GRASSROOTS

Guest Editor

A guest editorial from the first editor of the Bulletin of the Grassland Society of Southern Africa, musing about how our newsletter has reflected the changing Society over the past two decades.

The morphing of the "Bulletin" into "Grassroots" is a very good example of the adaptability the leadership, of the Society has shown over the years. On the occasion of the 20th year of regular publication of a 'popular' format we can reflect on how things have changed – or have they?

Certainly the content is quite different as when we started the "Occasional Publications" and the "Bulletin" the intention was really to get "the science into practice" and to record the good ideas emerging from field days and non-congress events (this was sort of a Journal of Good Ideas and Failed Experiments but ISI didn't like the idea so we went it alone!). What we could not anticipate was that the publication, now well established as Grassroots, would provide the forum for the development of a new medium that now characterises the programme at the formal Congresses. This has moved us as a Society and discipline into the era of trans-disciplinary agendas and we have maintained our relevance through this I believe. For those who may not have thought about this buzzword here are my definitions:

Multi-disciplinary – many disciplines working on a project and they do not really need to talk to each other;

Inter-disciplinary – as above, but they have to write a joint report so are forced to talk to each other at the end of the project. Usually these 'studies' come about where one discipline takes on a project, gets into trouble so find some mates from other disciplines to help; and

Trans-disciplinary –here all possible disciplines (especially those very hard ones we call "soft sciences"!) get together and write the project proposal so they are all in it from start to end.

Of course the last of these is where the GSSA has moved itself to in my view. Whether this was done by accident or design I don't know, but this is what has and will keep this Society alive. The GSSA and all its elements have done well to survive the changes in the 'scientific' environment over the last three decades and I have no doubt that the strength-in-adaptability will prevail.

Oh, by the way, I see from Mike Peel's Presidential Address (GSSA Congress 2010) that the planted pastures issue remains. That has not changed in 30 years! Perhaps if the debate was taken into a trans-disciplinary realm, things may look different!

Peter Zacharius (PeteZac) has been a member since 1982 (Processional since 1993), served as Honorary Secretary for more years than he can remember from 1985. He was President in 1993 and has served in every portfolio, except Treasure, available at the time he was on Council structures (1985 to 2005) and attended 21 consecutive congresses. Career decisions have distracted him from the veld since 2006 and after a 30 year association with UKZN he is now Chief Operations Officer for the Safe Blood for Africa Foundation.

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.

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Regulars

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On the cover: Area B: Stockpiled placement. Photo: Flip Breytechbach

2010 Sustainability Awards and 10th Anniversary of Impumelelo Innovations Award Trust Function at Artscape, Cape Town: May 2010,

N GABRIELS
on behalf of GSSA

I felt really cultured arriving at Artscape on this particular Sunday evening. Light classical music was playing in the reception area and the aroma and aesthetic value of picture food filled the room. There was an air of excitement and expectancy as honorary guests, politicians, prize winners and the rest of the audience filed into the awards venue. The well-known South African comedian, Mark Lottering, was the Master of Ceremonies for the evening. He was very entertaining and managed to make one or two "faux pas" of the evening look as if it was part of the "act". The audience was addressed by Dr Franklin Sonn (Chairperson) and Ms Rhoda Kadalie (Executive Director) of Impumelelo Trust, who stressed the importance and the value of development projects in the townships and rural areas of South Africa. They commended the winners of the 2010 Impumelelo Innovations awards for their hard work, their commitment and their innovations; and the direct impacts of their projects on poor South African communities.

Nine silver, eight gold, four platinum and three social entrepreneur awards were awarded that evening. Winning projects ranged from HIV/AIDS and other health care related projects to literacy, handcraft and music therapy community clinics to greening and recycling projects to mentoring of emerging black farmers. The innovation winners were awarded with certificates and prize money funded by the Ford Foundation, Open Society Foundation of SA, Charles Stewart Mott Foundation and the Konrad Adenauer Foundation.

The projects which were most impressive to me were the Orange Bag Recycling Project from KwaZulu-Natal and the Abalimi: Harvest of Hope - from Seed to Table Project from the Western Cape. The Polokwane Declaration of 2000 prescribed a 50 % reduction in waste to landfill by 2012 and zero waste to landfill by 2022. In order to achieve this, the Cleansing and Solid Waste Unit of the eThekwini Municipality initiated the Orange Bag Recycling Project in August 2007. In partnership with Mondi Paper, the municipality provided orange refuse bags to households in selected areas to be filled only with paper and plastic products. Publicity campaigns were carried out to promote this. Private enterprises collected the bags and took them to Mondi for recycling, thereby reducing the amount of waste taken to landfills. The project was so successful in its pilot stage in the Outer West of Durban, that is has been extended to the Inner West, Durban North and Durban Central. It currently reaches approximately 100 000 homes (60 % of the target). To date, more that 2000 tons of waste has been collected and recycled.

Abalimi Bezekhaya has assisted an estimated 3000 urban poor to "micro-farm" since 1982. In February 2008, Abalimi established Harvest of Hope – from Seed to Table to create a new value chain for farmers from Khayelitsha and Nyanga to sell their produce directly to customers in upper income suburbs through an organic box scheme. This provides a reliable cash income to about 130 farmers. The potential is there for each farmer to earn an estimated R1500 per month, whether realised or not. Abalimi Bezekhaya received an award for his efforts in assisting these small farmers in progressing from survival and subsistence levels of urban farming to a livelihood level where they can earn cash and still produce food for their families.

The audience was rewarded for their patience with classical music and dance performances by the Libertas Choir, Opera singer Musawenkosi Ngqungwana, Hugo Lamprecht Sax quartet, the pianist Eben Wagenstrom and the Jikeleza Feather Dance group.

2010 GSSA Research Skills Workshop

Delegates at GSSA research skills workshop.

JULIUS TJELELE
Agricultural Research Council, Animal Production Institute

Once again congratulation to the organisers of research skills workshop held in Middelburg, Eastern Cape on the 21 to 22 September 2010. Several speakers discussed fundamental skills required to successfully plan, execute experiments and write scientific papers.

Among other speakers David Ward discussed an interesting talk on "the research question". This is a vital aspect of research, which is often not given the attention it deserves, and many questions are found to be unanswerable or even already answered in other research.

Most young researchers are faced with dilemma of whether to continue with research or move towards management? Luthando Dziba unpacked this issue effectively and hopefully we will now tackle such challenges carefully to avoid frustration.

One message that I took home was that "a scientific experiment, no matter how good the results may be, is not complete until the results are published". It is now up to the researchers, especially young researchers to practice all lessons learned from the research skills workshop.

We hopefully now know whether we want to pursue research or move towards management, have the required skills to write proposals, learned how to develop research question, design experiments, collect and effectively managed data and write scientific paper.

More scientific papers, papers, papers……

SA youth warned to protect environment

Pretoria - South Africa, especially the youth, need to take global warming and threats to the environment seriously if the country is to prevent the devastating impacts of climate change. This is according to Deputy Water and Environmental Affairs Minister, Rejoice Mabudafhasi who was speaking at the launch of the Kudu Green School initiative in Pretoria on Wednesday.

"The future of our environment lies in the ability of our youth to understand that the sustainability of our natural environment and ecosystems cannot only be left to existing legislation and policies," the deputy minister said.

The project seeks to rope in school children in Gauteng to be ambassadors in the fight against climate change. Through the initiative, youngsters from selected schools are made aware of the environment and are encouraged to create educational experiences that will change their perspective of climate change. Mabudafhasi said her department, together with other players in the environmental sector, had recently undertaken an initiative to ensure that environmental learning was well articulated and recognised within the newly revised school curriculum.

Several schools on Wednesday were presented with green flags as a symbol of their participation in the fight against climate change.

"An initiative like this one will therefore ensure that learners in urban environments are prepared for future careers in conservation and the natural sciences," Mabudafhasi said.

As hosts of the Congress of Parties on climate change (COP 17) in a year's time, South Africa is under pressure to demonstrate its commitment to reduce carbon emissions, something that can only be achieved through an emigration to cleaner sources of energy.

Mabudafhasi said it was imperative that public awareness on climate related issues be intensified through education and encouraging people to change their attitudes towards the environment.

David Mabunda, Chief Executive Officer at the South African National Parks, said the Kudu Green School initiative was one of the responses to the climate challenge, society was experiencing.

"We are here to commit to sustainability in design and in practice and we want to bring about an increased awareness, appreciation and connection of people to the natural world," he said.

