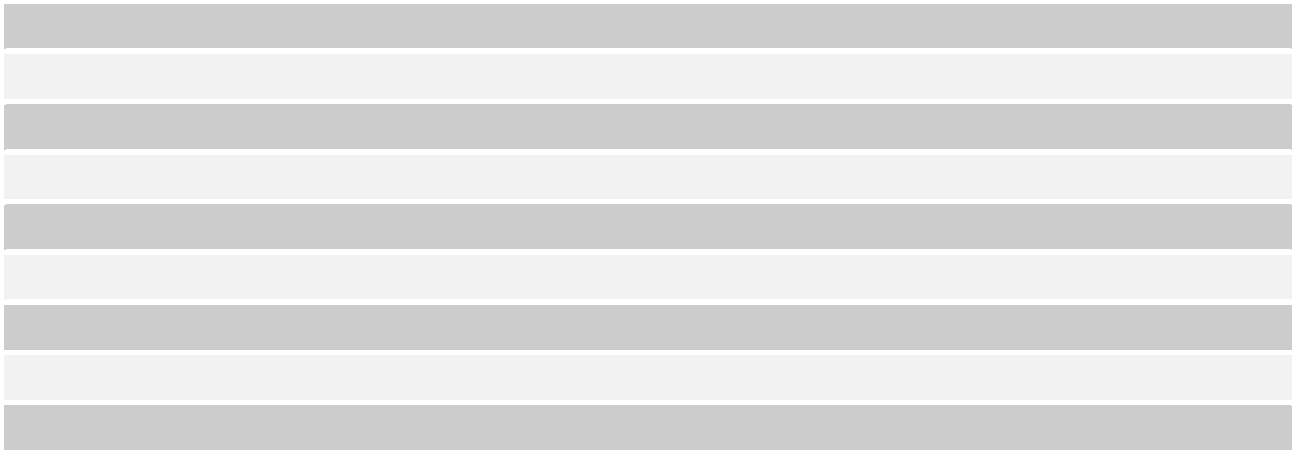
PLATFORM PRESENTATION: THE USE OF THE LOSS-ON-IGNITION METHOD TO PREDICT SOIL ORGANIC CARBON IN WESTLEIGH AND KATSPRUIT SOIL FORMS

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Ninety-six soil samples of Katspruit (gleyic) and Westleigh (plinthic) soil forms, selected from no-till kikuyu-ryegrass pastures, were used to develop equations for predicting soil organic carbon (SOC) content as determined from wet oxidation by the Walkley-Black method, from weight loss-on-ignition (LOI) using a furnace. Representative samples were taken from 24 locations (12 per soil form) and at eight depth increments of 100 mm. The vertical distribution of SOC displayed differences for the two soil forms. Soil organic carbon contents ranged from 7.22 to 0.09% in the Katspruit form and 4.64 to 0.09% in the Westleigh form, with the lowest values at a depth of 800 mm. Loss-on-ignition values ranged from 12.013 to 0.286% in the Katspruit form and 7.120 to 0.582% in the Westleigh form. Within each soil form, strong linear relationships were observed between LOI and SOC with r^2 ranging from 0.611 to 0.971. Loss-on-ignition is a rapid, economical and accurate method for estimating SOC content. However, a particular regression equation needs to be developed for each individual soil form.

Keywords: soil organic carbon; loss-on-ignition; gleyic; plinthic; vertical distribution



POSTER PRESENTATION: THE EFFECT OF DIFFERENT INOCULATION METHODS ON NODULATION OF THREE CLOVER SPECIES

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The role of legumes in the supply of nitrogen to the soil is well known. The method of inoculation is not always applied as prescribed. This varies from pelleting with *Rhizobium* bacteria, lime and adhesive or inoculation of seed with *Rhizobium* bacteria and adhesive alone or inoculation with bacteria and water alone or even spreading the *Rhizobium* bacteria on the soil after or with planting. A pot experiment was conducted at the University of Limpopo in which Red clover, Arrow leaf clover and Strawberry clover seed were inoculated in different ways. The following four inoculation treatments were applied on all three species: 1) a control treatment with no *Rhizobium* bacteria; 2) bacteria applied to the soil after planting (before irrigation); 3) wetting the seed with water and then mixing with bacteria and 4) applying the prescribed adhesive (CMC) to the seed and mixing with bacteria.

The nodulation process was initially slow in the control treatment and where the bacteria were applied on the soil. However a large amount of microscopic nodules formed later, but were too small to be weighed. The inoculation of seed with water plus bacteria resulted in good nodulation, but on average (between species) the treatment with adhesive (CMC) plus bacteria formed the largest amount of nodules. In treatment 4, the nodule size was the biggest and also pinkish in colour, which is a sign of healthy nodules.

