grass roots

Newsletter of the Grassland Society of Southern Africa

Incorporating Vol. 16-1 of the Bulletin of the Grassland Society of Southern Africa
ISSN: 10166122 ?Vol. 6 ?No. 1 ?February 2006

Deserts: managing southern Africa's Drylands

Fire:

Savannas and grasslands

Transfrontier conservation in the 'berg

Climate change in Africa

No-Till in KwaZulu-Natal

Contents

Features

Regulars

P.O. Box 41? Hilton ? Pietermaritzburg ? 3245 ? South Africa
Tel: +27 (33) 390 3113 ? Fax: +27 (33) 390 3113 ? Cell: 083 256 7202
Email: admin@gssa.co.za ? http://www.gssa.co.za

Editorial

Dear members

Welcome to the first edition of the New Year, and may January be the worst month of 2006.

This is the second edition of our new-look *Grassroots*, and, from the feedback we received, you seem to like it. Many of the comments were emails to the effect of “Grssrts looks nice. Shot”, so we couldn't really publish them, but thanks to all those who did write in. There was one letter, though, that did *not* fit that mould…

We are integrating the *Grassroots* and the website more effectively, so that both can be kept as up-to-date as possible, with news appearing in both media. Many thanks to all those who submitted notices for the website.

Speaking of the Website, Freyni and Glen have done a sterling job of updating the website and making it more relevant to our members, and the public. See the November 2005 issue of *Grassroots* for more details. If you haven't looked at it recently, I suggest you give it a go you should be pleasantly surprised. The site is much faster now, so even farm lines should be able to cope.

We're linking our site to other websites, starting with SciDev.net. This site is a brilliant news website dedicated to science in the developing world (there are two articles from SciDev.net in this issue of *Grassroots*). Click on the link on our website to see the top three current features on SciDev.net. There'll be more links in the future, which we'll announce in future issues of *Grassroots*, but keep checking the website is updated a lot quicker than the newsletter.

Alan

The Grassland Society of Southern Africa is dedicated to the advancement of the science and practice of range ecology and pasture management.

We welcome any contributions to the Grassroots*, in the form of news, informative articles, reports, short research notes, scientific papers and letters to the Editor. Email alan.short@dae.kzntl.gov.za or admin@gssa.co.za or fax 033-3559 605 or 033-3903113*

Printed by Wilprint
10 Willowton Road
Willowton
Pietermaritzburg
wilprint@iafrica.com

Letters

Dear Friends all,

NOW we're 'cooking with gas!'

Being a member of the Forestry Institute and EWT with wide personal and professional environmental interests, I'm delighted to read of your widening scope and look forward to seeing what develops. For too many years too many of us have tended to concentrate on our own 'little boxes', a lesson I learnt 35 years ago when moving from Zambia to [then] Rhodesia, where the 'little box' mentality was actively encouraged. With good reason in some cases, but to the detriment of the 'whole' in the broader sense.

Inclusion of the Ground Hornbill Group [to which I happen to be a recent field contributor] is an excellent start, and long may it continue, while not losing sight of the central strand of veld and range.

Having battled with ill-informed adverse criticism when introducing Goats to create a mixed Cattle-Goat system on our School farm some 11 years ago, I'm delighted to read Winston's 'change the animals to suit the bush, rather than [struggle to] change the bush to suit the animals' talk at Döhne.

My ranch experience is about to close shortly as I find it impossible to manage a small livestock enterprise in the anarchy which pervades the 'Zimbabwe' of today. Ten years of careful closed Nguni breeding destroyed by fence cutting and stray scrub bullocks about which the 'authorities' do nothing; vandalism, snaring, theft, lack of vet requisites and supplements exacerbated by the economic collapse of the last couple of years, associated unemployment, drought and 'Party' politics all combine to an unrewarding occupation which I propose to terminate in the next few months. Leave me time for more beneficial enterprises such as my involvement with community forestry - and livestock - here and in Zambia, our rented smallholding [this year's trees all planted on time for once], railway research with our national museum team, collating years of field notes, and learning how to use Punkin 'Puter to his full potential & not just for letters!

Bully for the DNA boffins and changing more names. I shall exercise my right of choice of classification, and shall retain *Acacia* with which I've been familiar for all these years. And not write any 'official papers' even if invited!

My very best wishes all round to all acquaintances & friends of years gone by [& shall commiserate with the Dredded Koos in the near future],

Love & Light from an ever Darkening Corner of our Spherical Globe,

geof

M Calvert, Waggon Wheels, Box 19 Plumtree Zim ; c/o Plumtree High School PB 5874 Plm, Zim]

ph ## 263 19 3547;
cell [zim] 011 615 994
gag@zol.co.zw

Letter (reluctantly) shortened Ed

News

Ecosystem assessment wins top environment award

David Dickson
Source: SciDev.Net

More than 1,300 biodiversity experts from 95 nations have shared one of the world's top environmental prizes for carrying out the first international scientific assessment of the planet's ecological health.

The 2005 Zayed International Prize for the Environment, awarded for 'scientific and or technological achievement in environment' went to the scientists for their work on the Millennium Ecosystem Assessment (MEA), whose final report was completed earlier this year

The international jury that awarded the prizes described the MEA as a "landmark study on the condition of the world's ecosystem services from fisheries and freshwaters up to the carbon capture of the world's forests".

The jury added that the assessment underlines the economic importance of the natural environment and demonstrates that the degradation of ecosystems is progressing "at an alarming and unsustainable rate".

http://www.scidev.net

EIA for Petronet's proposed new pipeline from Kendal (Mpumalanga) to Waltloo (Gauteng)

The Bohlweki-SiVEST Joint Venture held a number of public meetings in January to provide feedback on the findings of the environmental scoping study.

The draft Environmental Scoping Report will be available for review on the project website(www.nmppela.co.za) from 30th January until 28th February. Written comments should be submitted by 28th February 2006.

Contact: Nicolene Venter or Gift Magangane of the Bohlweki-SiVEST Joint Venture, PO Box 11784, Vorna Valley, 1686
Tel: (011) 466-3841
Fax: (011) 466-3849
e-mail:
k-w@nmppela.co.za

Route maps, registration form, comments form and other documentation also available from admin@gssa.co.za.

LETTERS (cont.)

In the past few months various people have asked about indigenous ornamental grasses for their gardens. I would like to know if anyone is aware of publications giving information on which of our indigenous grasses are suitable as ornamentals and how one could use them in the garden e.g. in full sun or semi-shade, around bird baths or simply for their beauty

Sigrun Ammann

Readers, write in - Ed

MSc and PhD bursaries available for students in rangeland, plant or animal ecology to work on NRF-funded research project:

The role of key resources in the Richtersveld National Park: Implications for livestock population dynamics and biodiversity conservation under current and climate change scenarios

The research is collaboration between co-investigators at Rhodes University (Dr Susi Vetter), the University of Cape Town (Prof. William Bond), Edinburgh University (Prof. Andrew Illius) and South African National Parks (Dr. Howard Hendricks). The project is based in the Richtersveld National Park (RNP).

The project aims to test recent theory on plant-herbivore dynamics in semi-arid systems. In particular, the aim is to test the predictions of modelling work by Illius and O'Connor (1999, 2000), which are:

1. Long-term mean herbivore abundance is very largely determined by the quantity of key resources, and scarcely at all by resources available in the wet season.
2. The potential for grazing-induced transformation of the vegetation comprising the wet-season resource increases as the ratio of key resource to wet season resource increases.

This theory is becoming widely cited but has not so far been explicitly tested in the field. Possible research projects under this programme include:

- Quantifying the seasonal, inter-annual and spatial variation in forage production and quality in the RNP.
- Relating this variability to herbivore and herder movement as well as herbivore population dynamics.
- Exploring the impacts of herbivore movement and numbers on the plant communities of the Richtersveld National Park.
- Comparisons of livestock population dynamics in the RNP (where herders have access to the Orange River) and similar areas in Namaqualand (e.g. Paulshoek) which do not have such a key resource available to them.
- Predicting impacts of climate change on the plant-herbivore dynamics and herder livelihoods.
- NRF funding is available for one MSc and one PhD student. Students will register at Rhodes University or at the University of Cape Town. At the PhD level, opportunities for study in Edinburgh may also exist for suitable candidates.

Applicants must have a strong background in ecology. Knowledge of plant-herbivore systems is a strong recommendation. A working knowledge of ecological modelling, remote sensing or animal nutrition would be an added advantage.

The NRF requires that preference be given to South African nationals.

Interested applicants should contact Susi Vetter at s.vetter@ru.ac.za.

DEADLINE for submissions: 15 March 2006

More information about the project can be found by going to www.ru.ac.za/botany and following the links.

Upcoming Events

From www.gssa.co.za

Population and habitat viability assessment for the Bearded Vulture
Date: 6 - 10 March 2006
Venue: Sterkfontein Dam
Contact: Brenda Daly by 10 February 2006
011 4861102, brendad@ewt.org.za

Training Workshops on Building Capacity to Set Priorities for Agricultural Biotechnology in West and Central Africa
Deadline for Registrations: 15 February 2006
Date: 13 - 17 March 2006 (2nd follow-up workshop: 1-5 May 2006)
Venue: Dakar, Senegal
Contact: marcel.nwalozie@coraf.org

1st COSTECH Scientific and Technological Conference: Science and Technology for Growth and Poverty Reduction in Tanzania
Deadline for Registrations: 15 March 2006
Date: 17 - 19 May 2006
Venue: Tanzania
Contact: costech@costech.or.tz

SEAON Summit and Student poster competition
Date: 26-28 March
Venue: Gauteng
Website: www.saeon.ac.za/students/
Contact: Marina Joubert
marina@southernscience.co.za

First International Association of Agricultural Information Specialists (IAARD) African Chapter Conference
Early Registration Deadline: 21 April 2006
Date: 21 - 26 May 2006
Venue: Hotel Intercontinental Nairobi, Kenya
Contact: Dr. Joseph Kiplang
jkngetich@yahoo.co.uk

Grassland Society 41st Annual Congress
Date: 17-21 July 2006
Venue: ATKV Klein Kariba, Bela Bela
Deadline for early bird registration: 31 May 2006
Contact: Freyni du Toit
admin@gssa.co.za
Website: www.gssa.co.za/congress2006

South African Weed Science Society Congress
Date: 15-18 July 2006
Venue: ATKV Klein Kariba, Bela Bela
Contact:
Suzette Bezuidenhout
Suzette.Bezuidenhout@dae.kzntl.gov.za

Global Spatial Data Infrastructure-9 Conference: Spatial Data - Tool for Reducing Poverty
Date: 6 - 10 November 2006
Venue: Santiago, Chile
Contact:
Harlan Onsrud onsrud@gsdi.org

International Conference on the Future of Transhumance Pastoralism in West and Central Africa
Date: 20 - 24 November 2006
Venue: Abuja, Nigeria
Deadline for Submission of Abstracts: 20 March 2006
Contact: Professor Jerome Gefu
jgefu@yahoo.com

21st Annual Conference of the Society for Conservation Biology
Date: 1 5 July 2007
Venue: Port Elizabeth
Details to be announced

Council news

The GSSA Council met on 19 January 2006 at ARC in Irene.

