grass roots

Newsletter of the Grassland Society of Southern Africa

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Above: *Inundated Karoo veld near Laingsburg in the Western Cape over Christmas. The rains brought welcome relief to local farmers and floods to the Garden Route. Other areas in SA remain drought-striken.*

FEBRUARY 2005 - in this issue:

P.O. Box 41 • Hilton • Pietermaritzburg 3245 • South Africa
Tel: 033 390 3113 • Fax: 033 390 3113 • Cell: 083 256 7202
e-mail: admin@gssa.co.za • http://www.gssa.co.za

EDITORIAL

Dear members

This is the first issue of the New Year, and my first as editor. Over the last 5 years Graham has shepherded our newsletter through several changes of format and a name change (from *Bulletin of the GSSA* to *Grassroots*). He's left a *Grassroots* that is interesting and relevant to its readers. Thanks, Graham. I'll be calling on your experience in the year to come, so don't think you can rest on your laurels just yet.

Where does the Society fit in the modern world, and especially South Africa? We believe that we still have a very important role in play. With humanity's ever-increasing pressure on the land, skilled and passionate practitioners are more than ever needed to guide the process of development. Many emerging commercial farmers will rely on livestock production from veld and pastures to make a living, and established commercial farmers are also being required to become more scientific and business-savvy in their operations than before. Who is going to advise them, if not members of our Society?

That doesn't mean that we can afford to be complacent. If the Society does not stay up-to-date - in fact, in the forefront of technology development and advice - then we will become obsolete. There are advisors out there who do not believe that the GSSA has any relevance to them or their clients. They prefer to fly overseas to obtain their information than to attend a GSSA event. That must change, and soon. The Society has done some hard soul-searching in recent months, and recently the Council and some experienced old hands thrashed out a new Strategic Action Plan to take us forward. You can read about that in this issue, and send us your thoughts.

On a lighter note, Theunis de Bruyn remembers many years of congresses, and Richard Fynn reports on his trip to the USA and UK. Our Congress is also coming up in July - the first entirely organised by us in three years. We have the advice of Wiseman Goqwana and Winston Trollope on veld condition assessment, and a report from Dundee researcher Erika van Zyl on cowpeas. You'll also read a summary of a workshop on “Grazing and Biodiversity in the Grassland Biome” held by the GSSA in September 2004.

Keep sending your articles and letters in. We'd like to know what you're doing and why. We'd especially like to hear from students. Tell us about your projects: what the problem is, how you're addressing it, what problems and preliminary results have you found, and where this research will go in the future.

All the best for 2005,

Alan

WOMAN OF THE YEAR AWARD

The search for the Shoprite/Checkers - SABC2 Woman of the Year is on. This is the tenth anniversary of this prestigious award for achievement by women, and the GSSA is participating in the Science and Technology category. Do you know any women who have not only achieved success in their own field but have made a tangible difference in communities and society as a whole? Nominate your candidates using the enclosed forms and submit before 11 May 2005. For more information, contact Nicky Findlay (findlay@dae.kzntl.gov.za).

GSSA Council 2004/05

President:
Nicky Allsopp
nallsopp@uwc.ac.za

Past President:
Annelie de Beer
asdebeer@nwpg.gov.za

Vice President:
Annelene Swanepoel
annelenes@elsenburg.com

Honorary Secretary:
Sigrun Kassier
kassiers@arc.agric.za

Honorary Treasurer:
Mike Panagos
panagosmd@tut.ac.za

Scientific Editor:
Pete F. Scogings
pscoging@pan.uzulu.ac.za

Public Relations Officer:
Nicky Findlay
findlay@dae.kzntl.gov.za

Bulletin/Newsletter Editor:
Alan Short
alan.short@dae.kzntl.gov.za

Chairperson of Trust:
Winston Trollope
winfire@procomp.co.za

PAC Chairperson:
Leslie Brown
brownlr@techsa.ac.za

Additional member:
Justin du Toit
dutoitJCO@ukzn.ac.za

Additional member
(Website co-ordinator):
Dawood Hattas
dhattas@botzoo.uct.ac.za

Additional member:
Mphoya Thobela
mphoya@mvelo.co.za

Administrator:
Freyni du Toit
admin@gssa.co.za

Letter to The President

Dear Dr Allsopp

When I started with my project to investigate the possibility that grass may grow on the soil of old ant heaps, I did not have a medal or a special prize in mind. I enjoyed every minute of my project and learned a lot during the process. I visit the donga regularly where I planted the grass and it is still growing.

I was very surprised when it was announced that I won the Special Prize from your Society but when my certificate arrived yesterday, I was even more surprised to find my certificate already framed. I was very honoured to be chosen as the winner of this special prize and this certificate will receive a special place in my room and will stay one of my most precious belongings.

The attached newsletter was very much appreciated and most interesting.

Thank you once again for my beautiful certificate.

Regards

Megan Dreyer

A New Strategic Action Plan for the GSSA

Introduction

The Society has been in existence since 1966, and we have been privileged to have some of the top ecologists and agriculturalists in southern Africa as members, but times are changing and the Society needs to adapt. The pressures on the Society and its members are numerous; administrative workloads seem to be increasing, especially for formerly government-employed scientists who are now managers or independent consultants. In order to stay relevant in Africa in the 21st century, we need to have a clear vision of who we are and what we can offer.

Members of Council met on 28-29 April 2004 for a Strategic Planning Workshop at Ukulinga Research Farm in Pietermaritzburg. The meeting was facilitated by Mphoya Thobela, Richard Hurt and Nicky Allsopp. A record of the workshop was written by Sigrun Ammann. The workshop focused on the achievements and strengths of the GSSA, the values held in common by its membership and the challenges facing the GSSA. The activities associated with the various portfolios were also examined.

The core business of the GSSA was seen to be the promotion of the "discipline" of grazing resource sciences. The GSSA achieves this through promoting these sciences through its congress, journal and other publications. It aims to serve an advisory function by translating this science to achieve practical outcomes. This function embraces the areas of policy support, consultancies on environmental issues, and provision of information for advisors, land users and land owners.

The GSSA should serve as a body ensuring continuity in the feedback loops between theory and practice. Theory should inform policy, applied research and practice, while these should in turn inform theory in order to ensure that this remains dynamic.

Factors which ensure the well-being of the Society are its image and its sustainability. Image is determined by ensuring the visibility and credibility of the Society and projecting a professional profile. To this end the Society needs to market itself in order to compete with and complement other leading organisations in the environmental sphere.

The sustainability of the Society is dependent on maintaining and increasing membership numbers, ensuring that there is capacity in that membership to serve the Society, and in maintaining its finances in a positive state.

At a meeting in September, Mphoya Thobela, Richard Hurt and Nicky Allsopp developed a list of objectives aimed at strengthening the Society. They also revised the vision and mission of the GSSA. The outcomes of this meeting are presented below for comment by the members.

It was decided to use the word "grazing" resources, in order to make the vision, mission and objectives of the Society more accessible to the general public, even though "grazing and browsing" would be more precise.

For each strategic outcome, a target date, responsible person and set of activities was decided upon. These have been summarised under each strategic objective below.

Most of the objectives outlined below are aimed at promoting the Society as an organisation that has relevant expertise that can be called upon by government, non-governmental organisations, commercial organisations or private individuals at need. That, in turn, will make our Society stronger and more relevant in today's world. Several of the objectives are designed to make the Society function more efficiently by clearing up ambiguities in the constitution, or about the role of certain office-bearers.

Vision

The Grassland Society of Southern Africa strives to be the champion of the wise use of natural and cultivated grazing resources in Southern Africa.

Mission

The mission of the Grassland Society of Southern Africa is to advance livelihoods of the people of southern Africa and biodiversity conservation through the science and practice of wise use of natural and cultivated grazing resources.

Strategic objectives

Objective 1: To inform key roleplayers in the environmental field of the GSSA

Target date: Congress 40 (July 2005)

Responsibility: Nicky Allsopp

Activities:
The GSSA should identify and lobby key audiences at the highest levels of government to advertise who we are and what we have to offer. We need to clearly state what we want in return, such as support for young scientists, funding for staff to attend local and international congresses and for exchanges in Africa, and for interested parties to consult with the GSSA on important issues within our core disciplines.

Objective 2: To ensure that Congress adopts a relevant theme each year through which it can promote the Society to a broader audience.
This is not aimed at excluding the full range of presentations at a congress, but to ensure that relevant issues are tackled at Congress which attract the attention of a broader audience.

Target date: 18-24 months prior to the Congress being held

Responsibilities:
Congress 40: Richard Hurt
Congress 41: Nicky Allsopp and current Vice President (Annelene Swanepoel)
Thereafter Vice President

Activities:
The incoming Vice President must ensure that a successful bid is associated with a relevant theme for the Congress taking place at the end of his/her presidency.

