# grass roots

*Newsletter of the Grassland Society of Southern Africa*

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*Nicolaas Willem Wagner who received the GSSA trophy for the highest mark in Pasture Science in the third year (Potchefstroom Agric. College)*

## *JUNE 2004 - in this issue:*



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# EDITORIAL

Hi everybody

I'm back. Thanks to Freyni for handling the editorial for me in the last issue; I was a bit busy running around trying to keep a three-year old daughter happy and make sure all was well with the wife in hospital for the birth of our son.

As always life moves on apace and almost half the year is gone. The Annual Congress looms large on the horizon, and reports have it that Annelene Swanepoel and her team from Elsenburg are putting together a really good programme for us. With regard to congress: please take note of the call for nominations for awards and office bearers. These are matters which deserve careful thought before arriving at congress.

In this issue we have another article from Dean Anderson; this one about the interesting concept of integrating animals of different species into a single Flerd. From the lack of news coming in from the various regions it appears that the Society and/or its members are not being particularly active. A happening of note which is reported on was the Prestige Grazing Day held at the University of KwaZulu-Natal entitled: "Grasslands in South Africa: Yesterday, Today, Tomorrow. This was well worth attending; if you missed the event, skip through to the report.

The derth of response to Grass Roots is leading me to believe that nobody is reading it. Please send in your comments on articles published or your own material for publication.

I look forward to seeing you at Goudini.

Grass greetings
Graham

# NEWS FROM GSSA COUNCIL

At the council meeting in January it was decided that it was time to have a Strategic Planning Workshop to assess the activities of the GSSA and develop a revised Strategic Plan. On 28 and 29 April council met at the conference facility at Ukulinga Research Farm. The vice president Dr Nicky Allsopp and Richard Hurt, of the PAC portfolio, led the very constructive workshop and did so excellently. On the first day it was very helpful to have a facilitator, Mpoya Thobela, not linked to the GSSA asking questions and facilitating the discussion.

The first task was to assess the present situation of the GSSA, looking at the achievements, strengths and challenges, vision and mission. Next a review was undertaken of all the portfolios on council, the budget, the membership, the administration and the vision and mission.

From all the reviewing and discussion, numerous actions were identified in order to achieve the re-worked mission and vision. Some proposed changes to the constitution were also identified and will be discussed at the next AGM.

It became clear during the two days that various circumstances have changed which means the GSSA operates in a different environment to the one of a decade ago and it is thus necessary to adapt accordingly. We also "discovered" the many excellent contributions members of the GSSA have made and an astonishing amount of strengths were identified. The flagships of the Society are the journal and the congress, while both the website and the Grassroots newsletter are invaluable to the profile of the Society. In order for Grassroots to be dynamic more contributions are required from members. The discussions also precipitated that the GSSA consists of a "friendly" group of people, which makes the Society accessible to everyone. We, however, also found that the GSSA is no longer very strong on influencing policy.

The challenges that were identified are mainly related to finances, raising the profile of the GSSA and its influence and finding enough people to become actively involved in the society. Retaining the knowledge base of experienced members, while also involving the younger grassland scientists was viewed as important, also for the leadership of the society.

We as council hope to see many of the GSSA members at the congress in June and hope for enthusiasm for the discipline of range and forage science.

# GSSA Council 2003/04



# JOURNAL NAME CHANGE: SUMMARY OF RESPONSES

In the last *Grassroots*, there was a proposal that the name of the journal be changed to *Range & Forage Science*. The motivation for the change was that this simple alteration could have a major impact on the sustainability and international exposure of the journal to the benefit of African scientists. The following is a tally of responses from the Editorial Board of the journal: **4 Yes, 8 No**. On the "no" side, the main reasons given were that:

- Ø the current name defines a niche for the journal,
- Ø there is no guarantee that a name change will have a positive effect, and
- Ø it is more important to achieve ISI rating.

The response from members was very much in line with the opinion of the Editorial Board.

Thank you all who responded.