The Council discussed expanding the marketing of GSSA to include more ecologists. Rangeland ecology has been a strong feature of the Society since its founding, but many ecologists still don't consider the GSSA as a possible outlet for their work.

The possibility of a new award for "Most Improved Farmer or Community" was discussed, as there was a feeling that we should do more to encourage wise use of resources by recognising those who have demonstrated a concerted effort to improve their veld and pasture management systems.

The possibility exists through Prof. Winston Trollope to get an exciting and dynamic keynote speaker from the USA for Congress 41 to talk on managing for heterogeneity. Funding for this is being sought. This is a good opportunity to expose SA scientists to global thinking and exposure for the GSSA in the USA.

The Council is still in discussion with NISC about the costs of producing the journal and the online access through Ingenta. Although NISC is doing an excellent job of producing the journal, the online accessibility leaves much to be desired, as it is a complex and not very intuitive process.

The acting Treasurer, Justin du Toit, gave a good summary of the financial dilemma of the GSSA. This highlighted the need for the GSSA to actively seek new sources of funding, since there are very few opportunities for cost-cutting.

Luthando Dziba, the acting PRO, has offered to publicize the GSSA to university students throughout the country as he will have the opportunity to travel with the ARC staff to the various universities. A new banner and poster are being designed; the new flier is already available.

2006 has been declared the International Year of Deserts and Desertification by the UN. See this issue of *Grassroots* for more.

Congress 42 will be held in the Eastern Cape in 2007. Susi Vetter, of Rhodes, has agreed to drive the organising of the Congress, and has already proposed a number of symposia for the event.

To pay your subscriptions or Congress fees online, follow these steps:

1.Go to www.gssa.co.za, and click "Subscriptions".

2. Choose Subscriptions or Congress 41 on the left. Click the category (e.g. "Ordinary") for which you wish to pay (click "View all" at the top of the page to see all available categories).

3. Type the quantity that you wish to pay for.

4. Confirm that you have made the correct choices, and click "Checkout".

5. Create a new account if you have not used the facility before.

6. Supply your credit card details. The site is a secure online shopping facility.

8. Follow the instructions and voila - you've paid your fees!

Climate change 'could disturb African savannahs'

Wagdy Sawahel
Source: SciDev.Net

Trees and shrubs could take over some of Africa's savannahs if, as many predict, rainfall in the Sahel increases in the next 50 years, say researchers in Nature this week (8 December).

Savannahs broad grasslands with scattered trees are both economically important and ecologically unique. The balance between tree cover and grassland is crucial, influencing both plant and livestock production, and ecological systems such as the water cycle.

Now a team of researchers led by Mahesh Sankaran of the Natural Resource Ecology Laboratory at Colorado State University in the United States, has found that annual rainfall plays a key role in determining how the balance between trees and grass is maintained.

Using data from 854 sites across Africa, Sankaran and colleagues report that savannahs fall into two types: 'stable' and 'unstable'.

'Stable' savannahs are those that receive less than 650mm of rainfall per year. Here, the amount of rain restricts the number of trees, allowing grasses to coexist.

'Unstable' savannahs receive more than 650mm each year. The amount of tree cover in such savannahs is determined not by rainfall, but by disturbances like fires and animals feeding.

Sankaran's data suggests that if rainfall increases across parts of Africa, as several climate change models predict, some 'stable' savannahs could be converted to 'unstable' savannahs. This means they would gradually be taken over by trees.

Changes in the tree-grass balance would have significant impacts on plant and livestock production, biodiversity, and the water and carbon cycles.

The research effectively combines the two dominant schools of thought on how trees and grasses can coexist in savannahs whether the balance is regulated by the availability of resources such as water, or by disturbances such as fire.

"Our analyses suggest that the two ecological viewpoints about mechanisms that determine tree-grass ratios in savannahs… are [both] valid, but at different points along a rainfall gradient," Sankaran told SciDev.Net.

He added that while many savannahs are not necessarily under immediate threat, it is very important to understand what drives the coexistence of trees and grasses in different regions in order to help manage savannahs as climate conditions change.

Reference

Nature 438, 846 (2005)

The Desert Margins Program in South Africa

Klaus Kellner
plbkk@puk.ac.za

The mission of the Desert Margins Program (DMP) is to help Africa stop the degradation of its drylands, particularly its biodiversity, soils and carbon stocks, by sharing sustainable practices and strengthening human capacities.

The strategy followed by the DMP is to:

- Analyze the root causes of dryland degradation in Africa;
- Document indigenous knowledge of sustainable practices;
- Develop more sustainable practices;
- Help governments design policies that encourage sustainable practices;
- Enhance African institutional capacities for land degradation research and outreach;
- Facilitate the sharing of technologies, knowledge and information; and
- Forecast possible climate change scenarios for land use planning.

The DMP program follows a multidisciplinary approach and is active in nine countries of Sub-Saharan Africa. These include four West African countries (Senegal, Niger, Burkina Faso and Mali), one East African country (Kenya) and four Southern African countries (Botswana, Zimbabwe, Namibia and South Africa). The incremental funding for the DMP program is by the Global Environment Facility (GEF), and the implementing agency is the United Nations Environmental Program (UNEP). The executing agency for all the African countries is ICRISAT (International Crops Research Institute for the Semi-Arid Tropics) in Niamey, Niger and the National Coordination Unit (NCU) for South Africa is at the North-West University (Potchefstroom campus). The main stakeholders in the DMP program include the farmers and local communities that depend on the natural resource for their livelihoods, as well as researchers, technicians, extension staff and policy makers from Government Departments (National and Provincial), academic and training institutions, non-governenmental organizations (NGOs) and community-based organisations (CBOs), international research centres, private enterprise and other relevant organizations. The DMP program will also enhance effective national participation in trans-boundary biodiversity conservation and sustainable management, such as Botswana, Namibia and Zimbabwe in the Southern African region.

The overall objective of the DMP is to arrest land degradation in Africa's desert margins through demonstration and capacity building activities. The GEF increment to this project will enable the programme to address issues of global environmental importance, in addition to the issues of national economic and environmental importance. The DMP has been developed in response to a recommendation made to the international research community at UNCED to consider specific contributions for implementation of the three International Conventions on Biodiversity, Climate Change, and Desertification. Three key areas were identified: (1) poverty alleviation; (2) increased agricultural production; and (3) environmental protection.

Similar circumstances and problems face all nine countries of sub Saharan Africa that form part of the DMP alliance and therefore have the same challenge to develop an integrated national, sub regional, and international action programme for developing sustainable natural-resource management options to combat land degradation and loss of biodiversity. The DMP therefore builds on the existing National Programs, such as LandCare, and involve both development and action-research efforts to unravel the complex causal factors of biodiversity loss through land degradation.

The DMP program runs over a period of 6 years from 2003 to 2008 (3 phases of 2 years each) and includes 7 to 8 outputs and 40 activities, depending on the specific needs and expectations in each country. The main expected outputs therefore include:

- Improve the understanding of ecosystem status and dynamics with regard to loss of biodiversity;
- Develop and implement strategies for conservation, restoration and sustainable useof degraded agro-ecosystems;
- Enhance the capacity of stakeholders and target populations;
- Test and promote alternative livelihood systems (including poverty reduction strategies in arid systems);
- Formulate, adopt and implement sound policy intervention/guidelines for sustainable resource;
- Implement participatory natural resources management methods;
- Ensure that target populations are involved at all stages of the project's cycle;
- Identify linkages between poverty and land degradation (Southern Africa).

> The mission of the Desert Margins Program (DMP) is to help Africa stop the degradation of its drylands

The GEF component of DMP will further develop and implement improved management of land use practices that restore and rehabilitate degraded agricultural land through integrated approaches that lead to sustainable use of globally significant natural resources and landscapes. The focus includes targeting the endemic organisms that are the keystone species, which determine ecosystem function, above and below ground, at different spatial scales (benchmark sites, national and sub-regional). This focus will seek to determine the causes, extent, severity of biodiversity loss, as well as the physical processes of soil and ecosystem degradation in selected key sites in Africa that harbour globally significant biodiversity.

The sites selected by the DMP countries are priority sites for dryland conservation and rehabilitation highlighted in the different country National Action Programmes (e.g. UNCCD) and have been identified in a consultative process encompassing national stakeholders at all levels. Hence, the DMP meets the dual country needs of arresting land degradation at priority sites, and of developing replicable models for promotion of sustainable dryland management and food security in all drylands at risk of desertification. At the sub-regional level, programmes have been initiated to carry out targeted actions to conserve biodiversity, including *inter alia*, to create a sub-regional information system, to harmonize databases and to strengthen human capacity development at the grass-roots level. Bottom-up consultations and negotiations were undertaken in each country with leaders of rural communities and donors of existing baseline activities to derive suitable target areas and ensure co-financing arrangements as demanded by GEF.