Keywords: inoculation; nodulation; *Rhizobium*; clovers; adhesive



PLATFORM PRESENTATION: ASSESSING THE VALUE OF THE JACOBSON TABLE AS A METHOD TO DETERMINE GERMINATION PERCENTAGE FOR COATED MEDICAGO SATIVA SEED

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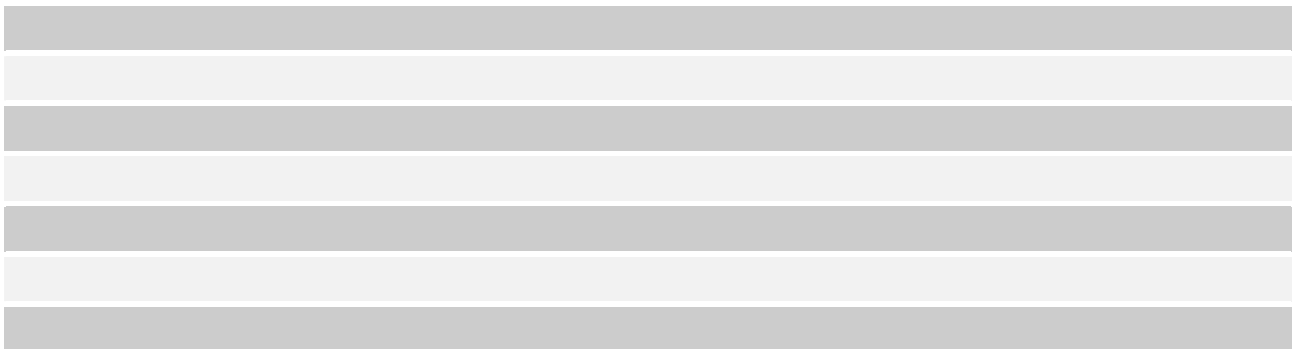
Germination is a process well described in physiological terms and water plays an essential role in this process. The process is driven by water potential differences between seed and soil water. The effects of different water potentials on germination range from damage, stay of germination or inhibition of germination. Factors influencing water potential differences are the amount of dissolved substances in the water and the amount of water in the substrate, i.e. the concentration of water.

When testing the germination potential of coated seed, the coating material influences the water potential of the substrate, therefore having the potential to influence the germination processes. In this study, substances in coated seed include nutrients, inoculant, insecticides and a fungicide suspended in a polymer.

According to data obtained from conventional germination trials using petri-dishes, there is a notable difference between coated and uncoated lucerne seed, where uncoated seed had higher germination percentages and rates. In our study, as an alternative to the closed system of a petri-dish a Jacobson table, also known as a Copenhagen apparatus, was used. With a Jacobson table, there is a reservoir of water, wetting the surface of the filter paper with a wick. This allows not only water movement towards the seed, but also chemical movement away from the seed. In these trials, ISTA (International Seed Testing Association) guidelines will be used with regards to temperature and water quality. Both the conventional and Jacobson table method was conducted in the "top of paper" method (TP), allowing the seedlings to continue to grow up to the seventh day.

Results found with the Jacobson table were corroborated with an emergence trial and the investigation of seven day old seedlings from each of the germination trials. The emergence trial will be conducted under similar environmental conditions, but will be planted in silica sand and watered with distilled water. It is therefore expected that this study will enable us to determine a more suitable method to test the germination potential of coated seed.

Keywords: water potential differences; germination potential; coated seed; Jacobson table; Copenhagen apparatus; emergence trial



POSTER PRESENTATION: THE DRY MATTER PRODUCTION OF ANNUAL FORAGE LEGUMES IN THE SOUTHERN CAPE OF SOUTH AFRICA

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A number of annual legume species are available as fodder for animal production in South Africa. It is important that these cultivars are evaluated in terms of dry matter (DM) production. The aim of this study was to evaluate the production potential of annual cool season forage legume cultivars. The trial, consisting of 12 cultivars, was carried out as a small plot trial on an Estcourt soil type on the Outeniqua Research Farm near George in the Western Cape of South



Africa. Sprinkler irrigation was used with irrigation scheduling done according to tensiometer readings. The trial was planted during May 2009 and May 2010 and carried out over two years. The experimental design was a complete randomised block design. Results were compared over four cuttings for 2009, as well as 2010.

Table 1: The total dry matter production (kg DM ha⁻¹) of annual winter growing forage legume cultivars evaluated at Outeniqua Research Farm for 2009 and 2010.

Species	Cultivar	Total DM production	Total DM production
		(kg DM ha ⁻¹) 2009	(kg DM ha ⁻¹) 2010
Arrowleaf clover	Zulu	4874 ^b	2212 ^{cd}
Balansa clover	Paradana	3094 ^{defg}	1735 ^{de}
Berseem clover	Calipso	11078 ^a	4370 ^a
Biserrula	Casbah	451 ^h	753 ^e
Barrel medic	Paraggio	2391 ^{fg}	2172 ^{cd}
Burr clover	Santiago	2796 ^{efg}	3489 ^{ab}
Sub clover	Campeda	3707 ^{cde}	2016 ^d
Yellow serradella	Sharano	2055 ^g	1567 ^{de}
Sub clover	Woogenellup	3902 ^{bcd}	2192 ^{cd}
Persian clover	Lazer	4332 ^{bc}	3072 ^{bc}
Pink serradella	Emena	3064 ^{defg}	2379 ^{cd}
Grazing vetch	Max	3197 ^{def}	1756 ^{de}
LSD (0.05)		1062	1008

^{abcde} Means with no common superscript differ significantly (P<0.05)

LSD = Least significant difference

Calipso had the highest total DM production and only Santiago could compete with it during 2010. Calipso, as a Berseem clover, is more productive than most of the other species.