Peter Scogings
Editor: African Journal of Range and Forage Science (pscogings@pan.uzulu.ac.za)

# THE KRUGER EXPERIENCE

*Ecology and Management of Savanna Heterogeneity*
*Edited by Johan T. du Toit, Kevin H. Rogers, and Harry C Biggs*

Kruger National Park in South Africa has one of the most extensive sets of records of any protected area in the world, and throughout its history has supported connections between science and management. In recognition of that long-standing tradition comes **THE KRUGER EXPERIENCE**, the first book on a century of ecological research and management in two million hectares of African savanna.

**THE KRUGER EXPERIENCE** places the scientific and management experience in Kruger within the framework of modern ecological theory and its practical applications. The book uses a cross-cutting theme of ecological heterogeneity - the idea that ecological systems function across a full hierarchy of physical and biological components, processes, and scales, in a dynamic space-time mosaic. Contributors, who include many esteemed ecologists who have worked in Kruger in recent years, examine a range of topics covering broad taxonomic groupings and ecological processes.

The book is an invaluable new resource for scientists and managers involved with large, conserved ecosystems as well as for conservation practitioners and others with interests in adaptive management, the societal context of conservation, links between research and management in parks, and parks/academic partnerships.

For more information on this book, visit: http://www.islandpress.org/books/detail.html

## HAVE YOU REGISTERED YET?

**The Joint Congress 39 of the**
**Grassland Society of Southern Africa**
**and the South African Society for Animal Science**
**will be held at Goudini Spa, near Stellenbosch,**
**from 28 June to 1 July 2004.**

**For more information please visit our website, www.gssa.co.za,**
**or contact Annelene Swanepoel**

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# Southern African Grasslands: Aspects of their Biodiversity, Dynamics and Management

*Prof. Braam van Wyk University of Pretoria*

*Transcription of a presentation delivered at the "Timber Plantations: Impacts, Future Visions and Global Trends" conference, Nelspruit, South Africa.*

*13 November 2003*

Thank you Mr. Chairman, ladies and gentlemen. My talk is on the Southern African Grasslands: Aspects of their biodiversity, dynamics and management. I think one thing I must point out at the very start is that when you look at the traditional timber producing countries where plantations are used to produce timber, that activity takes place through modification of the natural resource. A natural resource, in that case mainly the Boreal Forest, in the northern hemisphere is either selectively utilised or there is some clear cutting and replanting with species very much native to that part of the world. The difference in southern Africa is we destroy a natural resource before we establish another resource, which should then be artificially maintained.

And the questions are "What are we destroying?" and "Is the destruction worth that with which we replace it?" Surely we cannot eat grass and we need to make use of agronomical practices to cultivate food and other products, but at the rate at which we are losing our local grasslands, the question is "Is it worth it?"

I am not involved in any conservation organization, I am a Plant Taxonomist, my job is to make sense of the biodiversity of the South African Flora and I have to go out into the veldt and find many of these species so I can see on the ground what is happening with some of our biodiversity.

When we are talking about grasslands it is important to make the distinction between primary grasslands, these are grasslands that are natural, compared to secondary grasslands, which is the result of forest destruction, and it is interesting that in many parts of traditional timber producing countries, the grasslands tend to replace destroyed forests and the grasslands there are referred to as secondary grasslands, and the aim is ultimately to try and get some of those grasslands back to the climax stage, which is then forests.

But, there are a few parts of the world where we have primary grasslands of a temperate nature, they are not tropical. You do get tropical grasslands, just think of the grasslands of the Serengeti with the Blouwildebeest and so on. Those grasslands are very different from the grasslands that we have in the temperate parts of the world. There are only four areas where you can easily map the size of the temperate grasslands in the world, namely the Prairies, which is already largely destroyed, especially the long grass prairies which is 95% destroyed. The Pampas of South America, which is largely transformed especially by overgrazing and by alien invasive plants, the Steppes of Western Europe and Central Asia which because of human habitation for thousands of years have become very much also impoverished and suppressed. And, then the Highveld Grasslands of Southern Africa. The only grasslands that have evolved with man, because man originated in Africa. So there are certain features peculiar to the temperate grasslands of Africa.