The 4 target areas that have been selected in South Africa where the projects of the DMP program are carried out in the Northern Cape and North West Provinces, are: Paulshoek (Namaqualand), Suid Bokkeveld and Mier (Kalahari) in the Northern Cape and the Molopo (Bophirima region) in the North West Province. The collaboration and partnership between the DMP and other National and internationally funded programs, such as LandCare, BIOTA (Biodiversity Monitoring Transect Analysis in Africa), SKEP (Succulent Karoo Ecosystem Programme) and the European Union is also very strong.

The projects in each of the target areas are site specific and depend on existing activities, but all form part of the overall objective and outputs of the DMP program as prescribed for all participating countries. The strategy proposed for choosing sites within the DMP project is to focus most of the effort on a small number of well monitored sites where the work of the soil, plant, and animal scientists can be integrated with the studies performed by the socio-economists, policy analysts, and institutional analysts. These sites also act as sub regional "field laboratories", where the necessary interactions between farmers, researchers, and development workers are established. It is the partnerships formed by this integration of disciplines and combination of farmers/resource users contemporary knowledge, research and development, which is the strength of the DMP program.

Each main project in the 4 target areas has a project leader. The main objectives of the projects include:

North-West Province

1. Molopo (Partners from NWU and DACET)

- Design of a biodiversity assessment protocol: Characterize and establish baseline information on indigenous and endemic biota in different land-use systems. Importance of biodiversity for sustainable utilization of desert margin areas and indicators of degradation.
- Best land-use strategies and innovative approaches to sustainable biodiversity monitoring, conservation and management in semi-arid areas.
    - o Impact of communal grazing on soil and vegetation properties and their relations in semi-arid rangelands.
    - o Evaluate, document and promote best practices for biodiversity restoration, based on sound policy and legislation frameworks.

- o Evaluate changes in biodiversity in different land-use strategies and management using selected bio-indicators (e.g. ants). Contributions to social and economic development for agriculture and wildlife conservation.

Northern Cape Province

2. Mier (Mr Desmond Smit)

Awareness, training, capacity building and environmental education to increase the flow of information and understanding of land degradation and restoration practices between service providers and communities through technology transfer. Evaluate restoration and management strategies applied by farmers over the short and long-term.

3. Paulshoek (Dr Nicky Allsopp)

Sustainable management of natural resources for improved livelihoods, which are socially inclusive and ecologically sound and equitable. Enhance household food security and facilitate improvements in livestock farming. Develop and implement restoration methodologies.

4. Suid Bokkeveld (Mr Noel Oettle)

Conserving biodiversity and other natural resources by enhancing livelihoods of small scale rooibos tea (Aspalathus linearis) farmers including sustainable harvesting, marketing and enterprise development.
Implementation of restoration techniques and strategy plan to improve adaptation to climate risk. GIS for Suid Bokkeveld.

The expected end of the DMP program will make a significant contribution in reducing land degradation in the marginal areas and help conserve biodiversity. The project will at the same time provide alternative livelihoods or strengthen existing livelihoods to the rural communities. Most of the stakeholders, especially the local communities in and around the project sites, will have developed a common purpose and acquired the necessary skills, strategies and policies to: a) conserve and restore biodiversity; b) reduce and ultimately stop land degradation and c) manage the environment and the natural resources in a sustainable manner.

It is also expected that guidelines and recommendation domains (areas) and supportive national policies that address biodiversity concerns would be in place in implementing countries. The role of women in decision-making on management of natural resources will also be greatly improved. The projects are expected to effectively address the root causes of the threats to globally significant ecosystems in the region (long-term impact) and contribute towards biodiversity restoration in the region.

For further information, please contact:
Prof Klaus Kellner
DMP-National Coordinator
School of Environmental Sciences and Development
North-West University (Potchefstroom campus)
Potchefstroom, 2520
E-mail: plbkk@puk.ac.za or
Mrs Hestelle Stoppel
DMP NCU
Tel/Fax: (018) 299 2509

The International Year of Deserts and Desertification

Alan Short
Alan.Short@dae,kzntl.gov.za

The United Nations has declared 2006 the International Year of Deserts and Desertification, in an effort to raise public awareness about the plight of the millions of people living in the increasingly degraded drylands of the world.

Desertification is recognised as a phenomenon caused by human activity, combined with climatic fluctuations, in the world's fragile arid and semi-arid areas. Inappropriate use of natural resources has led to increasing degradation of these areas, with devastating consequences for the millions of people they support.

The United Nations recognised the importance of desertification in 1994, with the adoption of the United Nations Convention to Combat Desertification (UNCCD). National Action Plans, involving Governments, Non-Governmental Organisations and inter-governmental bodies have been established at regional and local level, with the emphasis on participatory programmes involving local communities. Africa has been highlighted as the continent worst affected by desertification.

An interagency committee has been established to drive the celebration of the International Year of Deserts and Desertification. Organisations are encouraged to become active in the initiative and to help raise awareness of desertification, to help stimulate efforts to fight it.

For more information, visit www.iydd.org.

Short-term influence of fire in a semi-arid grassland on (4): soil characteristics

H. A. Snyman
Department of Animal, Wildlife and Grassland Sciences, University of the Free State.
SnymanHA.sci@mail.uovs.ac.za

Introduction

The habitat of plants growing in arid and semi-arid regions of the world is characterized, at least during part of the season, by low and variable rainfall (Oesterheld *et al*. 2001, Wiegand *et al*. 2004), low humidity and high soil temperatures (Du Preez and Snyman 1993, 2003, Snyman 2002). All these factors combine to decrease the storage or availability of soil-water (Snyman 2000), which often becomes a dominant factor in controlling the growth and root distribution of plant species (Shackleton *et al*. 1988, Schenk and Jackson 2002). The direct effect of fire on belowground systems is a result of the burning severity, which integrates aboveground fuel loading (live and dead), soil water (Snyman 2003) and subsequent soil temperature (Snyman 2002), and duration of the burn (Neary *et al*. 1999). Poor root development accompanying fire (Snyman 2005), will increase the plant's susceptibility to drought and will reduce its capacity to extract mineral nutrients from the soil (Matarechera *et al*. 1998). This effect has been strongly implicated in the increasing frequency of man-made drought in the arid and semi-arid regions in southern Africa, in particular.

As with many other biological processes in arid systems, like plant uptake of nutrients and growth, decomposition and mineralization are closely related to climate and many such systems can be characterized as producing “pulses” or “flushes” of nutrients from mineralization during wet periods. Understanding changes in hydrological characteristics of the ecosystem under different fire regimes is therefore essential when making grass management decisions in these areas to ensure sustainable animal production. Therefore, short- and long-term studies are required to test interactions between fire, climate and vegetation change as affecting soil characteristics. The objective of this study was therefore to determine the short-term effect of fire on different soil characteristics in a semi-arid climate.

Procedure

The research was conducted in Bloemfontein (28°50'S; 26°15'E, altitude 1350m), which is situated in the semi-arid (summer annual average 560mm) region of South Africa. The study area is situated in the Dry Sandy Highveld Grassland (Grassland Biome) with a slope of 3.5%. At the start of this study the veld was in good condition (veld condition score was 92% of that of the benchmark site) and dominated by the climax species *Themeda triandra* with *Eragrostis chloromelas* and *Elionurus muticus* also occurring relatively abundantly. Soils in the study area are mostly fine sandy loams of the Bloemdal Form (Roodepoort family 3 200). Clay content increases with soil depth from 10% in the A-horizon (0 to 300mm) to 24% in the B1-horizon (300 to 600mm) and 42% in the B2-horizon (600 to 1200mm).

The research was conducted on 18 plots of 10 x 10m each, with an edge effect of 5m around each plot. The three treatments included fire burning against the wind (back fire), with the wind (head fire) (Trollope 1978), and a control with no burning. The experimental layout was a fully randomized design with three replications for each treatment. Two-way analysis of variance at 95% confidence level (burning x soil layer) was computed for soil-water content. The application of the different treatments on 30 August 2000 and on 23 August 2001 as well as the fire behaviour are fully discussed in the previous volume of Grassroots (Snyman 2005).

The soil-water content was determined gravimetrically by means of a Veihmeyer tube (Snyman *et al*. 1987) at 50mm depth intervals in all treatments (5 samples per treatment), 2, 8 and 20 months after burning.

Soil temperature was recorded with mercury thermometers once a week in each plot at 14:00 at 50, 100 and 200mm soil depths for all treatments (burning and defoliation). Although the thermometers were not properly ventilated, they were shielded. An estimate of soil compaction or soil penetration resistance was obtained from 30-point measurements per plot with a simple rod penetrometer (ELE pocket penetrometer) (Friedel 1987). Compaction readings were taken to a depth of 6mm. Points were placed 1m apart on three parallel lines in each plot. Soil compaction from an undisturbed bare soil surface nearby (Snyman 1999, 2000), against the potential was also measured. These measurements were taken three months (beginning of November), one year (at the end of April) and two years after burning (end of April), at about 18 hours after at least 25mm of rain had fallen (Donaldson *et al*. 1984, Donaldson 1986). Data on soil compaction and soil temperature were analysed using a one-way analysis of variance technique.

Results and discussion

Soil compaction

Fire caused the soil to be more compacted (P=0.01), even two years after the fire, than the case without fire (Figure. 1). Euckert *et al*. (1978) found a decrease in soil aggregate sizes after a burn, where these effects persisted longer than five years. Raindrop energy from post-burn events can destroy soil aggregates at the soil surface and clog soil pores or form a crust that would restrict infiltration and enhance runoff and erosion (Sykora *et al*. 1990). Soil compaction differed non-significantly (P>0.05) between head and back fires. Only two months after the fire, soil compaction was already higher (P=0.01) than that of unburnt grassland (Figure 1). An important contributing factor towards higher compaction with burning can be a decrease in basal cover and litter after the burning (Broersma *et al.* 1999, Snyman 2003, 2004). The loss of vegetative and litter cover (Hoffman and Ashwell 2001, Holm *et al*. 2002) allows a direct impact of raindrops on soils (Russell *et al.* 2001), and may also produce hydrophobic substances that can reduce infiltration (Emmerich and Cox 1992, Snyman 1999). Thurow *et al*. (1988) also argued that the function of aboveground biomass is to protect the surface soil from the disaggregating effect of direct raindrop impact.