Keywords: annual legumes; dry matter production



Planted Pasture Production – Irrigation, Harvesting Stage and Dry Matter Yields

SESSION CHAIR: PIETER A SWANEPOEL

Thursday 14 July 2011, 11:10 – 13:00

Platform and Poster Session

PLATFORM PRESENTATION: WATER PRODUCTION FUNCTION OF ANNUAL RYEGRASS AS AFFECTED BY NITROGEN

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At present and more so in the future, irrigated agriculture will take place under conditions of water scarcity. Owing to the global expansion of irrigated areas and the limited availability of irrigation water, there is a need to optimize water use efficiency (WUE). In South Africa, annual ryegrass (*Lolium multiflorum*) is one of the most widely grown cool season pasture species under irrigation. Water and nitrogen shortage are, however, limiting factors for the production of this type of pasture. By using proper irrigation and nitrogen management tools, the water productivity of the pasture can be improved. The objective of this study was therefore to determine the effects of different water levels in combination with different N fertiliser applications on the water production function (WPF) of annual ryegrass. For two seasons (2007 and 2008), the trial was conducted under a rain shelter on the Hatfield Experimental Farm of the University of Pretoria. The plots were arranged in a complete randomised block design with three replications. Three water applications to field capacity were applied i.e. a schedule of 1) once every two weeks, 2) once a week and 3) twice a week. Nitrogen was top-dressed after each harvest at a rate of 0kg, 30kg or 60 kg N per hectare. Soil water content was measured with a neutron probe to a depth of 1.2 m. After calculating the deficit, plots were irrigated to field capacity. Ryegrass was harvested to 50 mm above the ground on a 28 day cycle. Irrigation treatments ranged from 282 to 464 mm. The WUE ranged from 26.4 kg ha⁻¹mm⁻¹ to 28.6 kg ha⁻¹mm⁻¹ for the treatment that was irrigated once every two weeks and top-dressed with the highest level of nitrogen. From this study, it was concluded that the WPF was affected by the atmospheric evaporative demand, and the WUE was improved with higher N fertiliser applications as higher yields were produced.

Keywords: evapotranspiration; irrigation; water use; water use efficiency

PLATFORM PRESENTATION: THE EVALUATION OF DRY MATTER YIELD AND FORAGE QUALITY FOR FOUR PASTURES AS INFLUENCED BY THREE FREQUENCIES OF FLOOD IRRIGATION IN THE FALSE UPPER KAROO

T Phillip Nengwenani^{1}, Wayne F Truter² and Loraine van den Berg¹*

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Water is a scarce resource, particularly in the False Upper Karoo area where the average rainfall is 350 mm per year. Water, therefore, has to be used efficiently to avoid over-irrigation and under-irrigation of cultivated pastures. Flood irrigation is inefficiently used by farmers and most of them are uncertain about the impact of water on the dry matter yield and forage quality of different cultivated pastures. Due to the water constraints in the False Upper Karoo area, it is



essential to provide flood irrigation guidelines to farmers for different annual and perennial pastures, as well as their response to different water treatments.

Four cultivated pastures which are commonly used by the farmers in the False Upper Karoo area have been evaluated under three frequencies of flood irrigation: *Trifolium resupinatum* (Persian clover), *Medicago sativa* (Lucerne), *Lolium multiflorum* (Italian ryegrass) and *Festuca arundinacea* (Tall fescue). The three frequencies of flood irrigation treatments were: 1) Flood irrigation once per week (W1), 2) Flood irrigation once in two weeks (W2) and 3) Flood irrigation once in three weeks (W3). Amount of water was measured by V notch and rainfall was recorded. Annual and seasonal dry matter (DM) yields were measured. Annual and seasonal forage qualities: Crude protein (CP), Calcium (Ca), Potassium (K), Magnesium (Mg), Sodium (Na) and Phosphorus (P) were analyzed. Statistical analysis of monthly and annual dry matter yields and forage qualities of four pastures under different treatments are shown in Tables 1, 2, 3 and 4.

Table 1: Statistical analysis of monthly and annual dry matter yield and forage qualities for a Persian clover pasture between different water treatments

Treatment (T)	Dry matter and forage qualities						
	M	CP	Ca	K	Mg	Na	P
T monthly	*	**	**	**	**	**	**
T annually	S	NS	NS	NS	NS	NS	NS

*Significant at $P < 0.05$, **significant at $P < 0.01$ and NS = not significant at $P > 0.05$

Table 2: Statistical analysis of monthly and annual dry matter yield and forage qualities for a Lucerne pasture between different water treatments

Treatment (T)	Dry matter and forage qualities						
	M	CP	Ca	K	Mg	Na	P
T monthly	*	**	**	**	**	**	**
T annually	S	NS	NS	NS	NS	NS	*

*Significant at $P < 0.05$, **significant at $P < 0.01$ and NS = not significant at $P > 0.05$

Table 3: Statistical analysis of monthly and annual dry matter yield and forage qualities for an Italian ryegrass pasture between different water treatments

Treatment (T)	Dry matter and forage qualities						
	DM	CP	Ca	K	Mg	Na	P
T monthly	**	**	**	**	**	**	**
T annually	**	NS	NS	NS	NS	*	NS

*Significant at $P < 0.05$, **significant at $P < 0.01$ and NS = not significant at $P > 0.05$

Table 4: Statistical analysis of monthly and annual dry matter yield and forage qualities for a Tall fescue pasture between different water treatments