Objective 3: To promote GSSA Congresses by ensuring that Congress announcements reach the broadest possible audience

Target date:
Annual activity to precede sending of first announcement of next Congress

Responsibility: Public Relations Officer, Administrator and Congress organiser

Activities:
Interest groups associated with the theme of the Congress need to be identified, and mailing lists of related organisations, such as agricultural or conservation organisations, need to be added to the GSSA mailing list. All delegates who have attended congresses and authors who have published papers in the Journal must be informed.

Objective 4: To ensure the translation of technical and scientific information into articles accessible to the public

Target date: Congress 40 AGM

Responsibility: Past President

Activities:
Members are encouraged to publish and present their research findings in the popular press and other forums. Articles based on work originally published in the Journal or other GSSA communications should have a short note at the end to acknowledge their source.

Objective 5: Promote the discipline through providing links from the discipline to relevant radio and television media
The aim of this is to promote the discipline in its broadest sense as being relevant to SA, not to focus on promotion of the Society.

Target date: Congress 40 AGM

Responsibility: Public Relations Officer

Activities:
Several radio and television programmes are broadcast which are of interest to the GSSA and its "clients". These include agricultural programmes such as Agri TV on SABC2 and a lunchtime agricultural slot on Radio Sonder Grense, and the conservation programme 50/50 on SABC2. There are also a number of small community radio stations which have slots for agricultural discussion. There are many members of the Society who could contribute to such programmes, and they should contact the PRO (Nicky Findlay: findlayn@dae.kzntl.gov.za)

Objective 6: Develop a protocol to promote the Professional Affairs Committee (PAC) and Professional Members to the broader environment

Target date: AGM of Congress 40

Responsibility: Chair of PAC

Activities:
Develop creative ideas on how to promote PAC as professionals, consultants, ombudsman etc. Promotion of the Society as a whole will certainly be to the advantage of the Professional Members by making potential clients aware of the expertise in our membership.

Objective 7: Promote partnerships between the GSSA, SADC and researchers in other African countries

Target date: January Council meeting

Responsibility: Mphoya Thobela

Activities:
As Mphoya was unable to attend the January Council meeting, the target date has been moved to April.

Some proposals were made, such as arranging a tour for SADC representatives around the time of Congress 40, and working through the Centres of Excellence in livestock, indigenous knowledge and extension in the SADC countries.

Objective 8: To get ISI rating for the Journal

Target date: January Council meeting

Responsibility: Peter Scogings (Scientific Editor) to ensure that NISC (the publisher of the Journal) continues to seek ISI rating

Activities:
ISI rating is given to a select list of journals which meet accepted standards of science. Achieving ISI rating will greatly increase the profile of the Journal and those who publish in it. Pete Scogings reported at the January Council meeting that, as this is as much to the benefit of the publishers as to the Society, NISC is continuing to seek ISI rating.

Objective 9: To develop a new three year contract with NISC

Target date: January Council meeting

Responsibility: Annelie de Beer in consultation with Scientific Editor

Activities: Review existing contract with NISC and develop new three year contract. Several administrative and financial issues need to be discussed in the new contract.

The contract has been reviewed and will be renewed with minor changes.

Objective 10: To develop an advertising/advertorial strategy for Grassroots

Target date: January Council meeting

Responsibility: Grassroots Editor, Public Relations officer

Activities:
The Grassroots is only distributed to members at present. In order to reach a wider audience, it has been proposed that advertising revenue be sought in order to print more copies and distribute through outlets such as agricultural co-operatives. Although the broad outline of an advertising strategy has been discussed, this has yet to be implemented.

Objective 11: Resolve position of Web Coordinator and Grassroots Editor on Council

Target date: April Council Meeting

Responsibility: Nicky Allsopp

Activities:
Additional members to fill roles. If no suitable additional members are available, then members will be coopted to fill those posts.

Objective 12: To ensure that key administrative activities are executed timeously and effectively.
This refers especially to the maintenance of membership lists and the collection of subscription.

Target date: Every Council meeting

Responsibility: President assisted by Council

Activities:
Review activities of the Administrator on a regular basis, and ensure that the contract describes responsibilities adequately.

The current Administrator (Freyni du Toit) is doing an excellent job in rebuilding the administration of the Society after several years of poor management of this function by Council. This objective is regarded as strategic for ensuring the continued efficient administration of the Society.

Objective 13: Review constitution of the GSSA and propose relevant amendments

Target date: January Council Meeting

Responsibility: Justin du Toit to coordinate this activity.

All Council members to review constitution

Activities:
At the last AGM, two amendments were proposed. The first was a change to the membership structure. It was agreed that Retired members could choose not to receive the Journal, and thus pay a reduced fee. Some members who had retired from their professions no longer wished to receive the journal, but wished to remain members of the GSSA and stay up-to-date with the Society's doings. The second amendment was that *bona fide* students would pay the same fee as Associate members for three years.

A proposed amendment to be considered at the July AGM was discussed at the January Council meeting. This proposed amendment deals with the number of people needed to form a quorum at a GSSA general meeting. At present, 50 members are required to call a meeting quorate, but it has proved to be very difficult to assemble that many members for years. The figure of 50 was decided on when the Society was first established and membership was much larger. Some constitutions don't require a specific number of people, but a certain proportion of the membership. It has been proposed that we reduce the number of members required to form a quorum (say to twenty or thirty) or work on a percentage (say 10%) of members.

Objective 14: Review strategic plan at regular intervals

Target date:
Major review: First Council meeting after congress.

Evaluate progress: every Council meeting

Responsibility: President to ensure that this appears on agenda of Council meetings.

Activities:
The action plan and progress made will be reviewed regularly by Council, in order to keep it relevant and up-to-date. The first review happened at the January Council meeting; in general, progress was reasonable on most of the objectives. As priorities change or objectives are met, the action plan will be revised.

Conclusion

This approach has proved to be a valuable tool in focusing the efforts of the GSSA and its members.

We would welcome comments from members on the strategic plan for the GSSA.

Send your comments to Grassroots.

The effect of grazing on biodiversity in the grassland biome: Proceedings of a workshop held at Umgeni Valley, 29-30 September 2004

Alan Short[1] & Freyni du Toit[2]
[1]KZN Department of Agriculture and Environmental Affairs, Cedara
[2] Grassland Society of Southern Africa, P.O. Box 41 Hilton 3245
Alan.Short@dae.kzntl.gov.za

Introduction

The grassland biome is receiving more attention from conservationists and policymakers as an important reservoir of biodiversity, that also supports most of the population of southern Africa directly and indirectly through the goods and services it provides. This biome is also one that is increasingly threatened by transformation and mismanagement as human pressures on the system grow.

To address some of these issues, the Grassland Society of Southern Africa (GSSA) is planning a series of workshops on the effects of various land-uses on biodiversity in the grasslands of South Africa (SA). The first workshop, on the effects of grazing on biodiversity, was attended by some 29 people from KwaZulu-Natal (KZN), Mpumalanga, the Free State and the Eastern Cape. The participants came from a variety of backgrounds, including researchers in the Department of Agriculture, managers and researchers from conservation agencies and NGOs, students, consultants and farmers.

This report is a summary of the workshop proceedings, which will be made available on the GSSA website as soon as possible.

Objectives

The objectives of the workshop were:

1. To determine the extent of our knowledge of the impacts of grazing on biodiversity in grasslands.
2. To determine the knowledge gaps that urgently need to be addressed.
3. To suggest solutions (focussing on technical rather than policy solutions) to ameliorate negative impacts of grazing on biodiversity, using the tools (such as fencing, stocking density or watering points) available to graziers to manipulate their grazing.
4. To produce a summary of the challenges and opportunities discussed to be taken forward to the Grasslands Summit to be held in July 2005, at the Congress, where policies will be discussed.

The end result will be used to help inform the regulations of the National Biodiversity Act as well as the grazing recommendations of the Departments of Agriculture, conservation agencies and NGOs.

To this end, a set of guidelines on "biodiversity friendly" grazing systems based on best available knowledge and experience should be produced.

Objective 1: Overview of current knowledge

Very little direct investigation of the effects of grazing on biodiversity has occurred in SA. It was suggested that we use the work done in both Australia and the USA as benchmarks to find our own gaps. The grazing gradient approach used in Australia is not really appropriate in SA, however, as waterpoints are so evenly distributed across this country.

Lands used for grazing should not necessarily be destocked but seen as repositories for biodiversity; management approaches should be "tweaked" with this in mind.

A discussion of studies of grazing and biodiversity aimed to address the question "What is the nature and extent of the impact that grazing has on biodiversity, especially on significant taxa?"

Both species and structural/functional biodiversity should be addressed as there is no proper knowledge base, only a few case specific studies and their impact on biodiversity as a whole is unknown.