The National Lotteries Board (NLB) has promised to step in and provide funding to various environment-friendly projects across the country.

"If a project has got something to do with protecting the environment, we can provide funding for that," said board chairperson Alfred Nevhuthanda.

The NLB has a distribution of no less than R3 billion in funding to charities and non-profit organisations annually. Trade and Industry Minister Rob Davies has recently instructed the body to spend at least 50 percent of all its discretionary funds on rural organisations whose projects were committed to saving the environment.

BuaNews

SAEON's role in developing the next generation of scientists

R KHASHANE
SAEON Communications Intern

SAEON's education outreach programme had the privilege of hosting its first environmental science education symposium at Silonque Bush Estate in Phalaborwa.

The event attracted environmental education enthusiasts from across the country, comprising of teachers, learners and scientists. Among the guests were Lulekani Education Circuit Manager Tilly Baloyi and the Manager of SAEON's Ndlovu Node, Dr Tony Swemmer.

The symposium created a much needed platform for educators and learners to demonstrate and share their experiences gained as participants in the SAEON education outreach programme. The auditorium was abuzz with excitement as the 55 guests prepared themselves for presentations and discussions. Dr Tony Swemmer opened the proceedings and was followed by SAEON's Education Outreach Coordinator Sibongile Mokoena, who gave an overview of the programme.

"The aim of SAEON's science education is to give teachers and learners curriculum support so that learners are in a position to pursue careers in science," said Mokoena. The SAEON science education outreach programme is creating the next generation of scientist, she added.

The role of the scientist in education

Dr Dave Thompson of the SAEON Ndlovu Node gave a thought-provoking presentation on the role of the scientist in education. He said there is a huge gap between scientists and the curriculum, stressing that the relationship between scientists and the broader community needs to be improved. Thompson noted that most people who are not involved in the sciences receive most of their information from the media and through teaching by non-scientists. "Scientists need to be responsible educators and non-scientists need to be responsible learners," he added.

All in the name of science

DR. T SWEMMER,
SAEON Ndlovu Node
AND M COLGAN,
PhD student, Stanford University, USA

In these times of concern for the environment and efforts to combat global climate change, planting trees is highly regarded. Cutting down trees is not. However, this is exactly what SAEON's Ndlovu Node has been doing for the past three years. All in the name of science, of course.

Trees play a vital role in the regulation of the flow of carbon and water, between ecosystems and the atmosphere. The amount of carbon stored by trees and the rate at which trees grow and absorb more carbon out of the atmosphere is vital information, both for carbon credit projects and for global climate models that inform society of how our climate is changing (and how much more it is likely to change in future).

In order to provide more of the basic data upon which these complex models are built, the SAEON Ndlovu Node has been "harvesting" trees at a mining site. Harvesting involves making detailed measurements of a tree's dimensions before cutting it down and weighing it. By measuring trunk diameter and matching this with the tree's weight, future estimates of carbon stored in living trees are made at other sites where harvesting is not an option (such as inside Kruger National Park). For selected trees, roots are also dug up to be weighed, as nearly 30-50% of a tree's weight (and carbon) is located below ground.

Harvesting a range of tree species, in different types of ecosystems, is needed in order to make reliable estimates of biomass and carbon stocks over large areas.

Upcoming events

Technical Centre for Agricultural and Rural Cooperation (CTA) 2010 Annual Seminar
Date: 22-26 November 2010
Venue: Johannesburg, South Africa
Email: ctaseminar2010@cta.int

37th Annual Conference of the South Africa Association of Botanists (SAAB)
Date: 17-19 January 2011
Venue: University of Rhodes, Department of Botany
Tel: 046 603 8592
Email: saab2011@ru.ac.za

Climate Change Adaptation in Agriculture and Natural Resources Management
Date: 28 February -11 March 2011
Venue: Eastern Africa
Contact: Manon van Lent
Email: manon.vanlent@wur.nl

South African Association for Laboratory Animal Science Congress 2011
Date: 09-11 March 2011
Venue: Muldersdrift, Johannesburg
Contact: Sonja du Plessis
Email: Sonja@londocor.co.za

5th International Wildland Fire Conference – South Africa
Date: 09-13 May 2011
Venue: Sun City, South Africa
Tel: +27 21 797 5787
Email: info@wildfire2011.org

8th European Federation for Information Technology in Agriculture,
Food and the Environment Conference
Date: 11-14 July 2011
Venue: Czech University of Life Sciences Prague
Contact: Eva Cervenkova
Email: conference2011@czu.cz

10th African Crop Science Society Conference
Date: 10-13 October 2011
Venue: Maputo, Mozambique
Contact: Luisa Santos
Tel: (258) 2149 2177
Email: acss2011@uem.mz

Postgraduate Opportunity

Applications are invited from potential postgraduate students who would like to continue their MSc or PhD in Animal Nutrition or Pasture Science at University of Pretoria in 2011. The topics of research include:

Animal Nutrition
1. Screening of novel plant materials for their inhibitory effect on rumen methanogenesis.
2. In vitro and in vivo screening of commercial fibrloytic enzymes in terms of fibre degradation and reducing methane production.
3. Evaluation of drought tolerant alternative fodder crops leaf meals for milk goat production under small scale farming conditions.

Animal/ Pasture Science
1. Uncertainty assessment of greenhouse gas (GHG) emissions from the livestock sector (i) in terms of carbon sequestration and (ii) in terms of methane emission from ruminants using tropical/sub-tropical forages.
2. Manipulation of rainfall and grazing management with the aim (i) to generate data to gain a better understanding of the role of climate change, and (ii) to predict the effect of climate change on forage quality.
3. Modelling climate change impacts on the productivity of pastures and forage crops.

Requirements:
- Qualifications either BSc (Agric) for MSc degree and MSc (Agric) for PhD degree
- Knowledgeable on Animal Nutrition (Rumen fermentation) for registration in Animal Nutrition
- Knowledgeable on Grassland/ Pasture Science/ Agronomy for registration in Pasture Science

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Feature

Live topsoil placement versus stockpile placement - a biodiversity issue

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Introduction

The direct impacts of mining disturbance to land surfaces are usually severe, with the likelihood of the destruction of biodiversity within natural ecosystems through the removal of natural soils, plants and animals (IUCN and ICMM 2004). Mining is a temporary land use: the mineral deposit is finite and eventually exhausted. The major goal of sustainable rehabilitation is therefore, the maintenance of land use options for future generations. Mine closure and rehabilitation also need to take into consideration the long-term effects of acid mine drainage (AMD) and the need to rehabilitate in a manner that reduces the generation of AMD to acceptable levels. Ecological restoration is about a broad set of activities – enhancing, repairing or reconstructing degraded ecosystems – and also about optimising biodiversity returns (IUCN and ICMM 2004). In essence, the restoration of mined land is based upon ecosystem reconstruction. It is usually a question of re-establishing the ability of the land to capture and retain fundamental resources – energy, water, nutrients and species. Ecological restoration with biodiversity benefits in mind must involve an orderly set of considerations that promote successful procedures and practices (IUCN and ICMM 2004). One of the main goals of mining companies is to rehabilitate mined areas in such a way that biodiversity is restored in the shortest possible time. Topsoil is a strategic resource that should be conserved if at all possible. According to the Environmental Resources Management, Australia (2005) the characteristics of soils and waste material are one of the primary determinants of rehabilitation success.

Below is a checklist of the properties of substrates known to affect plant growth:

Physical properties:
Available water capacity
Infiltration and hydraulic conductivity
Aeration
Mechanical impedance
Chemical properties:
Nutrient availability
pH
Sulphide content
Bioavailability of toxic elements
Salinity
Microbiological properties:
Nitrogen fixation (Rhizobium)
Nutrient uptake (Mycorrhiza)
Nutrient cycling

Thus its removal, storage and replacement have been subject to a great deal of technical research in recent times in an effort to protect the physical and chemical properties and the biological processes of this valuable natural resource. Since Topsoil (A horizon) contains the majority of the seeds and other plant propagules, soil micro-organisms, organic matter and much of the more labile plant nutrients it is often the most important factor in successful rehabilitation, particularly where the objective is to restore a native ecosystem (Environmental Protection Agency 1995). In the restoration of sites where topsoil has been lost, the major ecological challenges are still related to the interactions between plant species and substrate – that is, revegetation. Yet in these cases faithful restoration of original ecosystems is rare. Mining substrates vary considerably in their physical and chemical attributes, but they tend to inhibit natural colonisation, and further succession may be restricted because of metal toxicity, infertility or acidity. Slow natural succession has sometimes been promoted as a reclamation option, but this is usually politically unacceptable in an erea when closure planning is becoming an every-day expectation (IUCN and ICMM 2004). Wherever possible, topsoil should be placed immediately on an area where the landform reconstruction is complete, known as live topsoil placement. Until recently, stockpile placement has been the more conventional practise and refers to the use of topsoil that was stored for rehabilitation for up to more than four years.