One of them is that they can stand a good deal of human impact, which is not the case in the rest of the world, which has only seen modern man impacting on them for the last hundred thousand years or less, and you find that its not only the animals but also the plants in other parts of the world that we call ecologically naïve. They cannot withstand human impact as well as plants and animals

can do in Africa. As an example, man has only been in Madagascar for a thousand years, yet the destruction has been immense. Man has been in Africa for hundreds of thousands and millions of years, if you should count the hominids, and it very much is still intact.

I would like to say something about the grasslands biome, its biodiversity, its dynamics, because if you also understand a little bit about how the system functions, I think it would also help to increase appreciation for this vegetation type.
I am not a manager or a ecologist but I know a little bit about the topic to be concerned about certain aspects and to have noted certain trends. I would like to highlight a few of those.

A brief comment about the environmental impact assessment, which is often used as justification for timber plantations or for any other form of land change (that has been justified by an environmental impact assessment), and to conclude with a few words on conservation.

The biome concept is one which maps areas with large similar vegetation, not looking at the species that grows there but more at the general effect produced by the plants in combination.
If it's mainly trees, we call it a forest. That's why its so easy to call a plantation a 'forest', but if you look closer you will see that a true forest is a very diverse system whereas your plantations tend to be mono-cultures. But, if not only referring to the plants, the plants are merely the habitat creating component plants create habitat. They are not only things that can be consumed, they are not only food, but they create habitat, a place to live for the rest of the components of the ecosystem notably the animal part.

Now, the grassland biome is here shown in yellow and you are all probably familiar with the biome map of southern Africa. This is the mapable portion of the grassland biomes, there are also outlying enclaves of the grassland biome, perhaps with a more tropical nature especially in Maputoland and as you move further north, there are also in some water-logged areas in savanna, the so-called dambos, where you get grassland areas. But these are mainly the temperate grasslands that has been mapped here as the grassland biomes. Now you will realize that this is mainly the area where heavy afforestation (plantations) is taking place. *So the impact of afforestation is mainly affecting the grassland biome.*

**Grassland Biodiversity**
The diversity how many plant species do we have in the grassland biome?
It is estimated that we have about four thousand (4000) plant species in the grassland biome alone. It is a significant figure; it is more than the total flora of many countries.
Switzerland 3 000 species, Sweden 1 700 species, Norway 1 600 species, the Netherlands 1 200, Finland, probably one of the biggest timber producers in the world, mainly from natural and semi-natural forests 1 000 native species.
So we are dealing in biodiversity terms in a very significant resource in terms of genetic material.

If we zoom in a little bit, and we ask the question "How many species are you likely to encounter in a plot of 1000$m^2$. If you walk a thousand steps in a piece of veld how many species are you likely to encounter?, and you will notice that the richest on that scale is probably the Rhenosterveld down in the Cape, part of the Fynbos biome. And the grasslands is the second richest broad vegetation type in South Africa, where some of your other biomes, which are shown here, forests very much lower for example than the average 82 species of the grassland biome. So it is quite a rich vegetation type.

I want to make a few statement now, a few dictums, a few sort of what I would call "generalisations or general truths" about the grasslands. I am going to use as an example, the North-Eastern Mountain Sour-veld, which is the vegetation type on the escarpment, here from Nelspruit to the

Wolkberg, and which has been particularly heavily impacted upon by afforestation.