The lower soil compaction with the inception of the growing season in all treatments (Figure 1) can be ascribed to its slight lifting by the severe frost characterising the study area during winter. The initial increase in soil compaction as the season progresses, regardless of fire treatment, can be ascribed to greater exposure of the soil to natural elements, while the decrease at the end of the season can be due to an increase in aboveground production (Snyman 2005), affording better protection to the soil. The slow recoveries of plant cover due to fire (Snyman 2005) lead to a decrease in soil compaction during the second season following the fire. The average soil compaction of a bare uncultivated soil surface was an average of 21.60 kg/cm over the two growing seasons, which is not much higher than that of burnt grassland over the first year following the fire. The average soil compaction of unburnt grassland of 7.91 kg/cm obtained in this study is more or less the same as the 8.75 kg/cm obtained by Snyman (2001) also on rangeland in good condition and the same soil form.

Soil temperature

The mean monthly soil temperature at depths of 50mm and 100mm is graphically presented in Figure 2 for the burnt (first year after burning) and unburnt grassland. At these depths, soil temperature did not differ much (P>0.05) between the head and back fires and were therefore presented as an average in Figure 2. Two seasons following burning, soil temperature at all depths did not differ much (P>0.05)

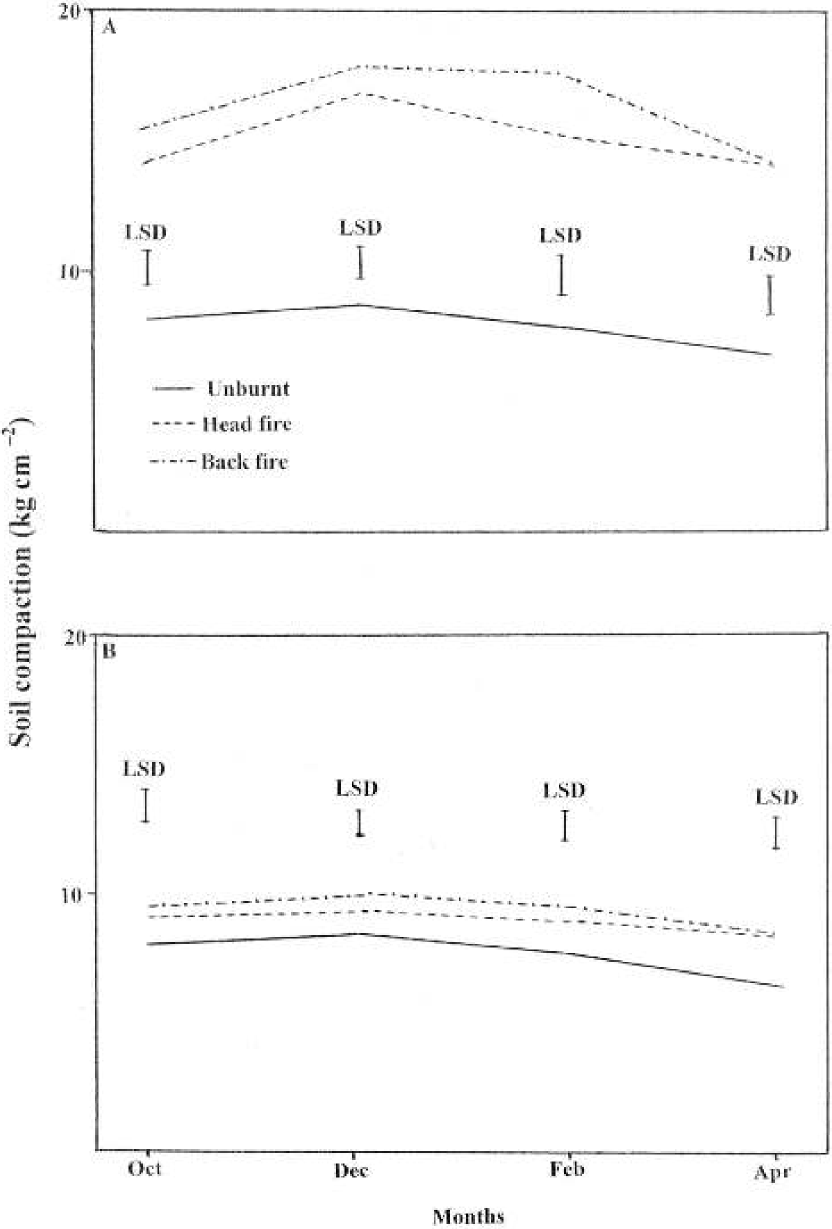

Figure 1: Soil compaction (kg/cm) for the burnt (first = A and second = B season after burning) and unburnt grassland, measured every second month. Least significant differences (LSD) are calculated at the 1% level.

between the burnt and unburnt grassland (data not shown).

Minimum soil temperatures are almost the same (P>0.05) regardless of depth and fire treatment. This low temperature may contribute to the much poorer root mass obtained in both unburnt and burnt grassland over the colder months. Unfortunately, little is known about the way in which root systems integrate the effects of wide ranges of temperature between different zones (Drew 1979, Distel and Fernandez 1988).

For the months of September to April, due to the lower cover (Snyman 2005) and litter, increase (P=0.01) in soil temperature occurred for both depths with grassland burning (Figure 2). The highest soil temperatures, regardless of depth and burning occurred during January, where burnt grassland reached temperatures of as high as 40°C up to a depth of 50mm. The greatest difference in temperature between

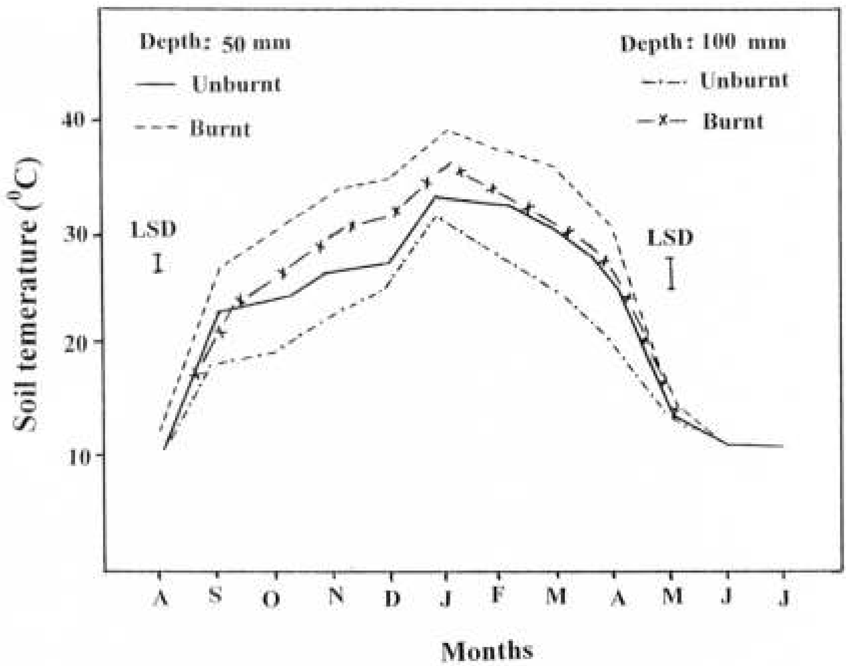

Figure 2: Monthly average soil temperature (°C) taken at ± 14:00 at 50 mm and 100 mm depths for the unburnt and burnt (first season after burning) grassland. Least significant differences (LSD) are calculated at 1% level.

burnt and unburnt grassland, was 7°C during December at a depth of 50mm. The higher soil temperatures recorded from burnt grassland at all depths could potentially restrict root growth (Snyman 2005). Although temperature as high as 40°C could decrease root extension rate in burnt grassland, there is considerable variation between species and genera (Bowen 1991) and it is likely that all of these species have roots adapted to high soil temperatures. In contrast, in the North American prairies, root growth was found to be associated with an increase in soil temperature (in areas where winter snow occurs) and moisture in spring and summer (Bartos and Sims 1974). Further notable from Figure 2, is that the impact of fire over the first half of the growing season was more than that in the second half, in both soil depths. The most important reason for this difference may be the lower plant cover (Snyman 2005) and litter increasing or improving as the season progressed. For most months, soil temperature did not differ significantly (P>0.05) between treatments for the 200 mm depths (data not shown). The soil temperatures also did not vary much at 200 mm depth during the seasons in all treatments. Two years following burning, soil temperatures at all depths did not differ much between the burnt

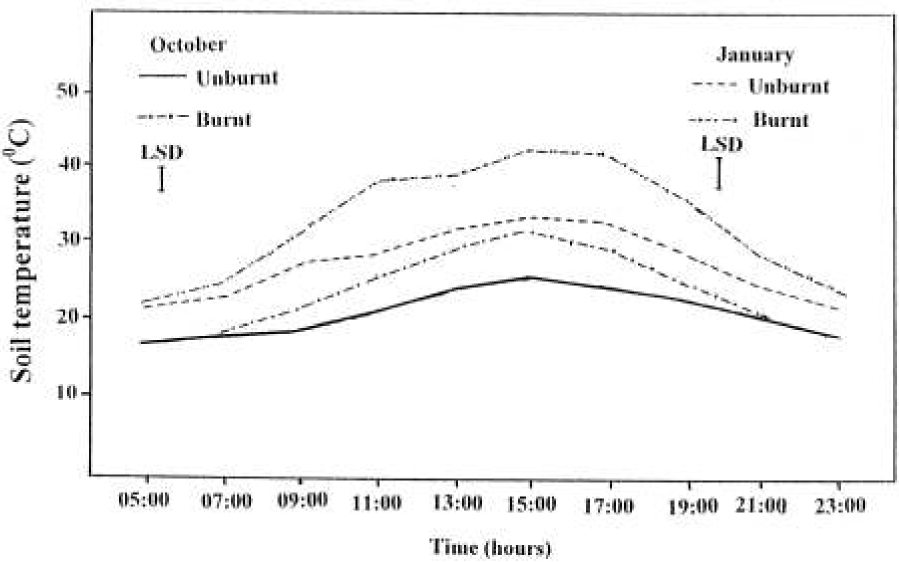

Figure 3: Average soil temperature (°C) for unburnt and burnt (first season after burning) grassland, measured every second hour at 50 mm depth, during the week of 4 October 2001 and week of 4 January 2002. Least significant differences (LSD) are calculated at the 1% level

and unburnt plots.