Material and methods

A pilot study to establish the effect of live vs. stockpile placement on the biodiversity was conducted at Kriel Colliery - Anglo Inyosi Coal. Two areas where live placement (Area A) was used were compared with two areas where stockpiled placement (Area B) was used. The comparison was in terms of plant species diversity, plant basal cover as well as canopy cover. No re-seeding of grass species took place in the areas where live placement was used. Re-seeding with grass species namely *Eragrostis tef, Digitaria eriantha* and *Chloris gayana* occurured in the areas rehabilitated by stockpiled topsoil. Four transects of 200m² (4m x 50m) were placed in both area A and B (total of eight transects). In each transect the following were recorded: plant species, growth form, mean canopy cover (Westfall and Panagos 1988) and mean basal cover. The PHYTO-TAB PC-Program package (Westfall et. al. 1996) was used to process the data.

Results

Live placement resulted in a higher number of plant species as well as a higher number of grass species compared to the stockpiled placement (Table 1).

Area A: Live placement

Area B: Stockpiled placement

	Live placement (A)	Stockpiled placement (B)
Mean no. of species recorded	30	16
Mean no. of grass species recorded	17	7
Mean no. of forb species per transect	12	9
Mean no. of dwarf shrub species per transect	2	1
Mean no. of species per transect	24	13
Mean canopy cover percentage	33%	40%
Mean basal cover percentage	11%	20%
Mean canopy cover percentage of grasses	26%	37%

Table 1. Plant diversity and cover comparison between live and stockpiled placement of topsoil

In terms of mean canopy cover there was not a notable difference between the two methods of topsoil placement. There was, however, a more notable difference in mean basal cover between Areas A (11%) and B (20%).

The areas rehabilitated by stockpiled topsoil and then re-seeded were dominated by the grasses *Digitaria eriantha, Chloris gayana* and *Cynodon dactylon* while the areas where live placement took place were dominated by the grasses *Eragrostis curvula* and *Cynodon dactylon.*

Discussion and conclusion

The mean canopy and basal cover differences indicated that the average size of grass tufts occurring on Area A were bigger than those occurring on Area B. This also indicated more bare areas existed in Area A which could probably result in more soil erosion compared to Area B. The higher plant species diversity, ant and small mammal activity noted in Area A will probably also result in a higher biodiversity. The nutritive quality of the grasses and the chemical properties of the soil will be determined and compared. Furthermore, in order to predict future plant species diversity for the two areas, the occurrence of seeds and seed viability will be determined.

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Challenges and possible solutions in running long-term trials

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Long-term ecological trials have provided valuable data for understanding dynamics of rangelands in response to fire, grazing, climate perturbations and other manipulations (Morris and Tainton 2002). However, long-term trials include many logistical and scientific challenges in addition to the usual challenges of running effective research trials. The Kokstad research trials illustrate many of the problems associated with long-term trials. These problems, and possible solutions to them, will be detailed below. Like any project, long-term trials require careful management and dedicated supervision to ensure their success.

Frequent staff turnover with inadequate documentation

In the twenty years since the establishment of the trials, there were four scientists and at least two technicians responsible for the trials (three scientists in the last ten years). In 1998, the scientist and technician were replaced simultaneously, meaning that there was no effective handover (for nine months, the trial was run by an experienced research labourer). One consequence of this frequent staff turnover was an unplanned change in the grazing regime on one of the trials.

In order to ensure that trials are effectively continued, it is absolutely essential that every detail of the trial procedure is covered in the trial protocol. While the project design for the Kokstad trials were detailed and more than adequate for setting up a trial, there were many small details that were not included in the project design document. For example, the exact date of burning, and the procedure for deciding when to place animals on the trial and when to remove them, were not clearly detailed in the original documents, with the result that the start dates and lengths of the grazing seasons varied substantially.

A proper handover protocol is also essential to avoid errors like the altered grazing regime. The grazing regime was clearly outlined in the protocol, but was somehow still changed. Unfortunately, it is very difficult to hand over a project when the previous project manager has already left the institution months before a replacement is appointed. Therefore, an institutional protocol of going through every detail of the project documents must be enforced when new staff is appointed.

Inadequate data management protocols

The data from the two-camp trials alone take up one drawer of a filing cabinet at Cedara. Given a few more years, additional draws will be required to store just the raw data. Backup copies will require another filing cabinet elsewhere.

It is not sufficient at the beginning of a trial to create one file labelled "two-camp trial" if masses of different data are planned to be collected for years. Every file and folder, both of the original data and of copies of the data sheets, must be created at the initiation of the trial. The protocols for handling the data must be outlined in detail. Copies of the data must be kept separately from the originals, in a different filing cabinet in a different building.

It is crucial that every data sheet is copied for backup. One simple method to copy the data is to use technology that has been in existence for decades – carbon paper. If two or three identical data sheets separated by carbon paper are used in the field, the copies will be created instantaneously.

The highly effective but now neglected system of White Label, Blue Label and Green Label files should be revived (ask any retired government researcher how the system worked).

Detailed data sheets for every variable measured must be included in the trial protocol document. If these data sheets are updated, then the project protocol document must be updated. The protocols for how the data is collected, where it is copied and archived, and how it will be analysed, must be included in the trial protocol.

Poor electronic data management

A major problem with the data from the Kokstad trials has been frequent changes in software over the years. The early data were captured in customised databases programmed in FORTRAN, but the programme has since become corrupted and the data is now inaccessible. Several spreadsheet programmes have emerged and, in turn, become obsolete over the past decade alone. Each scientist or technician captures the data in different formats on different programmes, under meaningless filenames and archived apparently randomly on the hard drive of computers which themselves quickly become corrupted or obsolete. The management of electronic data requires as much care as the management of the paper datasheets, yet generally receives the least attention.

Internationally, protocols and procedures for capturing, archiving, securing and backing up electronic data have been developed (see, for example, Kruger 2007). It is crucial that these international standards for data management be adopted by research institutions. There is no longer any excuse for creating Excel spreadsheets entitled “Kok1” saved under “My Documents” on the hard drive of a scientist’s computer.

The electronic data management systems for long-term trials must be established at the same time as the trial is designed. For existing trials, sound data management systems must be established to archive previous data and capture all new data. The systems must take into account the fact that the software and hardware used will be obsolete within 18 months, and therefore must be “future compatible”.

The data must be captured immediately after collection in the field. If it is left to later, the accumulated data sheets will become buried under a pile of administrative priorities and if they are eventually captured, they may be done so hastily and shoddily.

Data capturers must be properly trained in the programme and in the vagaries of the type of data they are entering. For example, a secretary unfamiliar with entering veld condition assessment data into a customised database swapped the latitude and longitude coordinates of several sites, so that the sites were apparently located in the Eastern Cape rather than in KwaZulu-Natal.

Systems for capturing data must be standardised and simple to use, and allow for the “double-entry” system of data capture (where every datum is entered twice by two different people, and the two datasets automatically checked against one another for inconsistencies).

Inadequate supervision

The Kokstad research station is located 250km away from Cedara, where the responsible scientists have been based for at least 15 years. A simple misunderstanding at the beginning of the season can result in several months’ worth of useless data being generated if the scientist does not join the technician and his staff on site and assist with the management of the trial.

Alternatively, a procedure outlined by the scientist may be logistically difficult, or require a disproportionate amount of time and effort from the technician in relation to the value of the data generated – a sure way to result in disgruntled field staff. For instance, the cover data on the runoff plots appeared to take an inordinately long time (about three weeks) to collect every season. It was only after three years that the scientist joined the field staff to help them collect the data, and found that the Levy Bridge that they were using was lacking nine of its ten pins. The field staff, having never been trained in the use of a Levy Bridge, was using the one remaining pin in each of the ten holes in the frame of the Levy Bridge. Had the scientist joined them for the very first season, the problem would have been solved immediately and a great deal of wasted effort on the part of the technician and his staff saved.