Treatment (T)	Dry matter and forage qualities						
	DM	CP	Ca	K	Mg	Na	P
T monthly	**	**	**	**	**	**	**
T annually	**	NS	NS	NS	NS	NS	NS

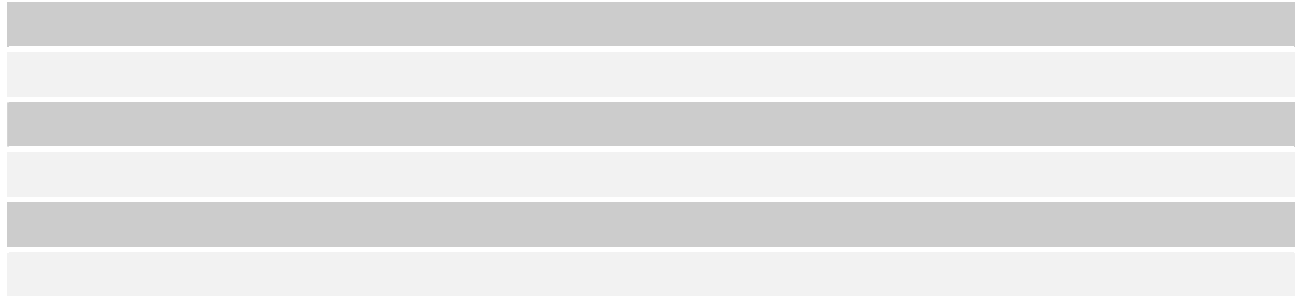
*Significant at $P < 0.05$, **significant at $P < 0.01$ and NS = not significant at $P > 0.05$

Significantly different ($P < 0.01$) between treatments monthly, on dry matter yields and forage qualities, not significantly different ($P > 0.05$) between treatments annually, on dry matter yields and forage qualities (CP, Ca, K and Mg) and significantly different ($P < 0.05$) between treatments annually, on forage quality (P) for a Lucerne pasture (Table 2). Significantly different ($P < 0.01$)



between treatments annually, on dry matter yield ($P < 0.01$) and forage quality (Na) at ($P < 0.05$) for an Italian ryegrass pasture (Table 3). Significantly different ($P < 0.01$) between treatments monthly, on dry matter yield and forage qualities, not significantly different ($P > 0.05$) between treatments annually, on forage qualities and significantly different ($P < 0.01$) between treatments annually, on dry matter yield for a Tall fescue pasture (Table 4).

Keywords: False Upper Karoo; cultivated pastures; flood irrigation; dry matter; forage qualities



PLATFORM PRESENTATION: DEVELOPING SIMPLE IRRIGATION SCHEDULING CALENDARS OF PASTURE USING SOIL WATER BALANCE MODEL - RYEGRASS AS AN EXAMPLE

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Water is one of the most limiting resources for irrigated pasture production. To increase irrigation efficiency many irrigation scheduling tools have been developed and made available to irrigators. Their adoption is however, still limited to only a few irrigators. This is due to the high costs and complexity of monitoring tools, especially for resource poor farmers. Hence, the Water Research Commission initiated a project to study the water use of planted pastures with the objective of providing farmers with simpler options for irrigation scheduling. The soil water balance model (SWB) is a mechanistic, real time, generic, crop growth, soil water balance and irrigation scheduling model and was calibrated and validated intensively for different sites and irrigation regimes using the measured data from the project. In this way the model was used to develop site specific irrigation guidelines for the major pasture growing areas of South Africa using annual ryegrass as an example. The model can now be used by farmers and irrigation consultants to develop their own site specific irrigation calendars with a few relatively simple input parameters. These calendars then can be modified to give allowance for rain or used in conjunction with simple low cost irrigation scheduling tools. SWB is freely available and can be downloaded from the following website <<http://www.up.ac.za>>.

Keywords: planted pastures; soil water balance model (SWB); ryegrass; irrigation scheduling calendar

PLATFORM PRESENTATION: CALIBRATION OF THE RISING PLATE METER FOR PASTURE YIELD DETERMINATION IN KIKUYU (*PENNISETUM CLANDESTINUM*) OVER-SOWN WITH RYEGRASS (*LOLIUM SPP.*)

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The rising plate meter (RPM) has been used by researchers and farmers to estimate the dry matter (DM) production of pastures grazed by dairy cows. There is limited data available for the calibration of the RPM for kikuyu over-sown with ryegrass and grazed by dairy cows in the Western Cape Province of South Africa. The aim of the study was to evaluate the calibrations developed for the RPM during a two year systems trial conducted on the production potential of kikuyu over-sown with Italian (*Lolium multiflorum* var. *italicum*), Westerwolds (*Lolium multiflorum* var. *westerwoldicum*) or perennial ryegrass (*Lolium perenne*) at the Outeniqua Research Farm in



the Western Cape Province of South Africa. Pastures were under permanent irrigation and intensively strip grazed by dairy cows. The pre-grazing and post-grazing regressions developed for all three kikuyu-ryegrass treatments differed over seasons and years, primarily due to the change in botanical composition from ryegrass-based pastures during winter to kikuyu-based pastures during summer. The post-grazing regressions developed during the study did not have a lower degree of accuracy (R^2 values) than the pre-grazing regressions. The RPM regression equations developed for kikuyu-ryegrass pastures could be of use to farmers in the surrounding area with similar pastures and management practices.