Burning increased (P<0.05) soil temperatures from 09h00 for both October and January (Figure 3).

With the October observations the soil temperature in case of fire was higher (P<0.05) up to 17h00 than that of the unburnt grassland while in January it was higher (P<0.05) still at 21h00. Later in the season when soil temperatures generally increase, the impact of fire on the heating of the soil surface generally increased to almost a full day. The soil temperatures during January increased more rapidly during the day and remained high for longer than the October temperatures regardless of burning. With the January observations, the soil temperature difference due to fire at 15h00 and 17h00 was as high as 9°C.

The highest temperature on top of the soil of 59°C, 49°C and 46°C respectively for one year after burning, two years after burning and unburnt grassland respectively, occurred during January. The higher soil temperatures observed with grassland burning accorded with previous research (Snyman 2002, 2003, 2004, 2005).

Soil-water content

Fire had a considerable impact on the soil-water content, especially over the first year following the fire (Figure 3). The influence of the head and back fires on soil-water content did not differ much (P>0.05) from each other and therefore the average is presented in Figure 4. The lower soil-water content after 20 months over the first 300mm soil layer, in unburnt grassland, resulted from the low rainfall characterising the second half of the 2001/02 growing season.

Figure 4 clearly shows that after only two months the soil-water content decreased by 23% over the first 900 mm depth due to the fire. This difference can largely be due to the lower plant cover and removal of litter due to the fire, which can be ascribed to an increased loss of water through greater runoff (Snyman 2000) and evaporation (Van de Vijver 1999, Snyman 2005). Over the first year following the fire, the soil-water decreased by 42mm to a depth of 900mm due to the burn treatment. Twenty months after the fire the soil-water was still 21mm lower than that of unburnt grassland. The curtailing of growth due to water limitations depends not only on climatic conditions and soil properties but also on species differences, e.g. rooting depth (Drew 1979, Distel and Fernandez 1988).

The soil layer of 300-600mm depth maintained a relatively constant soil-water content for the three periods of monitoring, regardless of fire. The reason for this may be found in the lesser concentration of roots in this layer (Snyman 2005), regardless of the fire, and also the small difference in root decrease due to the fire (Snyman 2005). The soil water in the soil layer of 150-300mm, was the one mostly decreased by fire and also with most roots occurring here. The considerable (P=0.01) decrease in root mass due to burning was responsible for this great variation.

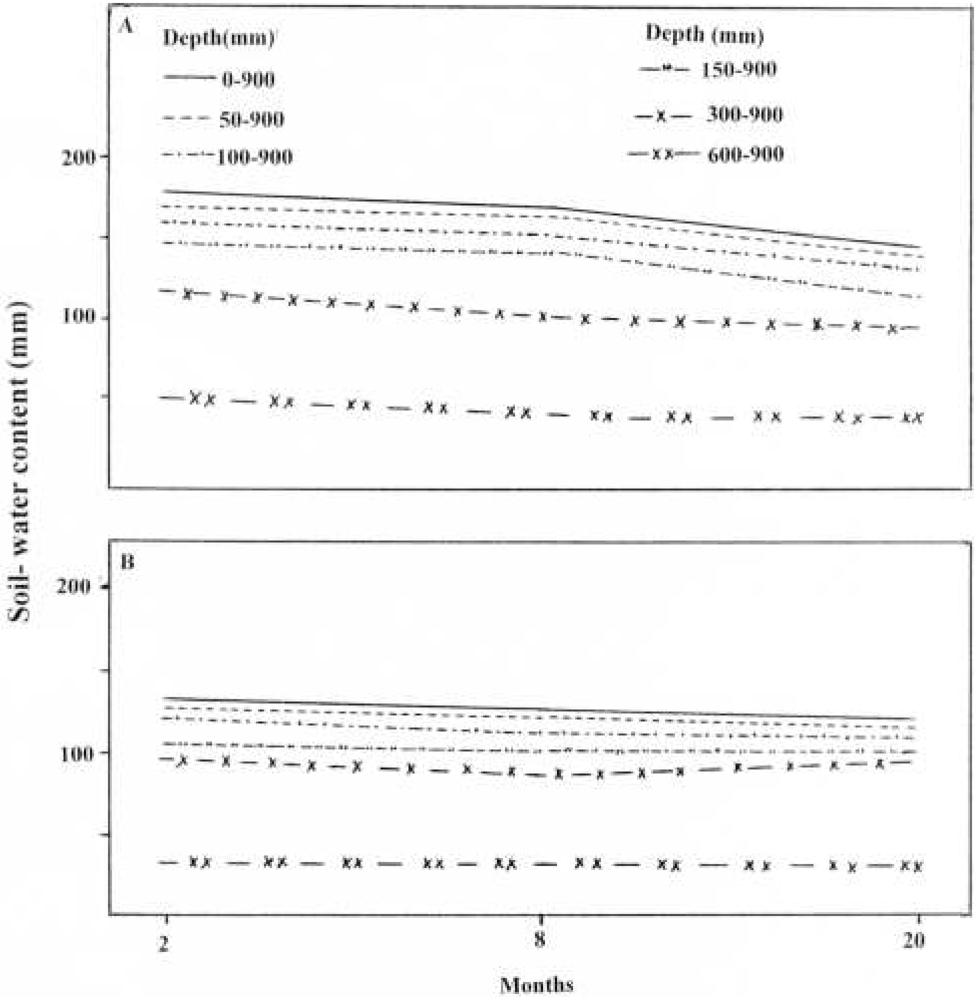

Figure 4: Soil-water content (mm) measured two, eight and 20 months after burning for the unburnt (A) and burnt (B) grassland, over different depths.

Root production in response to increased soil-water has also been recorded for African grasslands (Shackleton *et al*. 1988, 1989, McNaughton *et al*. 1998), Australian rangelands (Mott *et al*. 1992, Ingram 2003) and Argentina grasslands (Distel and Fernandez 1988).

The deep rooting patterns, regardless of fire (Snyman 2005), enable grasses to utilise surface as well as deeper soil-water. The large percentage of roots over the first 300mm depth is largely responsible for aboveground production as they benefit from the lightest rains (Snyman 2005). In contrast, the deeper roots, being thicker, are largely responsible for survival during times of water stress. Roots close to the soil surface produce fine rootlets that are maintained under moist conditions, but die as the soil dries out. The depth of water penetration does not exceed the rooting zone in these semi-arid areas (Bennie *et al*. 1994, Snyman and Oosthuizen 1999).

Conclusions

Although this study did not address basic concepts surrounding indicators of belowground sustainability, it rather focused on how fire affected specific components of belowground systems that, in turn, may affect overall ecosystem sustainability. The considerable increase in soil temperature and soil compaction, leading to a decrease in soil-water content as shown in this study, again emphasise the importance of burning with a specific purpose. The actual impact of fire on the hydrological cycle as determined in this study is not always considered. With water being the prime determinant of plant growth in semi-arid grasslands, reduced vegetation production after burning can be explained by the reduction of soil-water content as result of vegetation litter removal, which increases loss of water through evaporation. The effect of aboveground biomass removal through fire on vegetation production and nutrient content in the semi-arid areas, via changes in soil-water content, is greater than the effect of aboveground biomass removal through herbivores.

Throughout this study the soil-water content in unburnt grassland was higher, especially over the top soil layers, comparing with the much drier soil condition in the burnt grassland. This aspect has therefore a great influence on production and decomposition in roots and litter in arid and semi-arid areas, which are closely related to soil-water content. According to most researchers, nitrogen mineralisation, immobilisation and turnover are restricted both spatially and temporally to the soil layer wetted by rain and its amplitude in the heterotrophic cycle may be determined largely by the availability of water to soil microflora. Therefore it can be concluded that where soil-water may be the most limiting factor in burnt grassland over the first two years in semi-arid areas, it is nitrogen in case of burnt grassland when soil-water content is high. The rate of soil organic matter decomposition can increase to a maximum at about 37°C and then declines (Jenkinson 1981). Therefore, decomposition of litter and roots in burnt grassland, with the higher soil temperatures, may take faster than in unburnt grasslands.

References

Bartos DL and Sims PL 1974. Root dynamics of a shortgrass ecosystem. Journal of Range Management 27: 33-36.

Bennie ATP, Hoffman JE, Coetzee MJ and Very HS 1994. Opgaring en benutting van reënwater in grond vir die stabilisering van plantproduksie in halfdroë gebiede. Water Research Commission Report 227/1/94. Pretoria. 159 pp.

Bowen GD 1991. Soil temperature, root growth and plant function. In: Weisel Y; Eshel A and Kafkafi W (eds.). Plant Roots: the hidden half, pp 309-330. New York: Marcel Dekker Institute 410 pp.

Broersma K, Krysic M, Thompson DJ and Bornke AA 1999. Effect of long-term grazing on soil quality in southern British Columbia. Proceedings of the VI International Rangeland Congress. Townsville, Australia 1: 114-115.

Distel RA and Fernandez OA 1988. Dynamic of root growth and decay in two grasses native to semi-arid Argentina. Australian Journal of Ecology 13: 327-336.