Inadequate trial management, such as poorly functioning water troughs and poorly maintained fences, can have a much greater effect on results than the actual treatments applied. If trials are regularly inspected by outside staff, the responsible officers will be motivated to maintain high standards of management. Such a system was implemented successfully at Cedara, where the Animal and Grassland Science staff toured the station once a month to inspect one another's trials and facilities in a spirit of friendly cooperation.

Frequent priority changes

Research institutions frequently change management, who in turn change policies and priorities for the institution. For long-term research trials to survive changing policies, it is important for project managers to carefully examine the objectives of the trial and decide where within the overall objectives of the institution the trial fits.

Long-term trials, while expensive to establish, are often relatively cheap to maintain. It is important for research managers to sell the importance of the trial to senior managers and policy makers. However, in order to be convincing, the trial must be genuinely important, which brings us to our next point.

Figure 1: Long-term sheep grazing trial at Kokstad Research Station

Inadequate research
Long-term trials can be incredibly valuable research resources, yet many of them are inadequately used. Routine measurements are conducted on the trial, which may or may not be reported in regular progress reports (more about that later), but often no real, imaginative analysis of even the routinely collected data is conducted and published.

Many long-term trials have great potential for answering additional, specialised questions in fields completely removed from the purpose of the trial. Examples include Martindale's (2008) survey of plant diversity at Kokstad, Manson et al's (2007) survey of soils and landscape functioning of the Brotherton Burning trial, understanding competition and soil carbon on the Ukulinga long-term trials (Fynn 2003, Fynn et al. 2003), and invertebrate diversity at Brotherton (Uys and Hamer 2007).

Such long-term trials must be marketed to other researchers and research institutions. Trials should be used for farmers' days, training, workshops and other forms of technology transfer. They should be reported in the popular press such as the Farmers' Weekly. Responsible officers should regularly report interesting results and key questions to peers for discussion and to generate new ideas.

The first criterion for a trial to be recognised as important is good trial design and reliable records of treatment application and data collection. Many trials have been poorly designed (O'Connor 1985, Barnes 1992, O'Reagain and Turner 1992). Considering the decades of experience in establishing and running long-term trials in southern Africa, and the many critical evaluations of their effectiveness, there is no excuse for new trials to be poorly designed and maintained.

If the trial is widely recognised by the broader research community as important, the trial will be more likely to survive policy changes and budget cuts.

Poor analysis and reporting of routine results
The deadline for the annual report is approaching. The responsible officer, having reported all his other activities, suddenly remembers that he must report on his long-term trial. He quickly opens the spreadsheet of the year's data (assuming that they have actually been captured – see above), and draws a graph and a table of the change in relative abundance of *Themeda* and the cumulative weight gain of the livestock respectively. Satisfied that he has completed his report, he closes his document and moves on to more important things.

Routine analyses can be standardised and included in the electronic data management system, so that routine reports can be generated at the click of a button. This does not preclude the need for thorough and imaginative analysis and interpretation of results, but at least can help to ensure that the annual reports are themselves professional and meaningful.

Too much data
Scientists like to collect as much data as possible from a long-term trial – or rather, to expect their technicians and students to collect them. However, if the data are not going to be used to address a specific question, then a great deal of time and resources are wasted. The chances of data being incorrectly recorded by inexperienced personnel increases and data management becomes a nightmare.

Long-term trials should be designed so that the minimum data required to address the core questions are collected, and that a hierarchy of data priorities is incorporated into the design of the trial from the start. Additional questions can be asked of the trials in specific, short-term studies. In institutions where frequent changes in personnel are a major problem (such as government institutions), then it becomes even more important that the trial protocols are kept as simple as possible.

The principle of simplicity applies to the actual experimental design. A complex, split-split-plot design with multiple levels of treatments is almost guaranteed to suffer from incorrect treatment applications in the long term. The layout of the trial should be kept simple, so that , for example, fire treatments are less likely to jump to the neighbouring unburnt plot (Zacharias 1994). As Krebs (1999, p. 2) memorably put it "if you ever find a dichotomy of purpose [between the statistical and ecological requirements of the study], achieve your objectives, answer your question, and ignore the statistician".

(For a thorough and readable discussion of the basics of conducting ecological research, I heartily recommend the first chapter of Krebs).

Conclusion

The basics of sound project management – careful planning, documentation of procedures and results, regular reporting and so on, apply as much to long-term trials as to any project, but with additional challenges. Frequent changes in personnel, budget cuts, and frequent changes in computer hardware and software, are amongst the most common challenges that can upset the smooth running of a long-term field trial. All of these challenges and more can be addressed by assuming from the start that the initial project manager and field staff will not be there next year, which the office where the data is archived will burn down, and that the computer will become obsolete shortly before it is stolen. By building simple, effective data capturing, backup, archiving and reporting systems into the project design from the start, many of the problems afflicting long-term trials can be avoided. Most importantly, like any project, all the staff involved in the management of a long-term trial should have a clear idea of the objectives of the trial, and be an enthusiastic part of the running of the trial.

Acknowledgments

The tips and comments above are based on several years of personal experience and caffeine-fuelled discussions with colleagues and friends who have managed long-term trials. I thank them for their advice and help. The opinions and faults are my own.

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Importance, threats, status and conservation challenges of biodiversity in Northern Cape.

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Introduction

Biodiversity is a short term meaning the totality of life on earth, including the variability within a given species' population and the variety of ecosystems across a geographic area. This refers to genes, species (plants and animals), ecosystems, landscapes, and the ecological and evolutionary processes that allow these elements of biodiversity to persist over time.

An ecosystem is a collection of living organisms together with the physical and chemical environment with which they interact to form food webs and food chains. The functioning of a given ecosystem is driven by its constituent organisms and is best understood as a cyclical flow of energy and materials. In 1992, The United Nations Convention on Biological Diversity defined biodiversity as "the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems".

Biodiversity is unevenly distributed on Earth. Flora and fauna distribution and diversity depends on climate variables. In 2006, large numbers of the Earth's species were formally classified as rare or endangered or threatened species; moreover, many scientists have estimated that there are millions more species endangered which have not yet been formally recognized. About 40 percent of the 40,177 species assessed using the IUCN Red List criteria, are now listed as threatened species with extinction - 16,119 species (Baillie 1996).

Biodiversity in Northern Cape

South Africa has a wide range of climatic conditions and topography (e.g. coastal plains, steep escarpment, large plateau), giving rise to broad vegetation zones called biomes. These are the Fynbos, Succulent Karoo, Desert, Nama-Karoo, Grassland, Savanna, Albany Thicket, Indian Ocean Coastal Belt and Forest biomes (Mucina and Rutherfords 2006) (Fig. 1). Each of these biomes supports its own collection of plant and animal species.

The Northern Cape Province is consist of six biomes, Desert, Nama-Karoo, Succulent Karoo, Savanna, Fynbos and Grassland (Mucina and Rutherfords 2006). Each biome represents major life ecological zones. Within these biomes, there are groups of plant communities forming vegetation types, which are habitats to various living organisms and they pose unique features that distinctly differentiate them from other biomes and vegetation types.

The arid Savanna biome stretches over the Kalahari region of South Africa, Botswana and Namibia. It is characterized by a grass layer and a distinct upper layer of woody plants. Some parts of the arid Savanna are invaded by Karoo shrubs. The environmental factors delimiting the biome are complex. However, much of the area is used for game farming.

The Nama Karoo biome occurs on the central plateau of the Northern Cape. It covers much of the interior with its hardy bushes and grasses. Many of the plant species of the Nama-Karoo occur in the savanna, grassland, Succulent Karoo and Fynbos biomes. Nama-Karoo experience summer rainfall, varying between 100 and 520 mm per year. There is high erodibility of soils due to problems of overgrazing.

The Northern Cape's biological diversity and vast natural resources are facing challenges of biodiversity loss as a result of transformation and degradation of natural habitat. Changes of land use, development of natural habitat types into cultivation, urban and mining areas. The dominant vegetation is a grassy and dwarf shrubland. Grasses tend to be more common in depressions and on sandy soils, and less abundant on clayey soils. Grazing rapidly increases the relative abundance of shrubs. The amount and nature of the fuel load is insufficient to support frequent fires. The Brown Locust and Karoo Caterpillar exhibit eruptions under similarly favourable, local rainfall events, and attract large numbers of bird and mammal predators.