Keywords: rising plate meter; kikuyu; ryegrass; pasture yield

PLATFORM PRESENTATION: THE EFFECT OF HARVESTING STAGE ON HERBAGE YIELD AND NUTRITIVE VALUE OF *PANICUM COLORATUM* UNDER SUB HUMID CLIMATIC CONDITIONS OF ETHIOPIA

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The study was undertaken to evaluate the effect of stage of harvest on Dry Matter (DM) yield and herbage nutritive value of *Panicum coloratum* under sub humid tropical climatic conditions in the western zones of Ethiopia. The herbage ($P < 0.05$), leaf ($P < 0.05$) and stem DM yields ($P < 0.01$) and leaf to stem ratio ($P < 0.001$) values were significantly affected by stage of harvest while the effect of stage of harvest on harvestable stand density was not significant ($P > 0.05$). With lapse of time in maturity, the DM yield, stem yield and stand density tended to exhibit an increasing trend. Harvesting stage significantly affected ($P < 0.01$) crude protein (CP), neutral detergent fibre (NDF) ($P < 0.05$) and in vitro DM digestibility (IVDMD) ($P < 0.01$). Correspondingly, the effect of stage of harvest was not significant ($P > 0.05$) for acid detergent fibre (ADF), phosphorus (P), cellulose, hemi-cellulose, lignin and calcium (Ca) concentrations. The mean in vitro DMD value at 12 weeks of age was 6.73 and 6.25 percentage units less than the ones recorded for 8 and 10 weeks of age. The values of NDF obtained in the present study were far higher than reported critical levels. The effect of stages of harvest on the concentrations of P was not significant ($P > 0.05$). The values are apparently lower than the ranges reported to be adequate for maintenance in beef and dairy cattle and sheep and goats. Harvesting stage effect on Ca concentration was also not significant ($P > 0.01$). Higher values were recorded for early cut samples and except for the samples harvested at 10 weeks of age, a higher Ca value than required for dairy animals was recorded.

Keywords: *Panicum coloratum*; stage of harvest; herbage yield; nutritive vales; calcium and phosphorus





POSTER PRESENTATION: THE SUMMER DRY MATTER PRODUCTION OF EIGHT SUB-TROPICAL GRASS SPECIES UNDER DRYLAND CONDITIONS IN THE SOUTHERN CAPE OF SOUTH AFRICA

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Changes in rainfall patterns, high summer temperatures and scarcity of water for irrigation call for research on summer producing sub-tropical grasses for milk and beef production in the Southern Cape. Fifteen sub-tropical grasses were planted in a small plot trial, under dryland conditions, on an Estcourt soil type on the Outeniqua Research Farm near George (rainfall 728 mm per year) in the Western Cape of South Africa during March 2010. The aim of this study was to evaluate the production potential of summer producing perennial sub-tropical grass cultivars. The treatments were managed as foggage and sampled on a 90 day cycle.

Table 1: The dry matter content, dry matter production rate and total dry matter production of perennial sub-tropical grass cultivars evaluated under dryland conditions at Outeniqua Research Farm during the summer of 2010.

Species	Cultivar	DM content (%)	DM production rate (kg DM ha ⁻¹ day ⁻¹)	Total DM production (kg DM ha ⁻¹)
<i>Antheophora pubescens</i>	Wollie#	.	.	.
<i>Brachiaria brizantha</i>	Brachiaria	21.74 ^{de}	22.56 ^{cde}	2075 ^{cde}
<i>Chloris gayana</i>	Katambora	20.25 ^e	49.88 ^a	4589 ^a
<i>Chloris gayana</i>	Katambora*	24.11 ^{de}	49.27 ^a	4533 ^a
<i>Cynodon dactylon</i>	Bermuda	22.97 ^{de}	0.45 ^f	42 ^f
<i>Cynodon dactylon</i>	Vaquero	11.77 ^f	0.07 ^f	6 ^f
<i>Digitaria eriantha</i>	Irene	25.20 ^{de}	14.79 ^{ef}	1360 ^{ef}
<i>Digitaria eriantha</i>	Irene*	25.92 ^d	16.21 ^{def}	1492 ^{def}
<i>Eragrostis curvula</i>	PUK E436	37.51 ^{bc}	40.80 ^{ab}	3753 ^{ab}
<i>Eragrostis curvula</i>	Ermelo*	43.18 ^a	38.06 ^{abc}	3501 ^{abc}
<i>Eragrostis curvula</i>	Agpal	35.91 ^{bc}	22.05 ^{de}	2028 ^{cde}
<i>Eragrostis curvula</i>	Ermelo	39.64 ^{ab}	30.49 ^{bcde}	2805 ^{bcde}
<i>Panicum maximum</i>	Gatton	23.42 ^{de}	29.85 ^{bcde}	2746 ^{bcde}
<i>Panicum maximum</i>	PUK 8	22.89 ^{de}	17.64 ^{de}	1623 ^{de}
<i>Ehrharta calycina</i>	Mission	32.20 ^c	32.18 ^{bcd}	2960 ^{bcd}
LSD (0.05)		5.64	16.58	1526

^{abcde} Means with no common superscript differ significantly (P<0.05); LSD = Least significant difference; *Pelleted seed;

#Did not produce during the summer of 2010

The cultivar Ermelo (pelleted) had a higher DM content than most of the cultivars and only the DM content of Ermelo was similar. The cultivars Katambora and Katambora (pelleted) had a higher total DM production and DM production rate than most of the cultivars and only PUK E436 and Ermelo (pelleted) could produce a similar amount of DM. The *C. gayana* (Rhodes grass) cultivars Katambora and Katambora (pelleted), as well as the *E. curvula* (Weeping Love grass) cultivars PUK E436 and Ermelo (pelleted) were the most productive species.