It is a misnomer to call grassland a grassland because the bulk of the plant species in a grassland consists of what we call non-grassy herbs or forbs, wild flowers. And, if you take the 823 species reported in the North-eastern Mountain Sourveld, only 11% of the flora is grass. It is true that the grass dominates in terms of numbers, that's a strategy adopted by plants that are wind pollinated. Wind pollinated plants tend to be gregarious, it is part of their life setup, because they must grow in large numbers in order to maximize the chances of pollination because they are dependant on the wind, which is non-directional. This applies to all the grasslands. The bulk of the species in any grassland of South Africa would be non-grassy herbs. The figure may vary, it's particularly high in the Northeastern Mountain Sourveld 89%, but I would say in perhaps most other grasslands, more than 60% would be non-grassy herbs.
Another important point to remember, - is that when you look at the rare plants, what we call endemic plants, because often they are confined to a particular vegetation type or a particular region. Lets look at the endemic flora of the Northeastern Mountain Sourveld, those plants are only found in that area, and there are about 130 species. If you analyse them, 2% of them are forest species, of native forests, and 98% are grassland species. And that is the pattern throughout the grassland biome. That the bulk of the rare species are in the grassland and not in the forest. One implication of this observation, is that the old idea brought here by the eurocentric views of our first ecologists that came out in the early 1900s, continuing with prominent people like Acocks and even Frank White. They reckoned that these grasslands are just like their European grasslands that they are familiar with, secondary grasslands caused by the natives who chopped out and burnt the forests, and that these grasslands actually should be brought back to 'forest' and it is still used in some of the forestry propaganda to this day that they are restoring the land to what it should be.
It is time that we for once and for all forget about that view that these grasslands are secondary because, if you look at the special plants they contain and animals, they must have been in existence for millions of years because only then would there have been enough time for all these very specialized forms to have evolved.

**Grassland Animals**
Now, if we look at the animal component, birds, mammals, reptiles and amphibians, you will notice that the grasslands compare quite well with the other biomes. I am not going into detail here now, just to point out that many animals are highly specialized, they are highly adapted to an open grassland habitat. A tree dominated habitat is completely unsuitable to them, just like the flora for example, is highly adapted to open sunny conditions and can not tolerate shade. Many animals are threatened today, by transformation of grasslands. We see this particularly in the midlands of KwaZulu-Natal where the amphibians are under considerable stress the frogs… and there is even suspicion that *some may be extinct due to excessive destruction of grasslands.*

Grassland is not just grassland, we must all remember that within the grassland biomes, there is some difference in the floristic richnessin our richer grasslands, where on average in $100m^2$ we have between 30 and 50 species. So your more arid grasslands towards the west, the central grasslands, the drier grasslands, tend to be slightly more impoverished. So your escarpmental grasslands are among the richest and so are the grasslands of the bankenveld bordering the savanna biome and amongst the richest are these grasslands on dolomite which are also somewhat wet.
These figures are based on student work and I would not say they are too reliable because they are sampled at short periods of time and often not over all seasons, and when students encounter a plant which is difficult to identify they tend to ignore it and not worry about it, focusing on the grasses which tend to be the easier component to identify…

Let me make a few other statements, which I

think applies to the grasslands.
Sandy soil high floristic diversity.
Clay soil low floristic diversity,
Rocky-outcrops usually the highest diversity in any piece of grassland.
I mention this particularly for the managers who have to make decisions as to how to use a particular piece of land.
So Rocky Outcrops, rocky areas, tend to have, in any grassland, the highest diversity.

Floristic diversity in wetlands is low. In any piece of grassland, you tend to have your lowest diversity in the wetland. Yet, where you do have special plants in the wetlands, and there are many, they are highly specialised in the sense that they are not easily found elsewhere. Your more open grassland plants, can tolerate quite a spectrum from fairly dry to fairly wet, from very rocky, to less rocky to clay, to sandy. But wetlands plants tend to be very specific and that's why wetlands are also so important from a biodiversity point of view, despite the fact that a fairly large portion of wetland plants are cosmopolitan, they are world wide. You can see *fluitjiesriet Phragmites* spp. almost anywhere in the world, or the genus *Typha.*
The lowest diversity in any particular part of the grassland biome, would be cultivated areas and particularly fields that have been ploughed at one stage or another. To this day we have not seen any recovery of a piece of grassland to its original diversity, after it has been ploughed. Even after almost a hundred years.