Donaldson CH 1986. Simple technique for estimating soil compaction. Karoo Agric 3: 55-58.

Donaldson C H, Rootman G, Grossman D 1984 Long-term nitrogen and phosphorus application on veld Journal of the Grassland Society of South Africa 1, 27-32.

Drew MC 1979. Root development and activities. In: Arid-land ecosystems (eds.) DW Goodall, RA Perry. pp. 573-598. Cambridge University Press: London, 870 pp.

Du Preez CC and Snyman H A 1993.Organic matter content of a soil in a semi-arid climate with three long-standing veld conditions. African Journal Range and Forage Science 10, 108-110.

Du Preez CC and Snyman HA 2003. Soil organic matter changes following rangelands degradation in a semi-arid South Africa. Proceedings VII International Rangeland Congress, Durban, South Africa, pp.476-478.

Emmerich WE and Cox JR 1992. Hydrologic characteristics immediately after seasonal burning on introduced and native grasslands. Journal of Range Management 45: 476-479.

Euckert DN, Whigham TL and Spears BM 1978. Effects of burning on infiltration, sediment and other soil properties in a mesquite-tobosa grass community. Journal of Range Management 31, 420-425.

Friedel MH 1987. A preliminary investigation of woody plant increase in the western Transvaal and implications for veld assessment. Journal of the Grassland Society Southern Africa 4: 25-30.

Hoffman MT and Ashwell A 2001. Nature divided land degradation in South Africa. Cape Town, South Africa: University of Cape Town Press. 168 pp.

Holm AM, Loneragan WA and Adams MA 2002. Do variations on model of landscape function assist in interpreting the growth response of vegetation to rainfall in arid environments? Journal of Arid Environments 50: 23-53.

Ingram L J 2002. Growth, nitrient cycling and grazing of three perennial tussock grasses in the Pilbara region of NW-Australia. Ph.D thesis, University of Western Australia, 280 pp.

Jenkinson DS 1981. The fate of plant and animal residues in soil. In: Greenland DJ & Hayes MHB (eds.). The chemistry of soil processes. John Wiley & Sons: New York.

Materechera SA, Mandiringana OT, Mbokodii PM and Nyamapfene K 1998. Organic matter, pH and nutrient distribution in soil layers of a savanna Thornveld subjected to different burning frequencies at Alice in the Eastern Cape. South African Journal of Plant and Soil 15(3): 109-115.

McNaughton SJ, Banjikiva FF and McNaughton MM 1998. Root biomass and productivity in a grazing ecosystem: the Serengeti. Ecology 79: 587-592.

Mott JJ, Ludlow M M ,Richards J H , Parsons A D 1992 Effects of moisture supply in the dry season and subsequent defoliation on persistence of the savanna grasses, *Themeda triandra*, *Heteropogon contortus* and *Panicum maximum*. Australian Journal of Agricultural Research 43, 241-260.

Neary DG, Klopatek CC, DeBano LF and Efolliot PF 1999. Fire effects on belowground sustainability: A review and synthesis. Forest Ecology and Management 122: 51-71.

Oesterheld M, Loreti J, Semmartin M and Sala OE 2001. Inter-annual variation in primary production of a semi-arid grassland related to previous-year production. Journal of Vegetation Science 12: 137-142.

Russell, JR, Betteridge K, Costall DA and Mackay AD 2001. Cattle treading effects on sediment loss and water infiltration. Journal of Range Management 54: 184-190.

Schenk HJ and Jackson RB 2002. Rooting depths lateral root spreads and belowground/aboveground allometries of plants in water-limited ecosystems. Journal of Ecology 90: 480-494.

Shackleton CM, McKenzie B and Granger JE 1988. Seasonal changes in root biomass, root/shoot ratios and turnover in two coastal grassland communities in Transkei. South African Journal of Botany 54: 465-471.

Shackleton CM, McKenzie B and Granger JE 1989. Breakdown and decomposition in three coastal grassland communities in Transkei. South African Journal of Botany 55: 551-559.

Snyman HA 1999. Quantification of the soil-water balance under different veld condition classes in a semi-arid climate. African Journal of Range & Forage Science 16(2&3): 108-117.

Snyman HA 2000. Soil-water utilisation and sustainability in a semi-arid grassland. Water South Africa 26: 331-341.

Snyman HA 2001. Water-use efficiency and infiltration under different rangeland conditions and cultivation in a semi-arid climate of South Africa. Proceedings of the XIX International Grassland Congress. Sao Paulo, Brazil. 965-966 pp.

Snyman HA 2002. Fire and the dynamics of a semi-arid grassland: Influence on soil characteristics. African Journal of Range and Forage Science 19: 137-145.

Snyman HA 2003. Short-term response of rangeland following an unplanned fire in terms of soil characteristics in a semi-arid climate of South Africa. Journal of Arid Environments 51(1): 160-180.

Snyman HA 2004. Short-term influence of fire on seedling establishment in a semi-arid grassland of South Africa. South African Journal of Botany 70: 215-226.

Snyman HA 2005. Short-term influ-

ence of fire in a semi-arid grassland on (2): root distribution, seasonal root production and root/shoot ratio. Grassroots 5(3). 20-29.
Snyman HA and Oosthuizen IB 1999. Rangeland and soil condition: Their effects on productivity in a semi-arid climate in South Africa. In: Proceedings VI International Rangeland Congress, Townsville, Australia. 1: 211-212.
Snyman, HA, Venter WD, Van Rensburg WLJ and Opperman DPJ 1987. Ranking of grass species according to visible wilting order and rate of recovery in the Central Orange Free State. Journal of the Grassland Society of Southern Africa 4(2): 78-81.
Sykora KV, Van der Krogt G and Rademakers J 1990. Vegetation change in the south-western part of the Netherlands under the influence of different management practices. Biological Conservation 52: 49-81.
Thurow TL, Blackburn, WH and Taylor CA 1988. Some vegetation responses to selected livestock grazing strategies. Journal of Range Management 41: 108-114.
Trollope WSW 1978. Fire behaviour a preliminary study. Proceedings of the Grassland Society of Southern Africa 13: 123-128.
Van de Vijver C A D M 1999. Fire and life in Tarangire: effects of burning and herbivory on a East African Savanna System. Ph.D thesis, Wageningen University, The Netherlands, 177 pp.
Wiegand T, Snyman HA, Kellner K and Paruclo JM 2004. Do grasslands have a memory: modeling phytomass production of a semi-arid South African grassland. Ecosystems 7: 243-258.

The effect of large area burns on nutrients and herbivore distribution in the north of the Kruger National Park

Rina C.C. Grant
rina@sanparks.org

This study was done in the Mooiplaas region on the northern basalt plains of the Kruger National Park, after an area of 113.38 km^2 around the Capricorn roan camp burnt down in April 2002. Within a week after the fire there was a rainfall event of about 20 mm. Soon after, zebra that had been almost absent from the area, were seen on the burnt patch. To determine the effect of a burnt patch on the concentration of herbivores, the animals on the burnt patch and an unburnt control area of 228.87 km^2 was counted in May, using a fixed wing aircraft. These counts were repeated in September of 2002 (Figure 1). The density of animals was much higher on the burnt area within the first month after the burn, but animals were distributed almost evenly by September. However, most of the zebra that moved on to the burn in May were still there in September.

Grass samples were collected to test whether the nutrient content of grass in the burnt and unburnt areas differed. Ten samples of the young

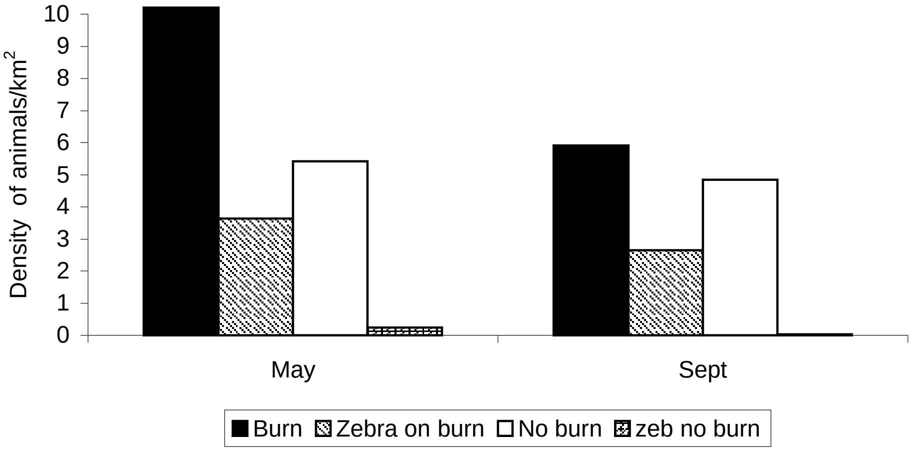

Figure 1: A comparison of animal numbers on burnt and unburnt areas one month after the burn and again 4 months later, indicating the small change in Zebra numbers on the burnt area.

growing grass of the same species were collected in May in both the burnt and adjacent unburn veld. The nutrient concentration in the grass in the burnt area was much higher than that of the unburnt area (Table 1).

Table 1. Nutrient concentrations in grass collected in the burnt and unburnt area near Mooiplaas.

	Burn	No burn
Nitrogen %	2.21 ± 0.072	0.71 ± 0.072
Protein %	13.8	4.43
Phosphorus %	0.73 ± 0.026	0.13 ± 0.026
Sodium %	0.92 ± 0.036	0.14 ± 0.036

Discussion.

The high nutrient concentration in the burnt patches at least partly explain why animals move onto the burns. The fact that zebra remain in these burnt areas may be important for management as a large zebra population may have a detrimental effect on the grass layer as it is does not have a chance to recover, especially if there is a water source nearby. This was actually the case in the Mooiplaas region as showed by the MSc study of Johann Oelofse (Oelofse *et al.* 1999).

Acknowledgements.

Thanks to Johan Oelofse, the ranger in Mooiplaas, for arranging to collect the samples and alerting us to the situation.