Keywords: Summer producing; *Chloris gayana*; *Digitaria eriantha*; *Eragrostis curvula*; *Panicum maximum*

**POSTER PRESENTATION: THE DRY MATTER PRODUCTION OF BRASSICA AND RAPHANUS SPECIES IN THE SOUTHERN CAPE OF SOUTH AFRICA***M Dalena (M) Lombard*, Philip R Botha and Janke van der Colf*Western Cape Department of Agriculture, Institute for Plant Production, Outeniqua Research Farm, George, email: dalenal@elsenburg.com, philipb@elsenburg.com, jankevc@elsenburg.com

Grass and legume pastures are used as fodder for dairy and beef cattle in the Southern Cape. There is a need for productive high quality crops during the summer and autumn. Possible alternatives are species from the *Brassicaceae* family. These include forage rape (*Brassica napus*), forage turnip (*B. rapa*), Kales (*B. oleracea*), Swedes (*B. napobrassica*) and fodder radish (*Raphanus sativus*). Leaves, stems and/or bulbs can be utilized as forage, depending on the species. A cultivar trial was executed on the Outeniqua Research Farm near George, consisting of eight cultivars. The experimental design was a complete randomised block design. Plots were sampled individually when specific species reached maturity. The aim of this study was to evaluate the dry matter (DM) production potential of forage rape, forage turnip, Kales, Swedes and fodder radish cultivars.

Table 1: The dry matter production and dry matter content of annual Brassica and Raphanus cultivars evaluated on Outeniqua Research Farm.

Species	Cultivar	Days from plant to harvest	DM Prod. Leaves, Stems (kg DM/ha)	DM Prod. Bulbs (kg DM/ha)	Total DM Prod. (kg DM/ha)
Forage rape	Interval	81	5383 ^a	*	5383 ^a
Forage rape	KR7872	81	5307 ^a	*	5307 ^a
Forage turnip	KR7809	64	4379 ^{ab}	131 ^c	4510 ^{ab}
Forage turnip	Dynamo	64	4051 ^{bc}	176 ^b	4228 ^{bc}
Kale	Caledonian	139	3947 ^{bc}	*	3947 ^{bc}
Kale	KR6099	139	3721 ^{bc}	*	3721 ^{bc}
Fodder radish	Nooitgedacht	64	3249 ^c	106 ^c	3355 ^{cd}
Swede	Invitation	139	2069 ^d	252 ^a	2320 ^d
LSD (0.05)			1064	35	1068

^{abcde} Means with no common superscript differ significantly ($P < 0.05$)

LSD = Least significant difference

*No bulbs

The cultivars Interval and KR7872 had a higher total DM production than most of the cultivars and only KR7809 could produce a similar amount of DM. The cultivars Interval and KR7872 had a higher leaf and stem DM production and only KR7809 could produce a similar amount of DM. The forage rape cultivars Interval and KR7872 and the forage turnip cultivar KR7809 were the most productive species.

Keywords: Forage rape, forage turnip, Kales, Swedes, fodder radish, cultivars



Rethinking Approaches to Communal Rangelands II

SESSION CHAIR: CLEMENT F CUPIDO

Thursday, 14 July 2011, 14:00-15:00

Platform Presentations

PLATFORM PRESENTATION: PERCEPTION OF COMMUNAL FARMERS ON CAUSES, TYPES OF DEGRADATION AND TECHNIQUES TO RESTORE DEGRADED RANGELANDS