**Grassland Dynamics**

I would like to say a few things about grasslands dynamics, because I think this is not understood by many people.
The grasslands represent an extremely stable ecosystem. It means the non-grassy herbs, the bulk of the species, can live to a great age, and the turnover of non-grassy herbs are very low indeed. Some people still think when the veld turn green in spring that that must be a new bunch of seeds coming up. There is very little re-generation from seed in a good piece of grassland. Those plants would sit for years and years in the same spot. I know plants that has been in the same spot like some of these wild flowers (e.g. *Gerbera* spp.) for forty years, and they still look the same, as I remember them as a child, and there has been no spread from that particular spot.

Nearly all the native species in grassland are perennial, that means they have underground structures that keep them alive. The bulk of the biodiversity of the grasslands is underground, not above ground. What you see is just the 'tip of the iceberg'. They have rhizomes, rootstocks, tubers, bulbs, corms, etc., forget about all the technical distinctions between these structures, but they are underground storage structures.

Annuals are very few. Compare that with the Succulent Karoo in Namaqualand for example.
There are a lot of annuals in Namaqualand. Native annuals, the daisies, all those wild flowers that you see in floral display, they are the pioneers. They are annuals. They come up from seed. You don't have that sort of thing in the grasslands it is a very interesting observation. And if you do get annual non-grassy herbs, they tend to be mainly naturalised alien weed, like cosmos for example, kakiebos or blackjack, or stinkblaar/olieboom (*Datura* spp.), and I think we must be grateful for those weeds, so you will notice that those weeds are not on the weed list, they are not classified as undesirable, because what they do, is they fulfill a role that few native plants are available for. So if you have a ploughed field and you want it restored, you need pioneers. But there are few native pioneers. In Namaqualand you have then, for example the daisies. In fact they have to plough up parts of Namaqualand to get the tourists there to see the floral display.
So you must be grateful for some of these weeds because they fulfill an important ecological role, they have seen a niche, a opportunity, and they are filling that void.
What does it tell us? It tells us that grasslands have never experienced over millions of years a form of destruction that one can compare with the plough. There was no need to put in place pioneers because they would

have had no functional job to do.

If we look at the perennials in a grassland, the bulk of the species, and we look at their response to fire, it is very important to note that they are not killed by fire, but they are all basically resprouters. It means if you burn them they come up again from the underground structures.
That is very unlike the Cape for example, where you have a large proportion of the flora being re-seeders. It means a fire will kill the whole plant, and it will have to come up from seed again and you must give it about 15, 20 years to produce seeds before you can have the next fire cycle, for if the fire cycles are in too quick succession, you wipe out the species.

You essentially don't have re-seeders in a grassland. There may be very few, but among the perennials, I am not aware of any one that is really killed (by fire) and I would love to hear if some you can give me some example's of perennials that's killed by a fire and have to come up from seed again as the re-seeders in the Cape.

**Pre-Rain Flowers**
To me personally the most interesting components of the grassland, is what we call the pre-rain flowers. There flowering is stimulated by fire and they are non-dependant on the rainfall, even this year with the drought there in Gauteng they would come out, all they require is the fire, and they do this by having water stored underground which they have pot-up during summer to give them a competitive advantage by being first to flower in spring, before the grasses emerge to flower. Hence they can advertise for pollinators without having to compete for visibility among tall grasses These pre-rain flowers are also characterised by extremely rapid seeding.
This rapid-fruiting has never been studied in detail, but they are fascinating plants, because within a week or two, almost overnight, they have fruit. And we think it is an adaptive strategy, that they cannot compete with the grasses, to advertise for pollinators, because they will have to grow very tall to stand out above the grasses, so what they do, they use this opportunity, once the grass has been burnt and the area is open, they have their own water, they flower profusely and they make their seeds quickly.
Because they want their seeds out, if the first spring rains come, just for that one in five hundred year replacement they need, so that when the seedling gets established it is early in spring and it's got the whole growing season so, by the time winter come, the underground structure is strong enough to see that little plant through the harsh conditions associated with the arid winter period, which is often charaterised by frost and cold in the grassland biome.