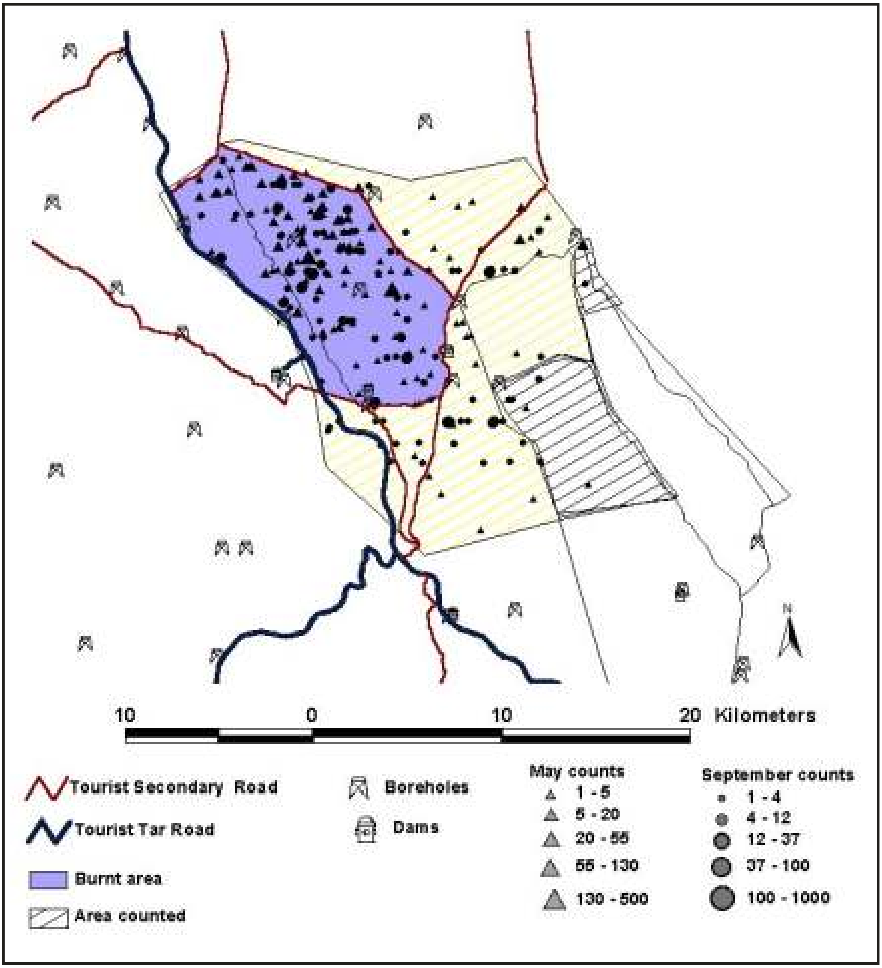

Figure 2: A comparison of animals on burnt and unburnt patches one month after the burn and again 4 months later, indicating the small change in zebra numbers on the burnt patch.

References

Oelofse J, Brockett BH, Biggs HC and Ebersohn C 1999. The effect of drought and post-fire grazing on the herbaceous layer of shrub-mopane veld on basalt in the Kruger National Park, South Africa. In: Proceedings of the VI International Rangeland Congress. People and Rangelands Building the Future. Vol. 1: 505 507.

Tackling conservation in the Maloti-Drakensberg Bioregion

Roger Uys and Richard Lechmere-Oertel
Biodiversity component, MDTP
roger@maloti.org

Conserving a bioregion that crosses political boundaries.

Stretching across two countries (Lesotho and South Africa) and three provinces (Free State, KwaZulu-Natal and Eastern Cape) the Maloti-Drakensberg Mountains represent a bioregion of globally significant biological and cultural diversity, along with being the primary water catchment for the sub-continent. People in both countries depend on these resources for their livelihoods. Yet, despite the obvious importance of this mountain bioregion, its biodiversity, cultural heritage and ecosystem processes are seriously threatened, primarily by habitat loss resulting from land transformation and degradation. The Maloti-Drakensberg Transfrontier Project (MDTP) is a World Bank funded intervention being conducted between Lesotho and South Africa to address conservation and community development issues in the Maloti-Drakensberg Bioregion (see map). The challenge for the MDTP is to conduct the conservation of this exceptional and unique mountain region across political boarders, while ensuring that the development needs of local populations are met. The MDTP has identified two broad requirements for addressing the threats to the natural heritage of this bioregion, namely: (1) ensuring all biodiversity patterns (ecosystems, habitats, and key species) and the ecological processes that sustain them are represented in a conservation network and (2) informed conservation management.

Ensuring conservation representivity in the bioregion.

Systematic Conservation Planning (SCP) offers us a defendable way to identify areas that are important for achieving biodiversity targets. In doing so, SCP also helps prioritize and focus the limited financial and human resources of conservation agencies. The starting point for SCP is to identify what biodiversity should be where. This is achieved by collating existing data from a range of sources: conservation agencies, herbaria, museums and universities. Based on a GAP analysis of the required and available data, targeted field surveys are conducted to fully understand the distribution of critical ecosystems and species. The next step is to state explicit targets for each biodiversity feature to answer the question of how much land we believe is needed to ensure the long-term persistence of ecosystems and their biodiversity. Target setting is a public process, engaging both specialists and appropriate stakeholders to ensure that the decision making process is transparent and can be interrogated. Transformed lands that have irretrievably lost the bulk of their biodiversity (e.g. plantations, ploughed fields and urban areas) are identified and treated as unavailable for conservation. Based on these biodiversity targets and the available land, a computer model (e.g. C-Plan, CLUZ or Marxan) is used to identify optimal configurations of areas to meet conservation and development objectives. In doing so, SCP takes cognisance of threats (e.g. potential spread of alien plants) and conservation opportunities (e.g. biodiversity-friendly land-uses).

This is latter consideration is important as SCP recognizes that we will not be able to meet our conservation goals if we are to rely on proclaimed conservation areas alone. In selecting priority areas for conservation, SCP aims to minimise the conflict between conservation and competing landuses such as agriculture and plantation forestry. In line with this thinking, a range of 'tools' have been developed nationally and internationally for achieving conservation targets that complement sustainable development objectives (e.g. conservancies, incentives, stewardship agreements, and education programs). Areas calculated as irreplaceable, i.e. if lost will cause a target not to be met, are 'red-flagged' for priority effort and protection from inappropriate development.

Photo: Kerry-Lee Schwikkard

Increasing development pressures necessitate a growing need for such decision-support systems to guide land-use planning activities (e.g. spatial development frameworks in municipalities). While most SCPs focus on biodiversity, the Maloti-Drakensberg Bioregion SCP will be quite unique in its simultaneous use of biodiversity and cultural heritage features for prioritising conservation action.

Addressing conservation management.

Without informed management, conservation lands exist in name only, giving rise to the term, “Paper Parks”. Indeed, many protected areas and conservancies have no formal management plan, which results in uncoordinated and ineffective management actions on the ground. Rangelands represent over 80% of the natural vegetation of the Maloti-Drakensberg bioregion, making them the focus of management activities. The management of rangelands for biodiversity and ecosystem processes centres on the manipulation of disturbances, primarily fire and grazing. Given the 'sour' nature of the bioregional grasslands, native herbivore numbers (and therefore grazing intensity) are naturally low. Historically, there were seasonal upland-lowland migrations of grazing herds, but these would not have penetrated very high into the mountains. Fire, and not grazing, is thus the dominant management tool in conservation lands. At the other extreme, many rangelands in the bioregion are subjected to excessively high livestock numbers, around 18 times that of the natural carrying capacities realized in conservation areas (Antelope carrying capacity having naturally stabilized at around 1 AU/55 ha at Giant's Castle compared to a livestock stocking rate of 1 AU/3 ha recommended for surrounding grasslands). Subsequently, in reviewing our understanding of disturbance effects, we have focussed on fire management in conservation lands and livestock grazing in communal areas. This assumes that commercial livestock operations apply the optimum mix of fire and veld grazing that, while not necessarily true or ideal for biodiversity conservation, maintain appreciable levels of biodiversity (O'Connor 2005).

While southern Africa has an impressive history of grassland research, much of this has been driven by agricultural production and therefore focussed on the dominant grasses, rather than the forbs (wild flowers) that constitute most of the plant diversity of these ecosystems (van Wyk 2004). Although the resulting management regimes applied to our grasslands are not necessarily suited to conservation objectives of biodiversity conservation.

Nevertheless, research, and subsequently grassland management, has been shifting over the last couple of years (e.g. Morris 2004) and is ripe for review to focus and direct future work. To date, the MDTP has reviewed fire best-practice, with the theme of 'Burning for Biodiversity, and is working to integrate this into a GIS-based decision support tool to guide conservation burning practices. The current phase is to review grazing best-practice for communal land-tenure, identifying appropriate interventions that can combine grazing and conservation objectives.

Expanding conservation management beyond fire and grazing.

Beyond fire and grazing, the MDTP has been working to improve and coordinate activities round a range of other management concerns: 1) track and trail maintenance, 2) extractive use of natural resources, and 3) alien plant and animal species. Tracks and trails are the main way in which people access the Maloti-Drakensberg Mountains, however if these are not maintained they become both uncomfortable to use and an ecological threat. To address this, the MDTP, along with Ezemvelo KZN Wildlife, is working to improve the hiking maps and has developed a protocol for auditing trails (a national first). Annual trail audits will provide managers with detailed information on the trail system to prioritize, budget and plan for annual maintenance.

The natural and cultural resources of the bioregion form the basis of many peoples' livelihoods and as such need to be utilized sustainably. To this end, Ezemvelo KZN Wildlife, in collaboration with the MDTP, has developed an access policy for conservation areas and a protocol to monitor rates of extractive resource use from the bioregion.