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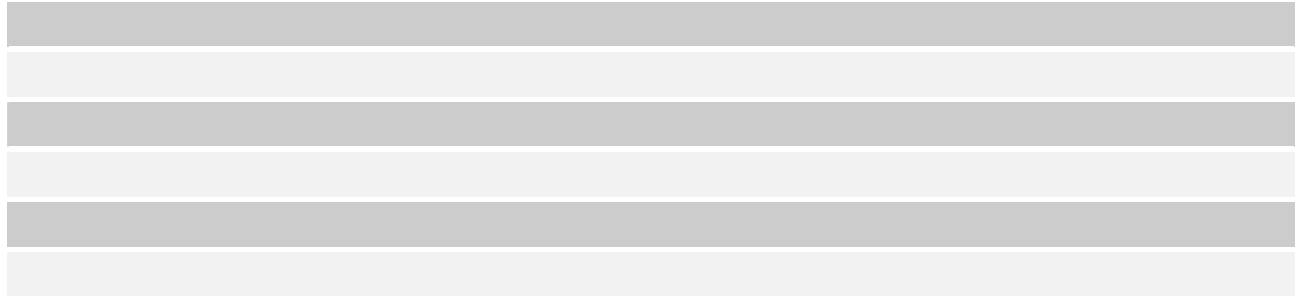
Degradation in biological and physical rangeland resources has become a serious challenge in communal rangelands. Rangeland users' perceptions have been overlooked in the determination of whether the rangelands are degraded or not, and the communal production system has been considered to be ecologically unfriendly and unsustainable. The members of the community influence the management of rangelands and therefore, their engagement in identification of degradation as a problem, vegetation restoration, and proper rangeland management as a solution and identification of a desirable rangeland state as governed by land users' interests and land production capacity are important. The objective of this study was to investigate land users' perceptions of the causes of rangeland degradation, the characteristics they use to describe degradation, and the alternative restoration techniques they apply. The study was conducted at Amakuze Tribal Authority (ATA) which is composed of six villages viz. Makuzeni, Gomro, Mpundu, Guquka, Sompondo, and Gilton. The study area was located at S32° 38', E26°56' with the altitude ranging from 763 m.a.s.l in low lands to 1500 m.a.s.l at the summit. Four villages were selected randomly and 40 households were selected in each village for a questionnaire survey. The soft system analysis (SSA), Sustainable Livelihoods Analysis (SLA), focus group discussions, various participatory tools and a structured questionnaire survey were used to determine communal rangeland residents' perceptions on rangeland management, degradation and restoration. Participatory Rural Appraisal (PRA) and focus group discussion data were analysed qualitatively. The questionnaire data were analysed with Chi square (SPSS-PC 1999). The villages were used as the replicates for one way ANOVA that was used to compare the differences between the respondents on quantitative variables.

Farmers indicated that communal rangelands were accessed by everyone as a resident right and no one controls access to rangelands, and there are no grazing rules. Farmers perceived the rangeland condition to be poor and this was attributed to burning (10.2%), bush encroachment (12.4%), land formation (14.6%), poor soil quality (16.8%), drought (20.4%) and poor grazing practices (25.6%). The rangelands were perceived to be degraded but there was no rehabilitation attempt by farmers on degraded parts of rangeland. Animals were perceived to be grazing all over the grazing area both in summer and winter without much area grazing preference. Farmers perceived that fencing of camps could serve as the best way to ensure sustainable utilization of grazing resources. Farmers perceived that degraded rangeland still had the potential to recover. The proposed method to facilitate rangeland recovery was building of stonewalls. Demarcation of rangelands into camps through fencing, appointment of rangers and rotational grazing practices were perceived to be the major factors that could improve rangeland management and therefore, prevent land degradation. Farmers indicated that they would like to be trained in rangeland



management in order to improve their grazing practices and manage rangeland degradation. They believe that building soil erosion control physical structures combined with provision of fences, appointment of rangers and use of objective grazing practices will control animal movement and in turn reduce land degradation. Farmers identified lack of skills in rangeland management as another factor causing rangeland degradation and therefore, would necessitate training in order to improve their knowledge of rangeland management.

Keywords: perceptions; communal; management; degradation; grazing



PLATFORM PRESENTATION: TESTING THE ACCEPTANCE OF A BOX BALER FOR HAY IN A SOCIETY OF HIGH TECHNOLOGY DEVELOPMENT

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In rural communities the shortage of fodder during winter and drought periods is a critical challenge for livestock. Farmers cannot afford to buy feed for maintaining animals during this time of the year. This is a problem in arid and semi-arid areas and humid areas. Farmers who can afford to plough forage in big areas often struggle due to tractor shortages and mechanical problems. Manual baling of fodder has never been a technique used to address this problem, except the use of machines which are not practical when a small area is planted. Introduction of the box baler could be a solution to overcome this fodder deficit. The box baler can be used to bale legumes, grass and maize stover for better storage and space saving. A box baler is a rectangular box made of wood, closed on one side to retain what is being baled and enabling pressing of the forage.

The box baler test was done at Döhne Research station and at Boldpoint community by 18 people. Two sizes were tested: Bigger box (BB) 1m x 50cm x 40cm and the smaller box (SB) 75 x 50 x 40 cm. The box baler test on the research station was done using grass cut by a mower and left to dry for 2 days. The grass was collected by hand and laid along the length and breadth of the box, one layer in each direction and pressed by trampling. Two ropes were laid across the box to hold the bale. The Participatory Rural appraisal technique has been applied to test the box balers. The first trial on the community was to test the boxes on already cut lucerne (70cm long) which had been left to dry for one day. Lucerne cut from an area of 11m x 5m was required to fill up the bigger box and from an area of 6m x 5m for the smaller box. The third test will be done by two individuals at Boldpoint community on lucerne and maize stover.

The results from the research station showed that the time taken to fill up and press the BB/SB with cut and wilted grass was 15 minutes by 13 people. When taking the bale out it has been observed that a third rope across the box's length will hold the bale better. Observations from the Boldpoint community study showed that the lucerne collection and filling of SB/BB took 20 minutes by 18 people. The BB box baler required extra effort to pull out the bale. The SB was easier to pull with an observation that the pulling rope must be under the two ropes laid across the bale. Evaluation on post field trial test: While in the field the farmers made comments and agreed that the technology is relevant to farmers who plant a small area. The BB could be used by men and youths, while the SB could be used by women and old men. The SB requires less energy to remove the bale as the bale weighs 11kg. The BB has a bale that is exactly the size of a machine bale and weighs 15kg. Both the SB and BB could be used for maize and grasses. Six out of 18 farmers mentioned that will be useful to bale grass, 6 out of 18 mentioned lucerne and 7 out of 18 mentioned maize stover.