The former vast migratory herds of springbok (Antidorcas marsupialis) have been replaced by domestic stock, particularly sheep and goats. A rich variety of rodents and reptiles also occurs in the Nama-Karoo. The few, endemic or near-endemic bird species include the Sclaters lark (Spizocorys sclateri). Sheep farming is the main agricultural activity in this region. Climate change models predict that the Great Karoo will become drier and more desert-like, particularly in the west. Only in parts of the eastern Karoo will the climate still suit the vegetation of the Nama-Karoo biome.

The Desert biome is found under very harsh environmental conditions than those found in the Succulent Karoo biome and Nama-Karoo biome. Summer rainfall, where mean annual rainfall is from approximately 10 mm in the west, to 70 or 80 mm on the inland margin of the desert. Rainfall is highly variable from year to year. The vegetation of the Desert biome is characterized by dominance of annual plants (often-annual grasses). The desert plains can be covered with a sea of short annual grass after abundant rains. Whereas in normal years, the plains can appear bare with the annual plants persisting in the form of seed. Perennial plants are usually encountered in specialized habitats associated with local concentrations of water. The Desert biome includes an abundant insect fauna which includes many tenebrionid beetles, some of which can utilize fog water.

The Succulent Karoo is found in the western parts of the Northern Cape, stretching down to the Western Cape. It is restricted to the year-round and winter rainfall areas and has the greatest summer aridity. This is the land of many spring flowers, which for a few weeks each year, draw large numbers of tourists from all over the world. Succulent plant species with thick, fleshy leaves are plentiful here, the diversity of which is unparalleled anywhere else in the world. This, together with many geophytes (plants that survive by means of bulbs tubers, in times of unfavorable climatic conditions) and annual plants, makes the Succulent Karoo unique and of international importance in terms of conservation. Examples of animals that occur here are the Bat-eared fox, Otocyon megalotis, Suricate, Suricata suricatta and the common Barking gecko, Ptenopus garrulus. Within the Succulent Karoo biome, the area known as the Knersvlakte is extremely rich in endemic plants. Hundred and fifty of the 1000 plant species found there occur nowhere else on Earth.

Importance of biodiversity

South Africa's biodiversity provides an important basis for economic growth and development, e.g. our fishing industry, rangelands that support commercial and subsistence farming, horticultural and agricultural industry based on indigenous species, our tourism industry, aspects of our film industry, and commercial and non-commercial medicinal applications of indigenous resources.

Biodiversity plays a major role in meeting human needs directly while maintaining the ecological process upon which our survival depends. It also provides excellent conditions and drives the processes that sustain species survival, hence global economy. Some of the provisions of biodiversity include ecological, economic and cultural values to the world's community.

Biodiversity threats in the Northern Cape

Biodiversity is under threat globally. The Northern Cape is experiencing human induced threats for biodiversity including desertification, open-strip mining, illegal or unsustainable plant harvesting, agricultural mismanagement, alien invasive species and insufficient environmental management. It is important that to protect biodiversity to maintain a good the quality of life and standard of living. Threatened, endangered or protected species may be lost permanently from their natural habitats resulting in extinction and hence biodiversity loss.

Developments also play a major role in land use change because of draining wetlands and clearing of trees. Habitat by fragmenting and over-utilizations of natural resources. Other threats to biodiversity includes, over-harvesting of trees to make building supplies and paper products and for use as fuel, introducing harmful species into foreign ecosystems, releasing toxic pollutants and poaching, unsustainably hunting, or illegally trading wildlife. Other global factors include climate change, habitat destruction and land degradation.

Conservation challenges of biodiversity
Biodiversity is a treasure that enriches our lives and we all have to learn and care for it, in return of our healthy environment. Though we face challenges of anthropogenic events, of which most of them are unpredictable, we have to be aware of each other's role in conservation of our biodiversity. The effective protection and use of biodiversity in our country requires our urgent attention because biodiversity conservation is a call for everyone and we can all answer it responsibly. The biodiversity loss is taking place at a quicker rate, and it seems not to be easy to predict and calculate details of what is threatening the diversity and abundance of Earth's species.

Many species and ecosystems will disappear over the next century; therefore a sound strategy must be initiated to increase existing protected land and strategically adding new protected areas. We must make efforts to preserve, conserve and manage biodiversity. Protection of biodiversity requires a network of national parks and reserves, located where appropriate ecosystem functionality and representatives exists and is protected from exploitation. National parks and nature reserves can be effective, providing protection to area's wildlife and prevent resource extraction.

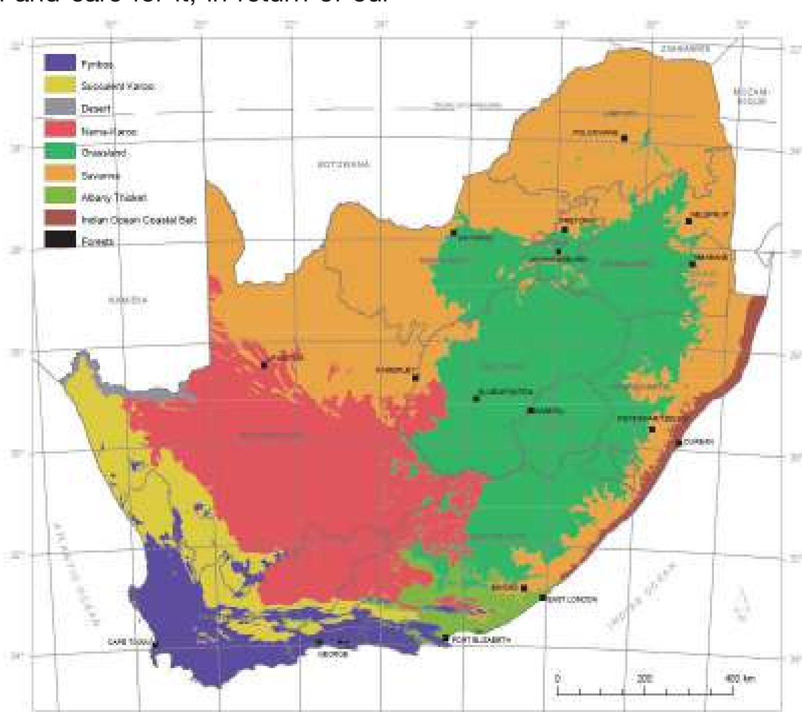

Figure 1. Distribution of different biomes in South Africa. Savanna, Nama-Karoo, Succulent Karoo, Fnybos, Grassland and Desert are the main biomes of the Northern Cape (adapted from Mucina and Rutherford 2006).

Figure 2. Some of biodiversity constituents of the Northern Cape, in this picture, Acacia erioloba, Eiland, Rolfontein floodplains, Vanderfkloof Dam in Dorrnkloof Nature Reserve, Vaal river in Schmitsdrift, Medicinal plant in Kuruman, Tortoises, Gemsbok, Meerkat in Kalahari, Riverine Rabbit, Springbok and Flamingo birds in Kamfers Dam.

Because we share the world with many other species of plants and animals, we must consider the consequences of our actions. Over the past several decades, increasing human activity has rapidly destroyed or polluted many ecological habitats throughout the world. By educating people about the consequences of our actions, we can all gain a better understanding of how to preserve the natural biomes of the earth. Although areas that have already been destroyed will probably never regain their original forms, conservation can help to keep them from deteriorating further. Biodiversity is no longer an issue confined to conservation biologists or wildlife supporters only. It is important to farmers, indigenous people, human rights and global trade.

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The restoration of bare patches in the Karoo: an evaluation of various techniques

(Extracted from Bulletin of the Grassland Society of Southern Africa, 1992)

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Introduction

The Great Karoo is an arid to semi-arid region of the inland, central and western parts of South Africa with an average annual rainfall of 100-600 mm increasing from the west to the east. Bare patches cover large areas of the Great Karoo. The surface soil of these bare patches is severely compacted, limiting moisture penetration. Perennial plants are rarely found in these areas (Louw 1992).

The development of large bare patches is usually the result of degradation processes, mainly severe overgrazing and patch selection (Kellner and Bosch 1992). Severe drought may also initiate the formation of such bare patches. The degradation of semi-arid regions may be rapid, but the recovery is slow due to low and variable rainfall, physical limitations to increasing soil moisture and depleted soil seed banks (van der Merwe and Kellner 1999; Wiegand, Milton and Wissel 1995; Call & Roundy 1991; Yeaton and Esler 1990).

The objective of this study was to identify and evaluate suitable methods for the revegetation of bare patches in the Karoo.