Alien species threaten the integrity of the bioregion, degrading rangeland condition in the case of invading plant species (e.g. bramble and wattle) and aquatic faunas in the case of trout. The MDTP is developing a GIS-based prioritization model for clearing alien woody plants in collaboration with the Working for Water Programme, and also has a project to identify and deal with emerging alien plant threats. The MDTP is also working with the Plant Protection Research Institute to motivate for a biological control agent for bramble, based on genetic studies to separate economic and invasive species. In terms of alien fish, which represent both a threat to aquatic biodiversity and ecotourism opportunity, a river zonation plan is being produced to identify potential trout-free zones in collaboration with key stakeholders.

Pulling it all together

This diverse range of activities, are pulled together in an overarching Bioregional Plan (BRP) for the Maloti-Drakensberg Mountains. The BRP is the mechanism through which all the information layers are integrated and interpreted into spatial maps highlighting the priority natural and cultural heritage areas. Most importantly, the BRP will take the next step of mainstreaming these results into the development sector, using mechanisms such as the municipality Integrated Development Plans (IDPs) and Land Use Management Systems (LUMS). Key outcomes of the BRP are a twenty-year vision and a five-year action plan that details the steps necessary to achieve the conservation targets in the bioregion, whilst maximising livelihoods. Mainstreaming is done by involving all the key role-players, such as the conservation agencies, Departments of Agriculture and municipalities, in the development of the strategies and action plans. The success of the BRP relies very much on the level of involvement of these role-players as they will be responsible for the implementation of the action plans.

References

Morris CD 2004. Manage the grassland not just the grass. Grass Roots 4 (3):16-19

O'Connor TG 2005. Influence of land use on plant community composition and diversity in Highland Sourveld grassland in the southern Drakensberg, South Africa Journal of Applied Ecology 42: 975988

Van Wyk B 2004. Southern African grasslands: aspects of their biodiversity, dynamics and management. Grass Roots 4 (2): 5-13.

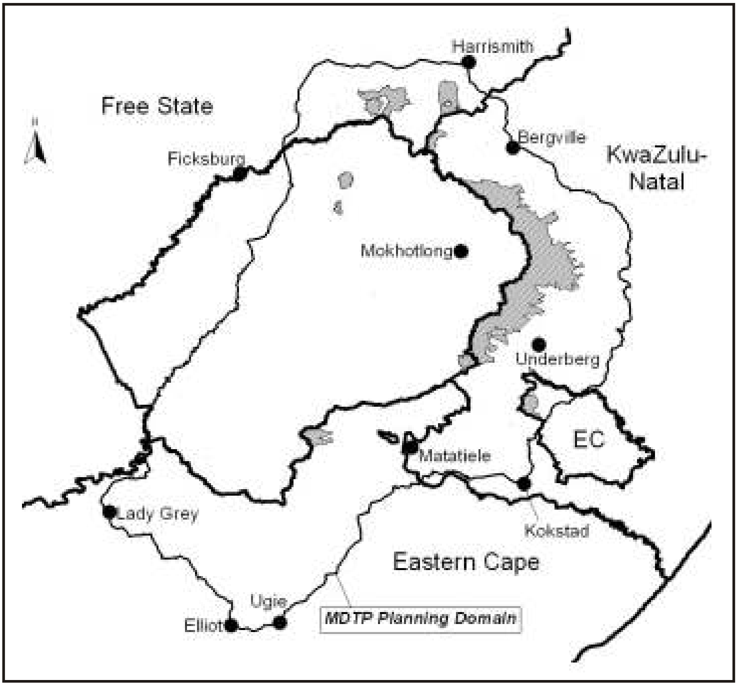

Figure 1: Map of the Maloti-Drakensberg Bioregion. Bold lines: provincial and international boundaries. Narrow line: boundary of planning domain of the Maloti-Drakensberg Transfrontier Project. The areas shaded in grey are formally protected areas.

No-till

in the dairy industry

Dairy Symposium hosted by the Milk Producers' Organisation (MPO) KZN and the Grassland Society of Southern Africa, 1 September 2005
Boston Country Club

Dave Goodenough
ARC-Livestock Business Division, Animal and Forage Production

Part 2

Ten years of no-till on Denleigh Farm

This presentation by René Stubbs, who farms in the Karkloof area a few kilometers outside Howick in the KZN Midlands, highlighted the advantages of the system of no-till farming, its profitability and sustainability.

Purchased by René in 1986, Denleigh, with a mean annual rainfall of 1160 mm, mostly in summer, previously had continuous maize production using conventional tillage methods, in conjunction with an extensive beef operation. There were no dairy cows on the farm and no pastures. Shortcomings of such a farming operation included severe erosion and related contour problems, a build-up of soil pathogens such as wireworms, rootworms, cutworms and diplodia and the soaring costs to replace equipment used in the maize production operation.

Denleigh is now a dairy farm with no-till pastures and no-till maize being produced for silage with a cover crop following, as well as no-till maize and soybeans in rotation for grain. The incentives for these changes implemented by René were that previously maize yields generally remained constant, despite the best efforts, contours did not require frequent repairs and reconstruction, recent no-till knowledge emanating from the USA, Brazil etc, the enthusiasm of local advisors, coupled with a reduction in glyphosphate costs used as a systemic herbicide prior to drilling in the required pasture grass, maize, etc, and recent improvements in no-till equipment.

Using no-till methods, René has seen a general and steady increase in silage yields over the past ten years, peaking at 14 t/ha and in grain yields peaking at 10 t /ha. The no-till methods have proved beneficial in other areas too, for example, it is estimated that a fuel saving of 30 to 40 litres/ha is possible with a saving of 300 tractor hours per year, as well as it not being necessary to replace equipment as frequently as when using conventional tillage methods.

The impact on the soil nutrient status and structure has also been substantial with soil acid saturations now approaching 0% thanks to periodic lime topdressings, with soil calcium, magnesium and organic carbons levels rising steadily over the years. There has also been a considerable increase in the earthworm populations with approximately 300 counted per square meter in a land no-tilled for the previous three years.

A change in the weed species has also been noted, with reduced populations of grass weeds, especially stoloniferous grass species, as well as a sharp decrease in soil pathogens. There is no longer a need to treat for wireworm, rootworm and black maize beetle.

The quality of the water in the nearby Karkloof River has also improved significantly as well as there being more food and cover for birds and buck in winter, resulting in an increase in their numbers.

René concluded his presentation by emphasising that the no-till system that he has adopted is effective, environmentally acceptable and economically sustainable. However, it requires a thorough understanding and long-term commitment and the passion to see it through. The system works!

Sowing ryegrass into kikuyu pastures

Nigel Smith and Beesie Stone spoke about their experiences and successes in sowing ryegrass directly into kikuyu.

Nigel, who farms near Creighton in KwaZulu-Natal in an area which experiences regular frosts in winter, said that he was forced into using this practice because of a shortage of irrigable land on his dairy farm. Initially he used annual Italian and Westerwolds ryegrass (*Lolium multiflorum*) varieties but is now drilling perennial ryegrass (*L. perenne*) varieties into his kikuyu pastures. The perennial ryegrass usually persists into the second year.

The key is to graze the kikuyu pastures regularly in the summer months and to not allow it to develop a "mat". Those kikuyu pastures ear-marked for the introduction of perennial ryegrass seed in autumn are mulched in January after a light grazing, using a heavy flail mulcher. The kikuyu is then allowed to grow out before being again grazed and mulched in March.

Nigel emphasised that in the Creighton area there is probably a 3-week "window period" commencing about 15 March when perennial ryegrass seed can successfully be drilled into kikuyu; drilled into the soil that is, and not incorporated into the mulch and rolled, as is sometimes the practice in other areas. Various seed drills can be used to drill ryegrass seed into kikuyu pastures, some however may require modification with, for example, the incorporation of a press wheel to ensure the soil over the seed is well-compacted.

The sowing rate may vary from 12 to 20 kg/ha, depending on the amount of persisting perennial ryegrass plants from the previous year.

Nigel recommends irrigation immediately after sowing and two weeks later a quick, light grazing to remove any late autumn kikuyu growth, thereby minimizing competition for the emerging perennial ryegrass seedlings. Delay the second grazing until the perennial ryegrass plants are well-rooted.

Irrigation must be applied throughout the year; every week during the dry late autumn and winter periods and, when required, in the months following to supplement the normal summer rainfall; although Nigel feels that the frequency of irrigation applications can be reduced because of the high organic matter content in the soil. Frequent fertilizer topdressings should be applied as is normally the case with an irrigated high producing ryegrass / kikuyu mixed pasture.

The kikuyu in such mixed pastures also contributes to less compaction problems by the dairy cows.

The benefits of this no-till system, says Nigel, is that the soil carbon levels are up from 1.5 to between 6 and 7 %, earthworm activity has increased, there has been an increase in the overall total DM production in these mixed kikuyu/perennial ryegrass pastures of up to 29 t DM/ha/annum and the land is utilized 365 days of the year. There is now no longer any need for big tractors, ploughs, rippers etc associated with the conventional preparation of land prior to planting.

Beesie Stone who farms in the Ixopo district in a relatively milder area with very few frosts and warmer summer months, (compared with Nigel Smith's Creighton farm), says that on his farm his kikuyu continues to grow in autumn for four to six weeks longer than is the case on Nigel's farm. Following a final grazing of his kikuyu pastures in early April, Beesie commences drilling his ryegrass seed into the kikuyu pastures after 10 April, using a local planter adapted with a press wheel, and he then mulches and rolls after drilling in the seed, followed by irrigation, which continues on a regular (weekly) cycle, as and when required depending on rainfall, and the normal recommended regular topdressings of fertilizer.

Beesie says he prefers to use the annual tetraploid large-seeded Westerwolds ryegrass varieties for drilling into kikuyu, with the first grazing five weeks after drilling in the seed. Dry matter production off such irrigated kikuyu / ryegrass pastures varies from 21 to 27 t DM/ha/annum. He sprays with a suitable insecticide to control cutworm and slug infestations.

Beesie also always establishes a land to fodder (Japanese) radish as a backup supply of forage for his dairy cows.


Sir Logic'a'lot
Puff
the
Admin
Dragon
Defies Logic