**Pyrogenic geoxylic suffrutices** is a very peculiar growth form that is associated with our grasslands, and it is very much a type of growth form in Africa. It is not found in significant numbers anywhere else in the world except perhaps to a limited degree in South America. It is a growth form where you get plants, woody plants that can beÊcompared to underground trees, and all that you see are these green twigs which can be compared with a canopy of the tree. And this is probably one plant sitting here, or maybe even this whole area may be one plant, and it's the canopy that just sticks out, the tips of the branches above ground. They burn down every year, but the rest of the tree stays underground.
Why they have adopted this strategy… it is a very interesting challenge to come up with reasons.
Is it fire? We don't think so.. Is some of it frost? Shallow water table? Grazing? ThereÊare lots of interesting things we can say about the reasons why plants have adopted this strategy and why it mainly evolved in Africa,
Now these clones, because we call them clones, they are essentially immortal, nothing can kill them. Grazers can not kill them, fire can not kill them, they are drought resistant. They grow extremely slowly, and if you look at the diameter of some of these clones, they must be the oldest inhabitants of our grasslands. I would say easily more than a thousand years for many of these clones since

the first seed arrived for that particular species. But I would not be surprised if some of them is one day shown to be perhaps more than 10 000 years old, amongst the oldest plants in the world, much older than any tree that you are going to see. They are very peculiar plants and we have quite a number of these species in our grasslands.

So much for the dynamics…

**Grassland Management**

I have to say something about grassland management. The standard book on the topic, is this one edited by Professor Tainton. It is very worrying when you look at the definition, for example "Veld condition assessment" which is one of the methods used to establish the condition of the veld. Veld Condition is defined - "it is used to describe vegetation in relation to its long-term potential for livestock production" . So it is an exploitational view of the veld that it is only there for livestock production and the main component of significance for livestock production is grass. So the bulk of the species in the grassland is kind of ignored and many of the methods described only depends on quantification of the grass stratum. They do not survey the other plants and the bulk of the plant species are not looked at. Because their aim is to produce more livestock and there is the belief that these other plants play no role in the diet of the animal.

So the question is:- For what does one manage? It is important to have management objectives. If you manage for biodiversity, surely this definition is unsuitable? But the point I want to stress here, is that it is sad that to this day, veld-management studies in Southern Africa has been aimed mainly the management of grass and not really the management of **grassland** in its full diversity.

That's why we know almost nothing of the bulk of the species, the non-grassy herbs. I would say essentially nothing. What I have been telling you here about their behaviour you wont even find in a text book, you won't even find reference to pre-rain flowers. Its not there.

We as taxonomists have known them for years, but the ecologists, the people who do the studies; many of them get money to conduct agricultural research, so they have to take an agricultural approach. The timber people get their money from the timber companies, and its difficult to be a conservationist in the timber business, because you are often not empowered to do what you would actually like to say and do, because remember, you are in the business of managing for trees.

Now what can one really manage as a manager? You cannot manage the climate - you cannot manage the temperature and you can not manage the rainfall. But there are three things that you can manage, and these are very important from a management point of view:

**Stocking Rate**

The one is stocking rate you have to establish grazing capacity it is determined by your management objectives which depends on whether you want meat production from the veld, if you want to stock the area with game, and you want to see how many animals can be carried, and the stocking rate is very important in a small management area, particularly if you make use of fire as a management tool.

Because if you cannot burn large tracts of land, you find that if you have a lot of animals on the property, they all tend to focus on whatever area is burnt and that is often not the whole area.. So, when people calculate stocking rates, they take the whole piece of land, lets say a 100 ha., but they only burn lets say 20 hectares every year and then this carrying capacity of 100 ha. is all focused on 20 hectares because that's where the game goes to. It's a devastating effect, particularly if you have too many animals.

**Fire**

These grasslands evolved with fire. Any piece of grassland should have a burning program. *Remove the fire, you destroy the grassland*, it is as simple as that. You can not replace the fire with mowing; you can not replace the fire with grazing. So if you cannot use fire, because of safety considerations,

then you must not manage for grassland. Then you must change your management objectives.