There was a geographic bias in the group, with most participants coming from KZN, and very few people with experience in the semi-arid and arid grasslands. Nevertheless, very few studies in the drier areas were identified that addressed the central issue.

One multi-disciplinary study that did attempt to address, in part, the effect of land tenure on biodiversity was the Drakensberg component of the National Botanical Institute's (now South African National Biodiversity Institute) Conservation Farming project.

Some of the work mentioned below was referenced in the scientific literature; other work may not have been published, or the references were not located before this article went to press.

Invertebrates

Peden (2004) examined 5 aboveground taxa along a fenceline between Cathedral Peak and the adjacent communal grazing land. The results were not necessarily useful due to methodological problems.

Some work from grasslands in and adjacent to Hluhluwe-Umfolozi was mentioned. Samways & Kreuzinger (2001) studied grasshoppers in the Hluhluwe grassland contrasting a conservation area with a communal area. Rivers-Moore and Samways (1996) contrasted a commercial area with a conservation area in Hluhluwe/Umfolozi and found that as long as there was grazing the effect of mega herbivores was mimicked in terms of species richness and abundance. William Bond studied grasshoppers and termites inside and outside of exclusion plots in Hluhluwe. Hans Olff also worked on grasshoppers in Hluhluwe.

Samways & Moore (1991) determined edge effects of afforestation on grasshoppers at Midmar in the KZN Midlands. Gebeyehu & Samways (2002) studied grasshoppers in Middelburg in the Eastern Cape. Work by Steve Johnson, where annual mowing increased richness, was mentioned. Hamish Robertson examined ants and beetles in the Conservation Farming study. Richard Kinvig's work indicated that increased sward heterogeneity increased species richness.

Plants

Peden's (2004) study at Cathedral Peak, Venter *et al*'s (1989) study in Hluhluwe and Tim O'Connor's study in the Berg were cited. Uys (in prep) examined Hluhluwe/Itala and the neighbouring mesic grasslands in the communal areas of Impetle. He pointed out that the greatest diversity of plants is to be found in the wildflower species, but that little is known about them as they are not agriculturally important. Du Toit (2003) addressed how grass plant diversity is affected by grazing and pattern. Short *et al* (2003) suggested that diversity of grasses is not a good indicator of plant diversity. Hoare (2002) compiled data from studies of plant diversity in communal and commercial rangelands in the Eastern Cape.

Vertebrates

There have been few studies explicitly examining the effect of grazing on vertebrate diversity. Trampling has been observed to impact on blue swallows. Conversely, cattle appear to be beneficial to wattled crane populations by opening up paths on the margins of wetlands for the chicks to move around. There has been one recent study on birds in the Wakkerstroom area.

Several studies of the effect of fire on birds and small mammals in the Drakensberg by Dave Rowe-Rowe were mentioned (Rowe-Rowe 1980, 1995; Rowe-Rowe & Lowry 1982). This topic came up as delegates debated the importance of patchy defoliation of grass swards and the effect this has on small animal populations.

Wetlands and aquatic systems

Again, no specific studies on this topic were mentioned, although the accumulated experience of the participants raised some general points. Dams are known to impact directly on the functioning and diversity of wetland systems. The increase in sediment load in rivers and streams, caused by decreased basal cover and trampling on the margins of wetlands can affect many invertebrate and plant communities. However, herbivory can also maintain or increase basal cover, while areas that are protected from defoliation experience increased erosion following a fire.

Fire

Several participants felt that fire could be equated to grazing, in its effect on the habitat of small animals and birds. Others felt that it was dangerous to extrapolate from fire to grazing, as there were very different effects of both. It was also pointed out that grazing cannot be looked at in isolation from fire, particularly since the one is often affected by the other. The effect of fire on biodiversity in the Maloti-Drakensberg region was examined in detail in a series of workshops hosted by the Maloti-Drakensberg Transfrontier Project.

Other biomes/regions

Although some studies have been done in other biomes in southern Africa, and other regions of the world, very little work has been done in the grassland biome of South Africa. Therefore, the results of work in other areas will be examined and, where possible, extrapolated to the grassland biome of South Africa. Mention was made at the workshop of work done in drier savanna areas, as well as the Karoo and Namaqualand. South Africa has a definite interaction between grassland and savanna which should not be ignored.

Functional groups, indicator groups and key species

Much work has been done in Australia and the USA in dividing taxa into functional groups according to their response across gradients of grazing intensity. This approach may be a useful way to approach the problem of the dearth of knowledge of species responses in South Africa. An identification of the traits that render a species more or less vulnerable to grazing impacts will allow predictions of the effects of grazing on taxa that have not been directly studied.

Uys (in prep) assigned plants to functional groups across a rainfall gradient. In drier areas, dicotyledonous species relying on seed for recruitment predominate. In moist areas there is an increase in long-lived perennials, bulbs or other types of underground storage organs which allow plants to tolerate disturbance. However, the species composition in mesic areas is changing under heavy grazing regimes, although the richness is the same. He proposed that the intermediate disturbance hypothesis was a failure and suggested that plant life history traits be used to predict response to grazing. Rob Scott-Shaw has found that there is a shift in species life-form across a grazing gradient in Midlands Mistbelt grasslands.

Geophytes form a significant proportion of the plant composition in more lightly grazed areas. They flower in spring and then maintain leaves until mid- to late summer, relying on them to produce reserves for the following season. If the leaves are removed, death results. These plants should be given more importance as a functional group in comparisons between light and heavy grazing regimes.

In South Africa, some progress has been made in assigning invertebrate taxa to functional groups according to their responses to disturbance. Similar invertebrate patterns are being found, especially with the effect of alien plant invasions and medicinal plant collections.

Well maintained grasslands are able to resist the invasion (<10%) of alien and weedy plant species due to the lack of disturbance.

Some progress has been made on designating species as indicator species. Most of the work in the plant kingdom has been on grasses, although Scott-Shaw has made progress with forbs in KwaZulu-Natal. Some invertebrates have also been assigned indicator classifications.

Environmental drivers

In order to understand the impact of grazing regimes on biodiversity, it is first necessary to understand the underlying environmental conditions which dictate how species will respond to grazing. These include geology, geomorphology, precipitation (amount and distribution) and temperature regimes. These in turn influence length of growing season, soil nutrients, and the distribution of sourveld and sweetveld (productivity through the winter months) among others. For example, east of the Great Escarpment, species richness increases linearly with rainfall until temperature begins to take effect.

Grazing systems

Grazing management regimes cannot simply be divided into "communal", "commercial" and "conservation", as practices within these broad land-tenure systems vary widely across the country; for example, Holistic Resource Management (HRM) versus standard grazing management recommendations. Within communal areas, management regimes can also vary widely.

Animals kraaled at night create nutrient hotspots at the kraal, which may persist for centuries.

Alien and bush/weedy species encroachment: can be induced by livestock, birds along fence lines, nutrient hotspots, areas protected from fire and general disturbance, especially along fence lines.

The effect of stocking rate and grazing regime (i.e. set stocking versus various systems of rotational stocking) need to be separated. Du Toit (2003) observed that paddocks continuously stocked in the Eastern Cape are structurally heterogenous. Potentially, such a sward could harbour more invertebrate richness than a structurally homogenous sward. However, Richard Kinvig noted that studies in the USA indicated that rotational stocking increased sward heterogeneity and hence invertebrate heterogeneity. Tim O'Connor observed that rotational grazing appeared to be deleterious to plant species richness, as all the impact is concentrated on a small area.

The Giant's Castle Nature Reserve has a stable large herbivore population, mostly comprising eland, of 1AU per 55ha, whereas commercial farms in the region stock at 1AU per 2 ha. However, the commercial farms have structures in place to control the impact of grazing. Thus the system has experienced herbivory but in a vastly different way: in conservation and communal areas the impact of grazing is dissipated over the entire area each year, while in the commercial areas one camp at a time experiences concentrated grazing impacts. Commercial operations mal, therefore, destroy more vulnerable growth forms. Maintaining plant diversity thus requires destocking, but the impact has already been in place for the past century and so we have perhaps reached a new stable state which we should maintain. Note that the large population of wildebeest and blesbok in Coleford Nature Reserve near Underberg has had a similar effect to the commercial regimes.

An alternative hypothesis was proposed: that in commercial livestock systems, where different camps may be rested from one season to the next, the impact of grazing can be altered between seasons, potentially encouraging diversity.

Commercial livestock farmers can control animal movement through fencing, whereas in wildlife systems management options are more limited and are largely restricted to controlling movement through fire.

Objective 2: What do we need to know?

The answer to this question will depend on a clear statement of objectives.

The summary of studies on biodiversity in the grassland biome illustrates the fact that studies are few and far between, and workers in different disciplines work in isolation from each other. More complementary studies in a few systems, rather than isolated studies in many systems, would greatly enhance our understanding of the effects of grazing on a wide variety of taxa.