Study site

A bare patch, covering an area of approximately 100 ha, on the farm Hillmore near Beaufort West, was chosen as the study site. Hillmore is situated south east of Beaufort West and receives an average annual rainfall of 190 mm. The annual rainfall during the study period was 364 mm. The soils are clayey loam, with a very low organic carbon content of 0.2 %. However soil nutrient status is high, with sodium 60 mg/kg, phosphorous at 159 mg/kg and potassium 430 mg/kg.

Methods

Six different treatments were applied during November 1999. A randomised block design was followed in this study. The treatments were:

1) No treatment (Control) (C)
2) Oversowing (S)
3) Oversowing and covering with branches (SB)
4) Tilled to a depth of 100 mm (T)
5) Tilled and seed (TS)
6) Tilled, seed and branches (TSB)

Each of these treatments was applied in 20x20 m plots with 5 replications. Branches of nearby *Acacia karroo* trees were used for covering the necessary plots. A total of 15 kg seed/ha was broadcast onto the soil surface, after the tillage treatment had been applied, using a seed mixture comprising *Atriplex semibaccata, Cenchrus ciliaris, Chaetobromus dregeanus, Pteronia membranacea* and *Tripteris sinuatum.* All these seeds were obtained from the Worcester Veld Reserve.

Botanical composition (frequency data) was determined for each treatment plot during surveys conducted in July and November 2000. Ten quadrants of 1x2 m were placed in each plot and all the plants were counted and distinguished between reproductive and vegetative plants and seedlings on species level.

The data was statistically analysed using Two-way ANOVA, student-t tests and polar ordination.

Results and Discussion
Polar ordination of the data set (Figure 1) shows that the control and the TSB treatments had the smallest similarity in species composition following both the July and November botanical surveys. The greater the disturbance applied the greater the similarity in species composition among treatments. The SB-treatment of November was not included because it is an outlier.

The most common species in July and November include *Pentzia incana* and *Chaetobromus dregeanus, Lepidium africanum, Salsola calluna, Othonna sedifolia, Tagetes minuta, Atriplex lindleyi, Tripteris sinuata, Salsola kali, Sonchus oleraceus.* There were 49 different species present in July in the different plots and 30 different species in November. The soil seed bank consists of mainly annual weeds of which *Gnaphalium pensylvanicum*, was the most common

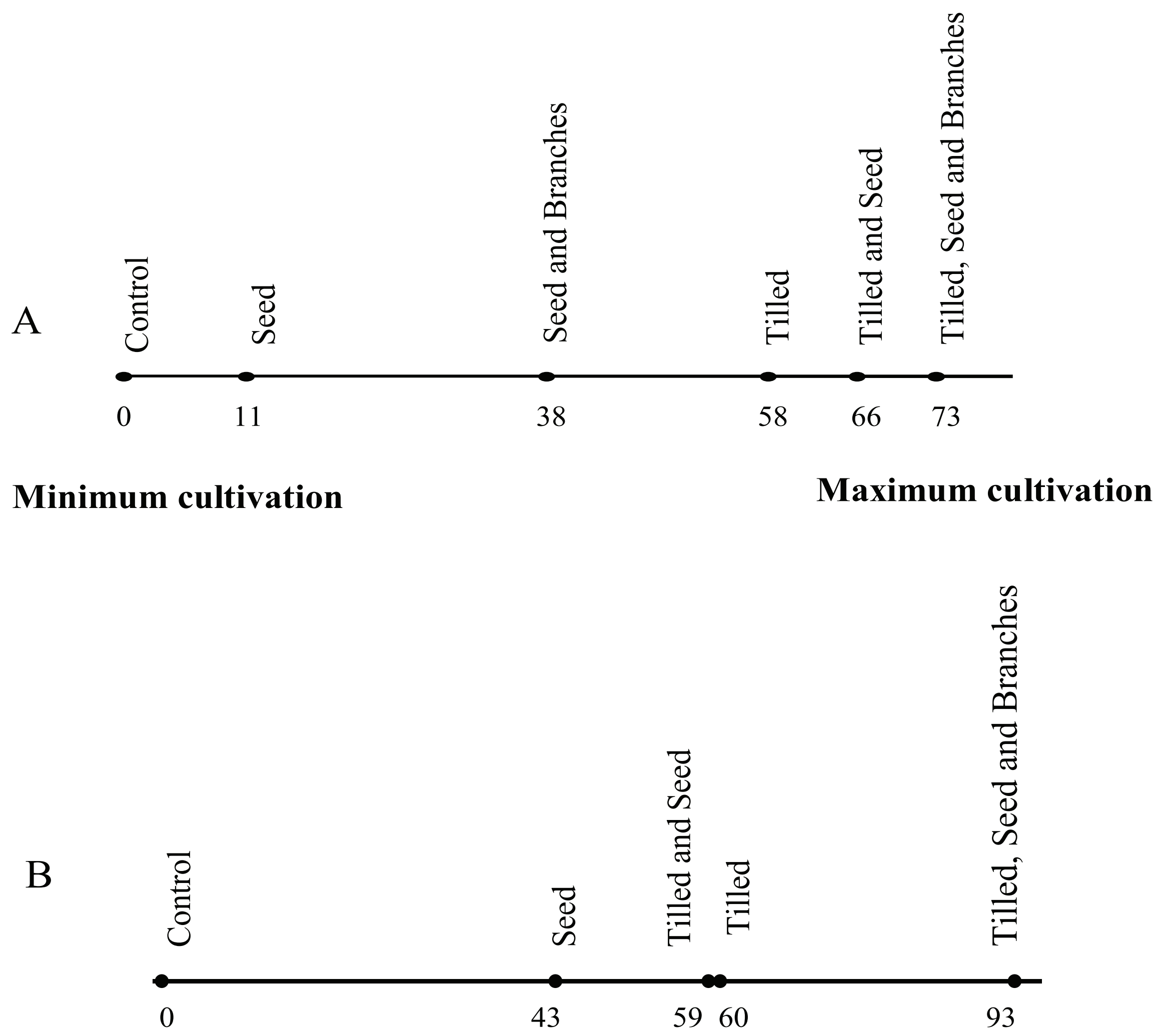

Figure 1: Polar ordination of the species composition of the different treatments in (A) July and (B) November 2000.

(Table 1).

Species	Hillmore
Lepidium bonariense	*
Hypochoeris radicata	*
Salvia sp.	**
Gnaphalium pensylvanicum	***
Gazania sp.	*
Oxalis sp	*
Creeping plant (maroon)	**
Species 1	*
Species 2	***
Species 3	*

Table 1: Species present in the soil seed bank on Hillmore

*** Many individuals
** Few individuals
* Very few individuals

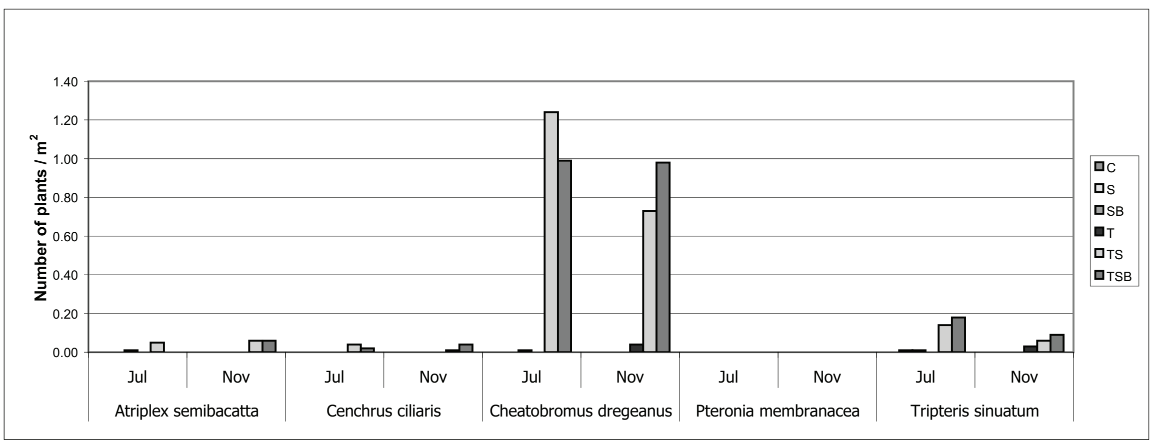

Figure 2: The density of the oversown species in the different treatments in July and November 2000.