Baling of maize stover eases transportation and storage from the field to the feed store. Competition of the box baler with the big project (lucerne baling project) has not been seen to be a



threat to their business. A job opportunity has been identified for someone to sell box balers. Time taken to cut the material with a sickle has not been tested, but evaluation is continuing. Farmers have been given the boxes to test. Generally, the technique has been introduced at a good time as rains have been heavy and a lot of forage has been produced. Therefore, anyone who is prepared to work harder for his/her animals could cut as much hay as they want to for their animals before it is burnt.

Keywords: box baler; fodder; lucerne; maize stover

PLATFORM PRESENTATION: RAINWATER HARVESTING FOR INCREASING LIVESTOCK FORAGE ON THE SEMI -ARID RANGELANDS OF LAMBANI VILLAGE, SOUTH AFRICA

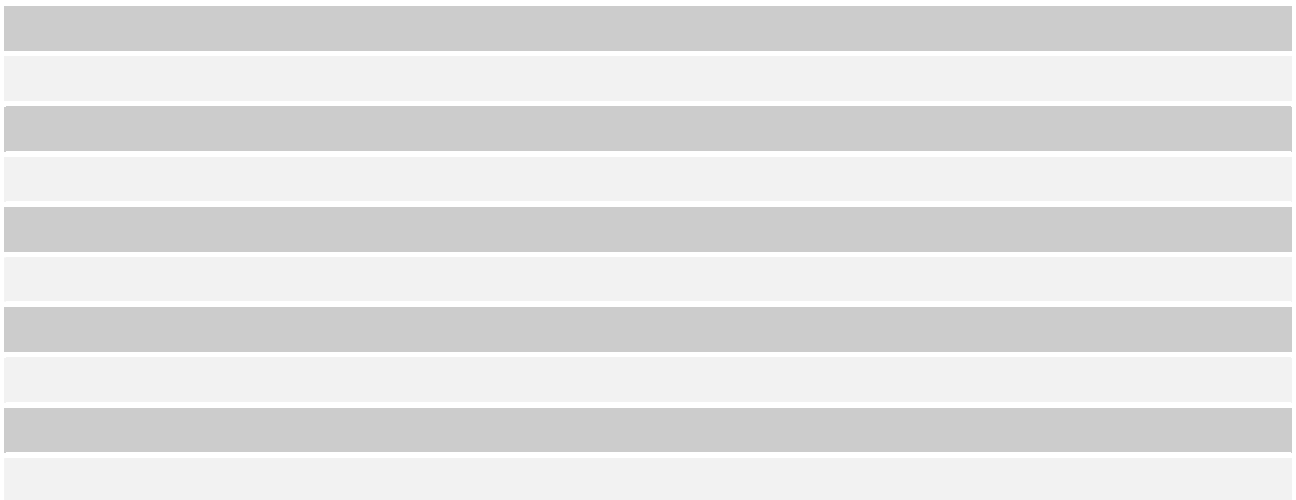
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The term water harvesting means the concentration, collection, and distribution of water that would naturally exit a landscape through other processes (runoff, evaporation). In the area where the study was conducted, water is the most limiting natural resource; hence every drop of rain should be utilized optimally. Lambani Village is in the semi-arid area with low rainfall and high evaporation. The long-term (1965-1993) climate data indicates that the area receives 579 mm of rain on average per annum of which 82% is received between October and March. The first aim of this project is to enhance the awareness of Lambani people of the importance of rangeland management in the production of livestock and to work hand in hand with local communities to demonstrate how improving range management practices can be of direct benefit to the Lambani people and the resources on which they depend. The second aim is to improve food security, incomes and livelihoods of smallholder farmers in the Limpopo Basin, through rangeland management, rainwater harvesting also improving livestock production.

Four treatments were implemented in 2009. Each treatment area is approximately 25m x 25m in size with the objectives of identifying and describing the farming system (rangeland, livestock) and to analyse the current practices within the existing farming system. This is in order to ascertain: what works, what does not work and what could be improved. Treatment 1: covering bare patches with branches, no grazing. Treatment 2: remove the *Helichrysum kraussii* (shrub) and cover the bare patches with branches, no grazing. Treatment 3: contracting water basins, no grazing and treatment 4: control, continuous grazing. The grass species present in the four treatments are: *Digitaria eriantha*, *Pogonarthria squarosa*, *Tricholaena monachne*, *Panicum maximum*, *Brachiaria brizantha*, *Hyperthelia dissolute*, *Perotis patens*, *Eragrostis regidior* and *Heteropogon contortus*. Results for both the 2009/10 and 2010/11 growing seasons on plant cover range from 5% to 70%, with treatment 1. The grass species also increases from 5% to 79% on treatment 1 over both growing seasons. Treatments 2 and 3 did not differ much from Treatment 1. The continuous grazing done in Treatment 4 did not give positive results compared to the other treatments. In Treatment 2, new seedlings of *Helichrysum kraussii* were also counted in 2010 and 2011 during the growing season. Therefore, the veld conditions ranged from poor, moderate and good conditions when compared to the initial stage/state.

Keywords: rainwater harvesting; livestock forage; rangelands





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