Functional groups need not be taxonomically determined or based on species important to conservation. The creation of functional types requires knowledge of responses to disturbance, which is lacking, and hence functional studies tend to be made at a very coarse level. This approach would change with time, and defining these groups ultimately rests with knowing what and how much you have - inventory work is vital to making progress. A good inventory approach will automatically include environmental variables and thus a greater understanding of causes of presence or absence of species.

There is a need for a repeatable measure, not just a rapid assessment, which will provide indicators of various aspects at multi-taxa and -trophic levels. However, a rapid assessment approach is crucial to assess the current level of biodiversity, overlapping between all aspects (plants, invertebrates, etc.). It is also important to determine what constitutes adequate biodiversity conservation. For current systems, we need to know:

1. Are they stable over time?
2. What levels of biodiversity are being protected, especially in land used for production?
3. What gaps in conservation are present on such land?
4. Could subsidies/incentives or land acquisition close these gaps?

A list of questions and hypotheses were proposed by the workshop:

- What type of biodiversity are we trying to manage for? Genes, species, etc.
- Why should landowners manage for biodiversity?
- What indigenous knowledge exits for grazing management?
- What are priority areas for conservation?
- How can grazing be used to improve the conservation status of species of concern?
- How do conservation and grazing objectives differ with land tenure?
- Are umbrella species definitely umbrella species? In other words, does the conservation of one or two species improve biodiversity conservation as a whole?
- Can you maintain biodiversity with fire as with grazing/mowing?
- Improved assessment techniques need identification of functional groups and key indicators of system health.
- How does the environment interact with grazing regimes?
- What are the particular effects of grazing on wetlands and other hydrological processes?
- What are the particular effects of grazing on soil integrity?

It is impossible to predict the outcomes and consequences of all perturbations of management tools. Looking at the “tools” in more detail:

- Animal type is adjustable and should perhaps be changed in some areas, e.g. large bodied animals are more damaging in the Drakensberg than small bodied. In general there has been a shift towards game farming but this does not necessarily increase biodiversity.
- Stocking rate at different levels of input the same output can be achieved, i.e. the Jones-Sandland model. Biodiversity if probably better at lower stocking rates

(heterogeneity is greater) and the same production can be achieved as at higher stocking rates. Historical stocking rates should be consulted, e.g. 1 AU per 55 ha versus 1 AU per 2 ha in the Berg.

- Movement and the preoccupation with rotation is sometimes necessary, e.g. in high rainfall areas there is a need to graze down uniformly and so smaller camps are required. This is not so in drier areas. Persuasive holistic managers are purporting interesting facts regarding grazing systems. Small camps can result in uniform stocking rates and probably increased extinctions.
- Fencing is no longer profitable to replace or increase. This has an effect on the spreading of aliens, etc. by birds which perch on fences.
- Resting: hotspots of biodiversity are not uniformly distributed (wetlands, cliff faces, streams, etc.) and these areas should be more protected thus increasing overall biodiversity.
- Fire: commercial areas are block burnt whereas conservation areas are mosaic burnt. This latter is logical but is a difficult hypothesis to test
- Level/Scale: managing for the primary base (plant species and structure) is likely to induce resilience and biodiversity at higher trophic levels.

Conclusion

The majority of grasslands are currently under livestock, wildlife or a combination of the two. It is unlikely that the physical management is going to change. The ideal situation would be, therefore, to manage from a production perspective and knowing the impact of these management principles on biodiversity. In summary: “Does 'ideal' veld management conserve biodiversity?”

Most biodiversity resides in small hotspots, rather than evenly distributed across the landscape. Therefore, the identification of hotspots and appropriate management would be a useful step in conserving biodiversity in grazed systems.

Policy issues

Technical solutions remained largely unidentified by the workshop, because so little is known about the effect of grazing on biodiversity. However, a number of policy issues were identified, which require addressing.

As discussed above, there is a dearth of technical knowledge about how to manage for biodiversity. This needs to be clearly acknowledged, but decisions based on best available knowledge and informed guesswork will still need to be made. Policies will not be limited to biomes, but will be implemented on a national or provincial level.

A system of rewarding farmers for “biodiversity friendly” farming practices needs to be explored. One possibility is the implementation of a certification programme which would allow preferential access to markets or premium prices on products.

Measures of ecosystem health are far easier to monitor than actual biodiversity, and standards need to be developed and agreed upon for monitoring purposes. Clear definitions of biodiversity and its important components need to be agreed upon in order to minimise conflicts (for example, in the forestry industry).

Large scale land planning has largely fallen away and been replaced by on-site Environmental Impact Assessments (EIAs). Landscapes can therefore be transformed piece by piece, entirely legally, until very little unmodified land is left. KZN Wildlife's C-PLAN, a GIS-based planning tool, identifies limits for transformation for certain areas or vegetation types. This type of landscape-scale planning should be implemented across the grassland biome.

The most important point raised by the workshop was that “Transformation, not grazing, is the major threat to biodiversity in the grassland biome”.

Objective 3: Solutions

Important biodiversity is likely to reside in relatively small areas, such as forest patches or wetlands. Landowners can relatively easily protect such areas from grazing.

Many areas are heavily stocked, and this is likely to have adverse impacts on biodiversity. Therefore, destocking of certain areas is might be beneficial to biodiversity conservation.

The gaps in scientific knowledge identified above precluded defining a set of technical solutions to minimise any adverse impacts of grazing on biodiversity. Nevertheless, a way forward was outlined by the workshop participants.

The way forward

Habitat transformation is the greatest threat to biodiversity. Therefore, any practice that allows some relatively undisturbed grassland to remain is to be encouraged.

Scientists and farmers around the world have spent decades developing sustainable grazing practices to conserve the forage resource.

"Does ideal veld management conserve biodiversity?"

Veld management is thought of from a production point of view based on the past century's guidelines and practices. These have been based primarily on the drive to reduce degradation and optimise production. To determine the answers to this question the following needs to be done:

1. Consolidate current knowledge and research effort:
   - More collaboration
   - Build on existing datasets
2. Produce/Review guidelines for biodiversity management
   - Despite the dearth of knowledge, many educated guesses can be made as well as implementing common sense
3. Explore funding avenues for answering the questions raised in Objective 2.
   - Examine data collected in different disciplines and pursue immediate research questions
4. Have strong links/partnerships between all groups involved in grasslands to present a united front, avoid confusion and increase funding.

Acknowledgements

Thanks to all the participants of the workshop for their time and insights. Richard Hurt initiated and coordinated the organisation of the workshop. The Maloti-Drakensberg Transfrontier Project generously contributed towards meals, and the Wildlife and Environment Society of Southern Africa provided the venue. We are grateful for their assistance.

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THE MEMOIRS OF A CONGRESS DELEGATE

Theuns de Bruyn

Whilst speakers and chairpersons
Theorise and dogmatise,
Delegates and congressors
Perspire and find sleep
And abundance of indifference.

But barrages of datasets
And graphs and tables and epithets
Annihilate and exterminate
Our only hope of sanity:
Let's protest this inhumanity!

Because the eloquent oratory
And flowery prose and detenté
Is lost upon the bourgoise.
And the most welcome phrase
Is "In conclusion, gentlemen",
For then a glass we raise.

These fierce assaults on simple minds
- pulverised and minimised
by excesses of hops-extract -
should not be allowed to distract
from our mission most divine
to seek solace in the fruit of vine.

COWPEAS AS FODDER CROP FOR LACTATING EWES

Mrs Erika van Zyl & Mr AM Sadie
P.O. Box 626 Dundee, 3000
vanzyle@dunrs.kzntl.gov.za

Introduction

Cowpea *(Vigna unguiculata)*, a crop of ancient African origin, is a summer growing annual legume which is very popular amongst farmers in South Africa, for human and animal consumption. Literature as early as 1923 mentioned the commercial use of cowpeas and in the 1950's it was described as one of the most important legume plants in SA (Dannhauser 1991; 2002; Donaldson 2001; Van Zyl 1990).

Plant breeders have, over time, selected specific cultivars from the original genetically diverse species Chapman (1989)

Since this is a good and hardy quality fodder crop, farmers have used it for both grazing and haymaking. Pods are normally produced during late summer and this adds to the nutritional value of the plant. This coincides with the decrease in veld quality, or even planted pastures such as kikuyu, during late summer and autumn. Ewes lambing in autumn or late summer need good quality grazing and the value of cowpeas as a fodder crop for these sheep should not be underestimated. In spite of all the positive characteristics, it is a fact that there is presently a shortage in seed and a lack of available cultivars. There is also a feeling that more research should be done on its value as animal feed.