The oversown species that show the best germination were *Chaetobromus dregeanus* and *Tripteris sinuatum*, although their numbers declined from July to November 2000. The best germination results were found in the TS and TSB treatments (Figure 2).

The Tilled-Seed-and-Branches treatment was the most successful, but also the most expensive (Esler and Kellner 2001). Tilled-and-Seed treatment was almost as successful, but will be much cheaper to apply, since it is not so labour intensive.

Conclusion

From the treatments applied in this study bare patches in the Karoo can be successfully revegetated. Success depends on ensuring either severe mechanical disturbance of the soil (cultivation of furrows to a depth of at least 100 mm) to increase water infiltration; or the provision of physical barriers (such as tree branches) to slow water movement across the soil surface, limit the effects of raindrops impact, reduce soil temperature, and act as a "catch" for wind-blown seed and organic matter or both. In addition viable seed of desirable species must be introduced where seed banks have been depleted.

Seeds of pioneer species such as *P. incana, Aridaria spp.* and *Galenia spp.* can also be oversown to provide a soil cover and a microhabitat for subclimax and climax species, like *C. dregeanus* and *T. sinuatum* to establish in.

Acknowledgements

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Feature

Long-term effects of burning on woody plant species sprouting on the False thornveld of Eastern Cape

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Introduction

Sprouting allows woody plant species to persist in a site after a wide range of disturbances (e.g. prolonged fire), where opportunities for seedling establishment are limited. Everham and Brokaw (1996), Reich et al. (2003), Vesk and Westoby (2004) and Paciorek et al. (2000) have noted that the effect of fire on sprouting of woody plant species could be affected by a number of environmental factors. A study to investigate long-term effects of fire on sprouting of woody species was conducted at Honeydale section of the University of Fort Hare Research Farm.

Materials and methods

Study area, experimental description and measurements

The farm is located at 32o 47' S and 26o 52' E with an elevation of 517.9 m asl on the False thornveld of Eastern Cape. The area has undulating terrain dominated by Eastern Thorn Bushveld. The climate is semi-arid with about 480mm annual rainfall, most of which occurs in summer, the annual average temperature is 18.7°C. The study consisted of six burn treatments (No-burn, 1-year, 2-year, 3-year, 4-year and 6-year burn) replicated twice. Number of sprouts for woody plant species was obtained by counting sprout of plants within 15m by 15m quadrats. Three quadrats were established in each 0.5ha plot.

Statistical analysis

Treatment effects were assessed with ANOVA using the GLM Procedure of SPSS at 5% level of significance. Difference between the treatments means ($p = 0.05$) were separated using LSD.

Results

The results demonstrated significant difference ($p \leq 0.05$) in number of sprouts produced by woody species as a consequence of different fire frequencies (Table 1). *Acacia karroo* produced significantly highest number of sprouts in 1-year than in other burn treatments (Table 1). The second highest number of sprouts for *A. karroo* was obtained under 3-year burn; however this was not significant when compared with number of sprouts recorded under 2-year. The lowest mean number of sprouts obtained under no-burn treatment for this species was not significant when compared to values in 4-year and 6-year (Table 1). Asparagus species recorded highest mean number of sprouts (10.33) under 3-year burn; however, this was not significant when compared to values obtained under 1-year, 2-year and 4-year (Table 1). Lowest mean number of sprouts (3.75) for this species was recorded under 6-year burn; however, this figure was not significant when compared to the figure obtained under 4-year. *Diospyros lycioides* produced highest number of sprouts under 3-year burn and lowest under 6-year, however, this figures were not significant compared to those obtained in other burn treatments.

Ehretia rigida recorded more sprouts under 4-year burn than in other burn treatments and lowest under 3-year (Table 1). Highest number of sprouts for this species was significant only when compared to the value obtained in 6-year burn while lowest value was significant when compared to values in 1-year, 2-year, and 4-year. The number of sprouts for *E. rigida* produced under no burn, 6-year and 3-year were not significantly different. The number of sprouts for *L. ferocissimum* in no burn, 4-year, 6-year and 3-year did not have enough replicate for statistical comparisons. *Opuntia* species did not produce enough number of sprouts in no-burn, 4-year, 6-year and 3-year for statistical comparisons.

Portulacaria afra produced highest number of sprouts under 3-year and lowest under no burn treatments. Highest number of sprouts for *P. afra* species was significantly higher when compared to figures recorded under 1-year, no burn and 6-year burns while lowest value (1.25) was significant when compared to the figure recorded under 3-year.

Discussions

Different burning frequencies did not lower the sprouting potential of tree species but either promoted more sprouts or did not have a clear effect. Short burning intervals (1-year, 2-year and 3-year) seemed to favour more sprouting in species such as *A.karroo, Asparagus species, P. afra, L. ferocissimun* and *Opuntia* species. This may suggests that control of encroachment by these species cannot be easily attained by fire alone. Different burning frequencies did not exhibit clear effect on number of sprouts produced by *E.rigida, D. lycioides* and other species. Plant age, soil moisture at time of burn, intensity of fire, season of burn, health of the plants, and frequency of droughts play a part in how fire affects woody species in the long run (Higgins 1986b). Anderson and Bailey (1980) reported that If fire occurs before active growth has begun, increased density from sucker development could result; on the contrary, Vogl (1974) and White (1983) argues that fire will damage living tissue regardless of whether the plant is actively growing or dormant. In grasslands, most fire-adapted or fire-tolerant woody species cannot sustain large populations in grasslands subject to intense fires on a frequent basis (Glover 1972).

Woody species respond differently from fire damage, *Rosa woodsii* took 2 to 3 years to recover completely from fire damage (Monsen and Davis 1985). Leege and Hickey (1971) and Bock and Bock (1984) reported that wild rose plants sprouted after a burn and remained at the same densities as at pre-burn.

Species	1-year	2-year	No burn	4-year	6-year	3-year
A. karroo	2.59^{a}	1.612^{bcdeg}	0.11^{bf}	0.974^{bde}	0.514^{bef}	1.946^{bcdg}
Asparagus species	7.16^{acd}	9.84^{bc}		6.69^{abcd}	3.75^{acd}	10.33^{bc}
D. lycioides	9^{a}	5.11^{a}	3.25^{a}	6^{a}	2^{a}	3^{a}
E. rigida	2.75^{abce}	2.89^{abce}	1.5$^{a\,bcde}$	3^{bce}	0.6^{acde}	1^{abcde}
L. ferocissimun	3.455^{a}	3.909^{a}				
Opuntia species	0^{a}	0.14^{a}				
P. afra	2.33^{ab}	4.29^{abc}	1.25^{ab}	3.69^{abc}	1.85^{ab}	5.8^{bc}
Others	14.12^{a}	2.25	0.71^{b}	1.4^{b}	0^{b}	19.5^{a}

Values within each row followed by different letters are significantly different at $p \leq 0.05$ (LSD test).

Conclusions

The results of this study demonstrated that long-term fire had effects on woody species sprouting; however, discrepancies due to environmental factors are probable. Short interval burns (1-year, 2-year and 3-year) increasingly enhanced sprouting of *P. afra* and *A. karroo*. Burning did not have consistent effects on number of sprouts produced by *D. Lycioides* and *E. rigida.*

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The Journal of the Grassland of South Africa: Some reflections of a Referee

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Curiosity drives me to seek an explanation for the high rejection rate, and reflection has led me to the conclusion that there are three important factors, viz. the quality of the researchers, interaction between researchers and biometricians, and the structure of organisations involved in research.

The quality of researchers

A good scientific paper is essentially a product of the intellect of the researcher. However, in my experience there are many graduates in research posts who, though by no means unintelligent, do not have the combination of qualities needed for high quality research. Deficiencies naturally vary between individuals, but three characteristics stand out a lack of curiosity, an inability to see and analyze problems holistically, and a dislike of the self-discipline and commitment needed for the successful completion of a research project. Significantly, such people are often very 'busy' with matters other than research, and have a propensity to dabble in one inconsequential research project after another. Some even become senior research administrators, with predictable effects on the motivation and efficiency of their juniors.

It is also my experience, however, that there are potentially good researchers who currently perform poorly because they have a deficient training. They lack motivation and experience in problem solving, and are not properly advised by senior colleagues. Many grassland scientists are employed in the Department of Agricultural Development, where it is a rule that graduates must hold at least a Master's degree in a research subject before being appointed to a research post. Before, and even after, such an appointment their salaries are much lower than those of graduate extension staff with equivalent qualifications, and worse, similar to those of technicians with much lower qualifications. Moreover, even after appointment to a research post, they remain at a disadvantage because of the time they spent in a junior post while working towards a postgraduate degree. This is hardly a situation favouring the recruitment of good research material, and hardly an environment in which to motivate promising junior staff.