Evaluation

In December 2003 cowpeas were planted on Aalwynkop, in the Dundee district, a farm of Mr Hendrik Klopper. It is a neighboring farm to the Dundee Research Station, which falls in the Sandy Sourveld of northern KwaZulu-Natal (KZN). The veld in the area is well known for its sharp decrease in quality in late summer. The cultivar used was Bechuana White, which was planted at a rate of 50kg/ha. It was established during December, in 900 mm rows, with 150 kg of superphosphate per hectare. This was a maximum seeding rate; less seed can be used according to rainfall.

Seventy-seven Mutton Merino ewes (with their lambs), which grazed on veld during the previous summer and lambed on Kikuyu pasture in autumn, were used to graze the 15 ha of cowpeas. Grazing commenced on the 5th April 2004 and ended on the 1st June 2004, when all the available grazing material was utilized. Due to abundant material, an additional 140 dry sheep were added during the last part of the grazing period.

Commercial 25 kg energy blocks were supplied (Protein supplement 150g & energy 8.8 MJ ME/kg *ad lib)*.

Rainfall

The total rainfall for the summer season of 2003/04 was 473.6 mm, well below the long term average (Table 1).

Table 1: The 2003/04 monthly rainfall (mm/month-1), compared to the long-term average monthly rainfall for Dundee

	Sept	Oct	Nov	Dec	Jan	Feb	March	Apr	May	Total
2003/04 mm	6.3	19.5	97.9	67.1	55.3	91.7	132.4	3.1	0.6	473.9
Long Term mean mm	33.6	77.0	108.8	131.0	135.0	110.5	82.4	42.7	20.9	741.9

Fairly good showers fell in November, when seedbed preparation started. The monthly precipitation was below average until March, when above average rainfall was measured. During April and May the precipitation was very low again (Table 1).

Production and nutritional value

The dry matter yield of the cowpeas (total plant) was 5.8t/ha, meaning that the cowpeas produced 12.9 g DM/mm of rain. (In comparison with veld which produced in the same 5.3 g DM / mm of rain for this season).

The nutritional value of the cowpeas (whole plant) are given in Table 2.

Table 2: The chemical analysis* of the cowpea crop (whole plant).

ADF (%)	NDF (%)	Crude Protein(%)	Ca (%)	P (%)
29.07	43.50	15.46	0.74	0.25

*Chemical analysis by Feed laboratory, Cedara

The relatively low ADF and NDF value of the cowpeas are an indication that the energy value and digestibility of the crop were high and explain the good intake that was observed. Pods were already formed when the samples were taken and they contributed to the high crude protein value. The Ca and P values can be described as normal and adequate. Analysis of cowpea leaves, done by other researchers, showed high levels of iron, selenium, vitamins A, C and E, which all contributed towards the high performance of the animals (Anon 1995).

Animal performance and carrying capacity

The sheep grazed for 57 days on the 15 hectares of cowpeas and were withdrawn when it was decided that all available material was grazed sufficiently. The performance of the ewes with their lambs is given in Table 3.

Table 3: Growth performance of ewes and lambs on cowpeas (expressed per hectare)

Parameters	Ewes		Lambs	
	5/4/04	1/6/04	5/4/04	1/6/04
Total mass (kg)	4878.5	5049.0	781.7	1881.7
Total mass gain (kg)	170.5		1100.0	
Average mass (kg/animal)	64.2	66.4	11.3	27.3
Average gain (kg/animal)	2.2		15.9	
Average daily gain (g/day)	38.6		278.9	

Lambs grew at an average rate of 278.9g/day for the duration of the trial, which is very acceptable for lambs on this type of dryland pasture. Although lactating, the ewes also managed to gain weight (38.6 g/day), which will contribute to their body condition in the next breeding season.

Due to the abundance of grazeable material, 140 adult sheep (wethers and dry ewes) were added to the camp on April 19, 2004. They spent 43 days on the fodder crop. Unfortunately their starting masses were not taken, but their numbers were taken into account in determining the carrying capacity.

Carrying capacity

The calculated carrying capacity in small stock units (SSU) for a two-month (60 days) grazing period on Alwynkop was 15.1 SSU/ha/60 days. The following assumptions were made in the calculations:

- The ewes, with an average mass of 65.3 kg, were taken as the equivalent of 1.28 SSU
- The average mass of the lambs was 19.3 kg, which was taken as 0.51SSU
- The mass of the additional dry sheep that were not weighed was taken as 47 kg, thus the equivalent of 1 SSU.

Financial analysis

The total input costs on the 15 ha was R18446.25. This includes machinery costs, labour, seed and fertilizer (R1229.75/ha).

Income

- Value of lambs at the end of trial was R18 817.00 (881.7 kg x R10/kg)
- Value of mass the lactating ewes gained, was R1 705.00 (170.5 kg x R10/kg)
- Value of estimated gain of the additional dry sheep was R6 971.12.

According to previous experience, by researchers, it was estimated that these dry sheep gained 115.8 g/day over a period of 43 days, which represents a gain of 697.12 kg x R10/kg.

- Total value of live mass produced on 15 ha cowpeas was R27 493.12.

The profit margin is an indication of the financial efficiency of this system as part of the bigger enterprise. Lambs were not yet ready to be marketed at the end of the trial and only the value of the added mass of the other sheep was converted to a financial value. It could be argued that the sheep were bought in before commencement of the trial and sold for the same price/kg afterwards.

"Margin" above allocatable costs:
R27 493.12 - R18 446.25 = R9 046.87/15ha
or = R603.12/ha

This compares well with a budgeted maize gross margin of R641.75 at a maize price of R900 per ton and a production of 5t/ha.

Conclusions

Cowpea is a well-adapted and reliable fodder crop.

For small-scale farmers cowpeas can be used not only for grazing, but as a vegetable as well. Early pods are suitable for using as green beans and the leaves can be cooked as spinach. Another advantage of this crop that is well recognized by farmers is its nitrogen fixing abilities, which contribute towards soil fertility. It is an excellent crop for intercropping between maize (Chapman, 1989).

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Trip to the Ecological Society of America Congress

By Richard Fynn
Grassland Science, University of KwaZulu-Natal, Pietermaritzburg
E-mail: fynn@ukzn.ac.za

The Grassland Society of Southern Africa Trust kindly sponsored my travel expenses to present a paper at the Ecological Society of America Congress in Portland Oregon in August 2004, and to visit sites in Kansas and Minnesota. It is cheaper to fly to the USA via London than to fly direct, which gave me an opportunity to stop off and spend time in the UK with Mike and Kath Walters and visit the famous Rothamsted agricultural experimental station. Mike studied grassland science with me and did his MSc on burning Mopane in the Lowveld of Zimbabwe.

Mike and I collected Colin and Terry Everson from the bus stop in Watford and after a quick cup of coffee at Mike's place drove to Rothamsted in the town of Harpenden, which is only a 15 minute drive from Watford. Rothamsted houses the longest ecological experiment in the world, the Park Grass Experiment, started in 1856. It also houses the Broadbalk Winter Wheat Experiment, started in 1843 as well as several other long-term experiments. We met at 9:30 am with Professor Keith Goulding, who is head of the agriculture and environment division at Rothamsted and discussed research interests and the various experiments at the station. Following tea we were taken by Paul Poulton out to the Park Grass Experiment. I was particularly interested in seeing this experiment having read much about it and because of its similarity to our long-term grassland fertilization experiment at Ukulinga. Like Ukulinga, it has two different types of types of nitrogen (N) fertilizer treatment, ammonium sulphate and sodium nitrate (Ukulinga has ammonium nitrate). These different N fertilizers influenced soil pH and composition. *Arrhenatherum elatius* dominated the higher soil pH sites fertilized with sodium nitrate or N-fertilized limed sites, whereas *Holcus lanatus* dominated the lower soil pH sites fertilized with ammonium sulphate (Tilman *et al*. 1994). The acidifying ammonium sulphate reduced species richness to a much greater degree than sodium nitrate. Interestingly, plots were split about 10 years ago, with half of a plot no longer receiving N fertilizer. Species richness has recovered strongly in the half of the plot that used to receive sodium nitrate but has shown no recovery in the plot that used to receive ammonium sulphate. Liming greatly ameliorates the negative effect of N fertilizer on species richness, as it does at Ukulinga. Treatments that include various combinations of P, K, Na and Mg have effects on some of the less dominant species. Another interesting feature of the Park Grass Experiment is how some of the present dominants only attained dominance after 90 years of treatment applications. Thus, we should be cautious about drawing conclusions from short-term experiments. Owing to its manipulation of a wide range of soil nutrients and its 150-year existence, the Park Grass Experiment makes an impressive and extremely valuable contribution to plant ecological research.

Paul then took us to the Broadbalk winter wheat experiment. This famous experiment investigates the effects of various organic and inorganic fertilizers on wheat yields as well as the effect of excluding agrochemicals and different rotations on wheat yields. We were also taken to the soil and grain archives where soil and grain samples from the various experiments at Rothamsted have been stored at intervals since 1850. Analyses of these samples has allowed extremely valuable insights into the effects of various fertilizers and cropping regimes on soil organic carbon, the effect of nuclear bomb testing on C14/C12 ratios in the earth's atmosphere and the establishment of pre-pollution standards. All in all Rothamsted is an extremely impressive place and well worth a visit. We were treated to lunch at the Rothamsted cafeteria to round off a very enjoyable visit.

I then flew to the twin cities of Minneapolis and St Paul in Minnesota, USA. Minneapolis and St Paul are joined by a few bridges over the Mississippi river. It's lovely in summer but you don't want to be there in their freezing winter. I had arranged to visit David Tilman's sites at Cedar Creek, but was unable to contact the assistant director of Cedar Creek to finalize my visit so decided to visit some friends in Zimmerman about 45 minutes drive from Minneapolis. They took me around the Sherbourne wildlife refuge where I was able to have a good look at the prairie/oak savanna that characterizes the natural vegetation of the region. I also got to see bald eagles and my first look at one of the dominants of tallgrass prairie, Big Bluestem (*Andropogon gerradii*). The soils of this region are derived from glacial outwash and are very sandy and extremely low in N (50 300 mg kg^{-1} in Minnesota compared with 1500 3000 mg kg^{-1} in most South African soils). Consequently, competition for N appears to be one of the major determinants of plant community composition in Minnesota (Tilman 1988; Wedin & Tilman 1993).

After spending a few days in Minnesota, I flew to Portland, Oregon for the Ecological Society of America Congress, which was held at the Oregon convention center. This is the biggest ecological congress in the world with over 4000 oral and poster presentations. I managed to get on one of the congress tours to Mount St Helens. We were privileged to have as our guides researchers who have been at the forefront of ecological research on the mountain following the devastating eruption in 1980. We heard about all the research that is been done on the mountain to see how the ecosystem was affected by the eruption and its recovery over 24 years. Again, the slow rate of nitrogen accumulation in the lava flows is the principal factor constraining the rate of ecosystem recovery.

The conference was very interesting, with many parallel sessions encompassing all the various disciplines of ecology. The theme of the congress was: "lessons of Lewis and Clarke: ecological exploration of inhabited landscapes". Lewis & Clark were two explorers commissioned by President Thomas Jefferson to find a water-navigable route across the western continent to the Pacific Ocean, to learn about the biological and geological resources of the vast northwestern landscape and to make peaceful contact with the native people living along the route and to learn about their societies. They left St. Louis, Missouri in May 1804 and returned in September 1806. They traveled more than 3000 miles through uncharted territory. Along the way, they observed, collected and described dozens of plant and animal species that were new to science.

At the conference I concentrated on the grassland ecology and biodiversity sessions. It was great to see presentations by people whose papers one often reads such as Shahid Naeem, Brian Enquist, Brian Foster, Mark Westoby, Alan Knapp, Scott Collins and many others. My presentation was entitled "Plant strategies and the determinants of community composition in South African mesic grasslands" by R.W.S. Fynn, C.D. Morris, K.P. Kirkman and T.G. O'Connor. I drew on work that we have been doing on our two 54 year old experiments at Ukulinga, the burning and mowing experiment and the fertilizer experiment, as well as other work on natural productivity gradients and various competition experiments. I presented evidence of the strategies (tradeoffs in competitive ability, tolerance of moisture stress, suppression- versus tolerance-based competitive strategies) that plants are using to allow them to dominate at various positions on environmental gradients (e.g. burning or mowing frequency, soil depth, soil fertility etc.).

After the conference I spent a few days hiking down on the Oregon coast. The scenery is spectacular with beautiful forests, rugged coastline characterized by sheer cliffs thousands of feet high, forests above the cliffs and isolated beaches. It is very similar to our wild coast in many ways and even has a "hole in the wall". This is where Lewis and Clarke reached the Pacific Ocean after their amazing hike across the continent from St Louis, following first the Missouri river to its source and then hiking down Columbia River to the Pacific Ocean.

After a few days on the coast, I caught a bus back to Portland and flew to Manhattan, Kansas, which is the location of Kansas State University, which oversees the famous Konza prairie research station. Tony Swemmer, who is doing a PhD with Alan Knapp, showed me around Konza the first day. It was great to see all the burning and grazing experiments and others that I had read about in various papers (Knapp & Seastedt 1986; Gibson & Hurlbert 1987; Seastedt *et al*. 1991; Gibson *et al*. 1993; Collins *et al*. 1998; Knapp *et al* (1998). I also had some great close up viewing of bison as they grazed all around our car. I spent the second day with John Blair who is in the Division of Biology at Kansas State University. John Blair is well known for his research on grassland ecology, soil ecology and terrestrial biogeochemistry in tallgrass prairie. He showed me around his lab and took me out to Konza where we had a detailed look at the various experiments and projects running there such as the grassland fertilization and mowing experiment, the Hurlbert burning plots, a prairie restoration experiment, published recently in *Oecologia* (Baer *et al*. 2004), and the landscape-scale burning and bison grazing experiments. It was a surprise to me that two of the dominants in these grasslands, Big Bluestem (*Andropogon gerradii*) and Switch grass (*Panicum virgatum*) are much less sensitive to burning frequency and soil depth than some of our dominants. For example, in South African mesic grasslands, *Themeda triandra* tends to only dominate with regular burning (Everson & Tainton 1984; Fynn *et al*. in press) and generally on well-drained and relatively infertile soils (Fynn & O'Connor 2005). In tall grass prairie, however, Big Bluestem and Switch grass may dominate long-term unburnt grassland, long-term annually burnt grassland and shallow and deep soils. However, they tend to be most dominant in annually burnt treatments. Switch grass is also most dominant on deep fertile soils near streams, similar to our *Panicum maximum*. One main difference between these prairie dominants and our dominant species is that they are rhizomatous whereas ours are tufted species. A rhizomatous growth habit may give these prairie species an ability to tolerate high levels of litter accumulation in unburnt treatments (Knapp & Seastedt 1986) and low light availability in productive sites. John Blair also introduced me to Loretta Johnson who is doing some interesting work on belowground processes in prairie and Alaskan systems. I had coffee with her and learnt about some interesting new research that she is pioneering looking at which genes in various species are turned on under various stresses and environmental conditions. This has great potential for gaining insight into the mechanisms that enable species to succeed under various environmental conditions.

I spent my third day at Konza helping one of Alan Knapp's PhD students, looking at water potentials in a number of grass and forb species on shallow and deep soils. I learnt to identify *Andropogon gerrardii, Panicum virgatum, Sorgastrum nutans, Schizachyrium scoparium* and a *Bouteloua* sp. This concluded my visit to the USA and I flew back to South Africa via London.

The trip was a great experience for me; I learned a great deal and was able to make some very good contacts. I am extremely grateful to the Grassland Society of Southern Africa Trust for funding the travel expenses, the Discipline of Grassland Science, University of KwaZulu-Natal and my father for contributing towards conference registration fees and other expenses.

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Simplified technique for assessing the condition of the grass sward in the *Cymbopogon Themeda* veld in the southern Free State and north Eastern Cape provinces of South Africa

W.M. Goqwana & W.S.W Trollope
Department Livestock & Pasture Science, Faculty of Agriculture & Environmental Sciences, University Fort Hare, Alice, 5200

Introduction

A simplified technique based on key grass species has been developed to assess the condition of the grass sward for livestock production in the *Cymbopogon-Themeda* Veld type see Table 1 (Goqwana, 2004). This research product greatly simplifies the assessment of veld condition in this veld type as it obviates the necessity to be able to identify all the different grass species occurring in this veld type. The results of the technique are used to describe the condition of the veld in terms of its potential to produce forage for livestock and to resist accelerated soil erosion. This information is then used to formulate veld management practices like controlled burning based on the condition of the grass sward.

Procedure

The procedure followed for using this technique is that the different homogeneous vegetation units (HVU's) occurring on a farming unit are identified and demarcated on a map of the farm. This involves separating out all the different types of veld as influenced by soil type, aspect and altitude on the property. Sample sites are then located

Department Livestock & Pasture Science
Isebe Lemfuyo Namadlelo

in representative areas in each of the HVU's at a sampling intensity of one survey per 100 hectares, thereby varying the sampling intensity according to the size of the different HVU's.

Grass surveys are then conducted at each sample site using a nearest plant-point method. This involves recording the nearest rooted herbaceous plant to a point quadrat located at two metre intervals along two transects 100 metres long, parallel to one another and 25 metres apart i.e. 100 points per survey. The basal cover of the grass sward is indexed by recording the distance from the point quadrat to the edge of the nearest rooted herbaceous plant.