One might well ask, do the requirements for an MSc degree in grassland science provide adequate? In the preface to his informative book *How to write and publish a scientific paper,* Robert Day (1979) has this to say. "A scientific experiment, no matter how spectacular the results, is not completed until the results are *published*. In fact, the cornerstone of the philosophy of science is based on the fundamental assumption that original research must be published; only thus can new scientific knowledge be authenticated and then added to the existing data base that we call science". A properly-conducted research project involves a sequentially dependent series of activities, namely 1) identification of an important research subject, 2) planning the investigative procedure and, where applicable, assembling and locating the necessary materials, 3) executing the procedure and recording the observations, and finally, 4) interpreting and documenting the results in the form of a scientific paper. Experienced and talented researchers are skilled in all these activities, and usually produce valuable and, at times, elegant publications, which are widely read and appreciated. These form part of the factual base which is essential to the development of sound agricultural policies and extension programmes. All the steps leading to a scientific publication must be properly executed;

a poorly-conceived or badly planned and executed research project cannot yield a good publication.

The *Journal of the Grassland and Society of Southern Africa* is of crucial importance in the documentation and transmission of the results of research in southern Africa. However, of the many papers which I have refereed, disturbingly high proportions were not recommended for publication. Of those that were, many were only accepted after extensive revision and much time-consuming effort by referees. It might be argued that rejected material is not necessarily lost, and that the information can be published in 'popular' form. In general; however, papers are not rejected solely on the grounds that they are badly written. More likely reasons are that there are fundamental errors or weaknesses in say the design of the study, the method of execution, or the analysis of the data. If the results of such studies are presented in popular form, it will certainly be necessary to 'paper over the cracks'. It is in just this way that spurious information is relayed to producers, and incorporated into the dogma of grassland science.

Frequently candidates are presented, at a very early stage in their career, with a narrow research subject for investigation, provided with the necessary material, and told how to proceed. So 'programmed' they 'go through the motions'. Perceptive, original and probing thought, a prerequisite for good research, is not a requirement. Indeed, an imaginative student with a questioning mind might well develop a distaste for research out of sheer boredom. The upshot is, that while there certainly are good MSc theses (and good papers based on them) there are many mediocre or poor theses, and a corresponding number of mediocre MSc graduates, poorly trained, and in many cases unsuited to a career in research. One might also ask, should a MSc degree be a prerequisite for adequate remuneration and advancement of junior research staff! If the answer is no, then the question is, how can it be ensured that junior graduates are productively employed, while at the same time gaining experience and research skills'! submit that a good undergraduate training could form the initial basis for a research career.

Selected graduates could then serve an 'apprenticeship' of say two years in a suitable environment. He or she would work under experienced and competent senior staff with a view to gaining experience over a fairly wide field. During this period the individual preferences and talents in particular fields should become apparent. After this apprenticeship the potential researcher should be ready to undertake specific research studies with the aim of producing one or more quality publications. It is by these that he or she will be judged. Should a researcher choose at this stage to register for a higher degree, there can be no objection, provided that the end product of the activity is a good scientific paper or papers. However, the question arises, should the researchers who opt to not register for the higher degree, but have research papers accepted for publication in a reputable journal, be regarded as inferior to those whose publications are derived from theses? If it is accepted that the end product of research is a scientific paper, the answer must be no.

In the process of producing papers, the latter individuals will certainly by some means have to extend their knowledge and skills. That they do this without formally registering at say, a university, should be their choice. The proof of the pudding should be in the eating. Interaction between researchers and biometricians is ironic that in an era when most researchers have ready access to modem computer technology, access to biometrical advice is becoming increasingly difficult. This is primarily a consequence of the scarcity of biometricians, a situation which is made worse by the intense competition for their services in fields other than agriculture. Accordingly, current research projects are often planned without adequate biometrical consultation, and researchers commonly conduct biometrical analyses using standard computer software. There is, however, a disturbing tendency to confuse familiarity with computer operation with biometrical expertise. Data from studies in grassland science are often of such a nature that expert opinion is required on valid methods of analysis.

Slavish use of standard software, or incorrect assumptions about the: suitability of data for certain analytical procedures can lead to gross errors. Readers of scientific papers, including referees, do not have access to the researcher's original data. Hence they are often put in the invidious position of having to accept without question a statistical output which could well be spurious. It is by no means uncommon for inexperienced researchers to design experiments without first consulting a biometrician. Having collected the relevant (or sometimes irrelevant) data, and struggled in vain to interpret it, they expect what is understandably a less than cordial biometrician to sort out the mess. Frequently this is impossible. The result is a shameful waste of time, research funds and facilities. The ideal arrangement is for the research scientist to consult a biometrician with suitable experience at the planning stages of the experiment, and, where appropriate, to maintain continuous

communication during the conduct of the experiment and the processing of the data. Where the contribution of the biometrician is appreciable, co-authorship is indicated. Indeed, there are circumstances which warrant senior authorship for the biometrician. Understandably, biometricians who are sporadically approached for advice, but are not closely involved in research projects, lose their motivation, and seek career satisfaction elsewhere.

Some biometricians, especially those with limited experience, have a poor understanding of the complexities and practicalities of research in grassland science. Where difficulties in communication arise, the researcher might need to obtain a second opinion.

The structure of organisations involved in research

In scientific research, as in life in general, there is no substitute for experience. In most professional disciplines it is usual to specifically arrange that holders of the necessary primary qualification gain further experience and training in the various subjects comprising the discipline. Agricultural science differs from most disciplines in that research is commonly linked to a specific environment. Certain principles are of course universally valid. However, in the field of grassland science, for example, the problems to be dealt with, and the knowledge and skills required by a researcher in say the Karoo will differ radically from those in the bushveld, or grassveld in a high rainfall area. In consequence, skills and experience tend to apply to specific environments. This creates problems in the organisation and structure of research, and these are exacerbated by the fact that the staff establishment in the respective environments is usually small, and often inadequate in relation to research needs. Promotion opportunities within a specific field of expertise are limited, and individuals transferred on promotion to a different environment may be at a disadvantage for several years. Moreover, if they are appointed as leaders of research teams, they will not, at least initially, be in a position to lead.

All but a few of the papers submitted to the *Journal of the Grassland Society of Southern Africa*' emanate from either the staff of the Department of Agricultural Development, or staff or students of university departments. Some of the papers which are not accepted for publication are clearly written by individuals who have little or no talent for research. However, many seem to have been written by relatively inexperienced researchers who have not had adequate guidance. I judge that a major reason for this is that in both the above organisations the senior staff do not have the time, or the specific knowledge or experience to properly guide junior researchers. On the other hand, it can well be asked, should senior colleagues who are not in directive posts be expected to guide junior colleagues? This is a time-consuming and often thankless task, which might seriously prejudice their own research output. Apart from the current deficiencies in post-graduate training discussed earlier, it seems to me that the establishment and structure of most organisations involved in grassland research in this country militates against the motivation and guidance of junior researchers.

Nominal research leaders in the Department of Agricultural Development, for example, are burdened with administrative duties, and a range of other commitments such as liaison with producer organisations and agricultural unions. In addition, in the modem dispensation of the Department, they must, because of a shortage or lack of specialist extension staff, often act as specialist advisors to individual producers. While they might, and usually do, become knowledgeable about agriculture in the relevant region, their wide commitments hamper their ability to guide junior staff. Also, under the day-to day pressure from producers and others, there is a tendency to loses sight of the first priority of a research team, to produce high-quality scientific publications. If, good research has been done in the past, there might be some slack which can be taken up. However, in the long term the result is likely to be a poor research output, with low-quality publications arising from poorly-conceived and poorly-executed.

Conclusion

The present high rate of rejection of manuscripts submitted to the Scientific Editor of the *Journal of the Grassland Society of Southern Africa* is an indication of wasteful use of manpower and facilities in organisations involved in grassland research. Improving the standard of scientific papers, and thereby reducing the rejection rate, appears to require that attention be focused on three aspects, the selection of promising graduate researchers and improving especially their early training, improved liaison between researchers and biometricians, and revising the structure of research organisations to provide junior researchers with proper guidance and leadership.

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