In addition to the grass surveys the standing crop of grass is estimated with a Disc Pasture Meter by recording the disc height at two metre intervals along the same two transects used for recording the different grass species. The data from the grass and Disc Pasture Meter surveys are then used to describe the condition of the veld, using table 1 as a template. The three parameters used are the botanical composition of the species expressed as a percentage, the mean point to tuft distance in centimetres and the standing crop of the sward in kilogrammes per hectare. This value is calculated using the calibration developed by Trollope (1983) for estimating the standing crop of grass under veld conditions in the Eastern Cape Province viz.

$$y = 340 + 388.3x$$

where: y = mean fuel load - kg/ha;
x = mean disc height - cm.

Table 1: Simplified technique for assessing the condition of the grass sward in the *Cymbopogon Themeda* Veld in the southern Free State & north Eastern Cape Province.

ASSESSMENT VELD CONDITION - GRASS SWARD
Cymbopogon Themeda Veld

Sample Site:.. Date:.....................

Soil Type:.. GPS:..

CATEGORY	SPECIES	FREQUENCY %	FORAGE FACTOR	FORAGE SCORE
DECREASER SPECIES	*Themeda triandra*		8	
DECREASER TOTAL				
INCREASER I SPECIES	*Cymbopogon plurinodis*		3	
	Elionurus muticus		-2	
INCREASER I TOTAL				
INCREASER II SPECIES	*Heteropogon contortus*		5	
	Eragrostis spp.		1	
	Karoo		-5	
	Forbs		-6	
	Bare Ground		-4	
				242
INCREASER II TOTAL			FORAGE SCORE	
Other species				
TOTAL				

TREND

CATEGORY	%	GRAZING	Tick
DECREASER SPP.		MODERATE	
INCREASER I SPP		UNDER	
INCREASER I SPP		SELECTIVE	
INCREASER II SPP		OVER	

CONCLUSIONS

FORAGE/ FUEL POTENTIAL

POTENTIAL	SCORE	FORAGE
		Tick
VERY HIGH	> 500	
HIGH	401 - 500	
MEDIUM	301 - 400	
LOW	200 - 300	
VERY LOW	< 200	

CONTROLLED BURNING

BOTANICAL COMPOSITION	%	BURN	
		YES	NO
DECREASER SPECIES			
INCREASER I SPECIES			
INCREASER II SPECIES			
FUEL LOAD - kg/ha >4000			
OVERALL DECISION TO BURN			

SOIL EROSION

FACTOR	POTENTIAL FOR EROSION		
TUFT DISTANCE	LOW	MOD	HIGH
	<3 cm	3-5 cm	>5cm
Distance = cm			
GRASS STD CROP	> 1500 kg/ha	<1500 kg/ha	
kg/ha =			
OVERALL SOIL EROSION POTENTIAL	LOW	HIGH	

The conclusions that can be drawn from the results of the key grass species technique are based on the following assumptions that have been developed through field experience gained with the use of this procedure of assessing range condition in the Eastern Cape Province.

Forage Potential

The range in the forage scores from very high (>500) to very low (<200) reflect the potential of the grass sward to produce forage for grazing domestic livestock. These categories have proven to be ecologically meaningful with highly applicable practical management implications.

Trend

This refers to whether the veld is being moderately grazed, under grazed, selectively grazed or over grazed. The criteria used for deciding the intensity of grazing is that if the veld is dominated by Decreaser grass species then it is correctly stocked and is being moderately grazed. If it is dominated by Increaser I grass species then it is understocked and is being under grazed. If it is dominated by Increaser II grass species then it is overstocked and is being over grazed. Finally if it is dominated by both Increaser I and Increaser II grass species it is being selectively grazed.

Soil Erosion

The effect of the herbaceous vegetation on accelerated soil erosion depends upon the basal and canopy cover of the grass sward. If the basal and canopy covers are high then the potential for soil erosion is low and *vice versa*. Simple indices have been identified for these two parameters. Basal cover is satisfactorily described by recording the distance from a measuring point to the edge of the nearest grass tuft and is easily measured in the field. The different categories of point to tuft distance reflecting low (<3 cm), moderate (3-5 cm) and high (>5 cm) potentials for soil erosion were derived from field research and experience. The standing crop of grass is an excellent index of the canopy cover of the grass sward and is readily measured in the field with a disc pasture meter. The different values that have been assigned to this parameter have been subjectively determined based on field experience in the Eastern Cape Province.

Controlled Burning

The necessity for veld to be burnt or not depends upon its ecological status and physical condition. In order to maintain the potential of the grass sward to produce forage, burning should not be applied if the grass sward is in a pioneer condition dominated by Increaser II grass species caused by overgrazing. Burning should be avoided if the veld is in this condition in order to allow it to develop to a more productive stage dominated by Decreaser grass species. Conversely when the grass sward is in an under grazed condition dominated by Increaser I species, it needs to be burnt to increase the better fire adapted and more productive Decreaser grass species. Finally controlled burning is also necessary when the grass sward has become overgrown and moribund as a result of excessive self-shading. When in this condition it is necessary to remove this old unpalatable grass material to restore the vigour of the grass sward and allow new nutritious regrowth to develop. Field experience gained all over southern and east Africa indicates that when the standing crop of grass >4000 kg/ha then the grass sward has become moribund and needs to be defoliated by burning or any other means of removal.

Examples of veld in different conditions assessed with the key grass species technique for the *Cymbopogon Themeda* veld

Examples of veld that is correctly stocked, understocked, overstocked and selectively grazed as determined with the key grass species technique are presented in Tables 2, 3, 4 and 5 together with conclusions as to whether the veld needs to be burnt or not.

Table 2: Example of veld that is correctly stocked and dominated by *Themeda triandra.*

ASSESSMENT VELD CONDITION - GRASS SWARD

Cymbopogon Themeda Veld

Sample Site:*Themeda triandra* dominant veld Date:.......................

Soil Type:... GPS:...

CATEGORY	SPECIES	FREQUENCY %	FORAGE FACTOR	FORAGE SCORE
DECREASER SPECIES	*Themeda triandra*	65	8	520
DECREASER TOTAL		65		
INCREASER I SPECIES	*Cymbopogon plurinodis*	10	3	30
	Elionurus muticus	7	-2	-14
INCREASER I TOTAL		17		
INCREASER II SPECIES	*Heteropogon contortus*	10	5	50
	Eragrostis spp.		1	
	Karoo	3	-5	-15
	Forbs	5	-6	-30
	Bare Ground	0	-4	
				242
INCREASER II TOTAL		18	FORAGE SCORE	783
Other species		-		
TOTAL		100		

CONCLUSIONS

FORAGE/ FUEL POTENTIAL

POTENTIAL	SCORE	FORAGE Tick
VERY HIGH	> 500	✓
HIGH	401 - 500	
MEDIUM	301 - 400	
LOW	200 - 300	
VERY LOW	< 200	

TREND

CATEGORY	%	GRAZING	Tick
DECREASER SPP.	65	MODERATE	✓
INCREASER I SPP	17	UNDER	
INCREASER I SPP	17	SELECTIVE	
INCREASER II SPP	18	OVER	

CONTROLLED BURNING

BOTANICAL COMPOSITION	%	BURN	
		YES	NO
DECREASER SPECIES	65	✓	
INCREASER I SPECIES	17		
INCREASER II SPECIES	18		
FUEL LOAD - kg/ha >4000			✓
OVERALL DECISION TO BURN			✓

SOIL EROSION

FACTOR	POTENTIAL FOR EROSION		
TUFT DISTANCE	LOW	MOD	HIGH
	<3 cm	3-5 cm	>5cm
Distance = cm	✓		
GRASS STD CROP	> 1500 kg/ha	<1500 kg/ha	
kg/ha =	✓		
OVERALL SOIL EROSION POTENTIAL	LOW	HIGH	

Table 3: Example of veld that is understocked and dominated by *Cymbopogon plurinodis* and *Elionurus muticus*

ASSESSMENT VELD CONDITION - GRASS SWARD
Cymbopogon Themeda Veld

Sample Site: *Cymbopogon/ Elionurus* dominant veld Date: *11th May 2004.*
Soil Type:.. GPS:..

CATEGORY	SPECIES	FREQUENCY %	FORAGE FACTOR	FORAGE SCORE
DECREASER SPECIES	*Themeda triandra*	2	8	16
DECREASER TOTAL		2		
INCREASER I SPECIES	*Cymbopogon plurinodis*	35	3	105
	Elionurus muticus	40	-2	-80
INCREASER I TOTAL		75		
INCREASER II SPECIES	*Heteropogon contortus*	2	5	10
	Eragrostis spp.	10	1	10
	Karoo		-5	
	Forbs	7	-6	-42
	Bare Ground		-4	
				242
INCREASER II TOTAL		19	FORAGE SCORE	261
Other species		4		
TOTAL		100		

TREND

CATEGORY	%	GRAZING	Tick
DECREASER SPP.	2	MODERATE	
INCREASER I SPP	75	UNDER	✓
INCREASER I SPP	75	SELECTIVE	
INCREASER II SPP	19	OVER	

CONCLUSIONS

FORAGE/ FUEL POTENTIAL

POTENTIAL	SCORE	FORAGE Tick
VERY HIGH	> 500	
HIGH	401 - 500	
MEDIUM	301 - 400	
LOW	200 - 300	✓
VERY LOW	< 200	

CONTROLLED BURNING

BOTANICAL COMPOSITION	%	BURN YES	BURN NO
DECREASER SPECIES	2		
INCREASER I SPECIES	75	✓	
INCREASER II SPECIES	19		
FUEL LOAD - kg/ha >4000		✓	
OVERALL DECISION TO BURN		✓	

SOIL EROSION

FACTOR	POTENTIAL FOR EROSION		
TUFT DISTANCE	LOW	MOD	HIGH
	<3 cm	3-5 cm	>5cm
Distance = cm		✓	
GRASS STD CROP	> 1500 kg/ha	<1500 kg/ha	
kg/ha =			
OVERALL SOIL EROSION POTENTIAL	LOW	HIGH	
	✓		

Table 4: Example of veld that is overstocked and dominated by *Eragrostis* species.

ASSESSMENT VELD CONDITION - GRASS SWARD
Cymbopogon Themeda Veld

Sample Site: *Eragrostis* species dominant veld. Date: *11th May 2004*
Soil Type:.. GPS:...

CATEGORY	SPECIES	FREQUENCY %	FORAGE FACTOR	FORAGE SCORE
DECREASER SPECIES	*Themeda triandra*		8	
DECREASER TOTAL		0		
INCREASER I SPECIES	*Cymbopogon plurinodis*	5	3	15
	Elionurus muticus	1	-2	-2
INCREASER I TOTAL		6		
INCREASER II SPECIES	*Heteropogon contortus*		5	
	Eragrostis spp.	64	1	64
	Karoo	15	-5	-75
	Forbs	5	-6	-30
	Bare Ground	10	-4	-40
		94		242
INCREASER II TOTAL			FORAGE SCORE	174
Other species				
TOTAL		100		

TREND

CATEGORY	%	GRAZING	Tick
DECREASER SPP.	0	MODERATE	
INCREASER I SPP	6	UNDER	
INCREASER I SPP	6	SELECTIVE	
INCREASER II SPP	94	OVER	✓

CONCLUSIONS

FORAGE/ FUEL POTENTIAL

POTENTIAL	SCORE	FORAGE
		Tick
VERY HIGH	> 500	
HIGH	401 - 500	
MEDIUM	301 - 400	
LOW	200 - 300	✓
VERY LOW	< 200	

CONTROLLED BURNING

BOTANICAL COMPOSITION	%	BURN	
		YES	NO
DECREASER SPECIES	0		
INCREASER I SPECIES	6		
INCREASER II SPECIES	94		✓
FUEL LOAD - kg/ha >4000			✓
OVERALL DECISION TO BURN			✓

SOIL EROSION

FACTOR	POTENTIAL FOR EROSION		
TUFT DISTANCE	LOW	MOD	HIGH
	<3 cm	3-5 cm	>5cm
Distance = cm			✓
GRASS STD CROP	> 1500 kg/ha		<1500 kg/ha
kg/ha =			✓
OVERALL SOIL EROSION POTENTIAL	LOW		HIGH
			✓

Table 5: Example of selectively grazed veld dominated by *Cymbopogon plurinodis* and *Eragrostis* species.

ASSESSMENT VELD CONDITION - GRASS SWARD
Cymbopogon Themeda Veld

Sample Site: *Cymbopogon/ Eragrostis* dominant veld.... Date: *11th May 2004*
Soil Type:... GPS:..

CATEGORY	SPECIES	FREQUENCY %	FORAGE FACTOR	FORAGE SCORE
DECREASER SPECIES	*Themeda triandra*	2	8	16
DECREASER TOTAL		20		
INCREASER I SPECIES	*Cymbopogon plurinodis*	45	3	135
	Elionurus muticus	6	-2	-12
INCREASER I TOTAL		51		
INCREASER II SPECIES	*Heteropogon contortus*		5	
	Eragrostis spp.	40	1	40
	Karoo	2	-5	-10
	Forbs	5	-6	-30
	Bare Ground		-4	
				242
INCREASER II TOTAL		47	FORAGE SCORE	381
Other species				
TOTAL		100		

CONCLUSIONS

FORAGE/ FUEL POTENTIAL

POTENTIAL	SCORE	FORAGE Tick
VERY HIGH	> 500	
HIGH	401 - 500	
MEDIUM	301 - 400	✓
LOW	200 - 300	
VERY LOW	< 200	

TREND

CATEGORY	%	GRAZING	Tick
DECREASER SPP.	2	MODERATE	
INCREASER I SPP	51	UNDER	
INCREASER I SPP	51	SELECTIVE	✓
INCREASER II SPP	47	OVER	

SOIL EROSION

FACTOR	POTENTIAL FOR EROSION		
TUFT DISTANCE	LOW	MOD	HIGH
	<3 cm	3-5 cm	>5cm
Distance = cm		✓	
GRASS STD CROP	> 1500 kg/ha	<1500 kg/ha	
kg/ha =	✓		
OVERALL SOIL EROSION POTENTIAL	LOW	HIGH	
	✓		

CONTROLLED BURNING

BOTANICAL COMPOSITION	%	BURN YES	BURN NO
DECREASER SPECIES	2		
INCREASER I SPECIES	51	✓	
INCREASER II SPECIES	47		
FUEL LOAD - kg/ha >4000		✓	
OVERALL DECISION TO BURN		✓	

References

Goqwana, WM 2004. The development of a method of assessing veld condition in the communal grazing areas of the north Eastern Cape province of South Africa. MSc Agric. Thesis, University Fort Hare, Alice.

Trollope WSW 1983. Control of bush encroachment with fire in the arid savannas of southeastern Africa. PhD thesis, University of Natal, Pietermaritzburg.

OBITUARY

Brian Hahn: 21 November 1946 5 February 2005-02-07

Dave Richardson

The Society has learned with great sadness of the death of Professor Brian Hahn.

Brian Hahn obtained a BSc in Applied Mathematics and Physics and a BSc (Hons) in theoretical physics from UCT. This was followed by a PhD in theoretical physics at Cambridge.

On his return to South Africa in 1973 he joined the Department of Applied Mathematics at Wits where he was one of the small group who demonstrated that simulation models of biological systems could make a substantial contribution to understanding of how such systems work. One of his earliest studies in the field of biomathematics was the development of a model of the spread of anthrax among animals in the Kruger Park. He moved to UCT in 1979.

One of his great contributions to biomathematics was the development in collaboration with Peter Furniss of the interactive modelling package DRIVER. This has enabled biologists to develop and implement their own models, especially those based on systems of differential equations. He subsequently upgraded DRIVER so that it could handle all the information required for modelling rangeland systems. DRIVER has been used to implement short-term (one year) mechanistic models of rangeland systems as well as models of ruminant digestion and metabolism.

Brian's greatest achievement was the development of multi-disciplinary research based on mathematical modelling that brought together a group of scientists that included mathematicians, a biochemist, animal scientists and botanists to form the Rangeland Modelling Group. This team developed hierarchies of models of range and livestock production for both Savanna and Succulent Karoo ecosystems. Brian built appropriate computer programmes for long-term models (100 years) of each system using equations and rules derived from output of the short-term-models together with information proposed by consensus. He developed a method of using replicate runs of models to investigate the effects of management strategies and climate change on livestock production and range condition. The model predicts the probable frequency of livestock mortality exceeding 75% and the probability of degradation of the range.

Brian's great legacy is the level of enthusiasm for modelling as a research method in rangeland science. He provided outstanding leadership and all those involved were encouraged to contribute their individual knowledge and understanding of specific processes to the success of the project as a whole.

Our heartfelt sympathy is extended to his wife Cleone and to his children Lyndall, Andre and David.

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Contact

Richard Hurt
email:info@mindmap.co.za
Tel: 033 345 3146
Fax: 033 394 6687
Cell: 082 887 1082

Freyni du Toit
email: admin@gssa.co.za
Tel: 033 390 3113
Fax: 033 390 3113
Cell: 083 256 7202

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CONTACT

All registrations, submission of titles and queries can be directed to:

Richard Hurt
E-mail: info@mindmap.co.za
Tel: 033 345 3146
Fax: 033 394 6687
Cell: 082 887 1082

Freyni du Toit
E-mail: admin@gssa.co.za
Tel: 033 390 3113
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