Here are some of the aspects that are taken into consideration -like time -is very important. David (Lindley) pointed out some of the burning that take place when they do fire breaks in the beginning of winter that can have a devastating effect on the normal function of the grassland.
Your best fires are late, late winter, or very early spring.
Fire is the life blood of our grassland, It has been here for millions of years, and man has been using it for at least 1.5+ million years here in Africa, in addition to the lightning fires.

**Invader Plant Control**
The third thing you can do from a management point of view is, invader plant control. Both bush encroachemnt by natuive species and invader alien species.
Native species like *Acacia karroo*, and Stoebe vulgaris (bankrupt bush). You can do this through fire, chemical or mechanical means or biological control and again your management objectives must help you how you are going to handle especially indigenous invader plants, which is often a problem when you exclude fire from a grassland region.

**Grassland Restoration**
We see the inability of grassland to regain its original floristic diversity and we consider destruction by ploughing or by timber plantations, especially if they have been there for a long time, as irreversible.
Don't waste your time to try and get grassland back.
You can ask Why? Why does grassland not come back? It is a complex issue, we think that one of the reasons is historical - Our grasslands are the culmination of millions of years of different vegetation types being superimposed, and you can never turn the clock back and repeat that. It is not primary succession like the dunes there in Richards Bay, where you have pure sand dunes along the coast and then they get progressively vegetated.
This is a different system where there used to be forests at times, where there used to be Karoo vegetation, and savanna vegetation all superimposed, and each time when a particular plant community or vegetation type change, it not completely replace the previous vegetation type -but some individuals stayed behind, some of the hardy ones and the whole thing gets 're-shuffled' and you can never repeat that in our lifetime, or in any future lifetime.

**Soil**
Soil changes are not often reversed, and one of the often overlooked soil changes is the increase in hydrophobicity of the soil. The soil becomes hydrophobic, especially under eucalyptus plantations. The soil becomes water repellant. It is a complicated factor - there is a waxy layer deposited on the sand grains, which is almost impossible to remove and it means that water run-off increases tremendously,
It is a feature of eucalyptus, the second worse would be wattle, then pine, and I know that grassland is least known for this hydrophobic condition.
It is being studied by the industry, they are very much aware of it. They are not putting it on display everywhere, but they are very much aware of this problem. And it is worsened by fire. So I hate to think what is happening to the soils, what has happened to the soils after these latest fires here on the escarpment. Will those soils ever recover? What is the run-off going to be after the first heavy rain? Erosion, flash floods, all sorts of problems.

Wetlands fortunately are relatively easy to restore so that is one of the best options. If you want to restore an old timber area, go for a wetland. And David (Lindley) has shown that the success is quite dramatic with wetlands.

**Forests are relatively easy to restore (native forests)**. There I support Dirk Versfeld. I think if you chop down some of these old plantations, instead of trying to get such an area back to grassland with weeds

and all sorts of nonsense, rather try and just leave them. Take the fire out and they will gradually go back to forests. Because if you take fire from a grassland in our high-rainfall regions it will over time revert to a forest.
So forest is one of the easiest vegetation types to restore with quite a lot of diversity associated with it, but forget about the grassland. But this must make us more cautious, because can we afford to lose more grasslands, because its not just a matter of restoring them. **Once we have lost them, we have lost them!**

**Environmental Impact Assessment**
A final word on environmental impact assessments I do not know how much trust one should place in those assessments. People try their best, But you know, once ploughed you can say look, that area is not a very high priority from a biodiversity point of view. It may still be a high priority from a grazing point of view, You can still graze black wildebeest there, they wont mind the species impoverishment they just want an open habitat. But, you are not going to get the original diversity in terms of plant species.
So we always say well, if that's a previously ploughed area that's the least concern, if you want to put other forms of agriculture in there.
It is important to survey grasslands during all seasons and not like often happens, that you are given two weeks time in the middle of winter to do an EIA in a piece of grassland. It's absurd. Because what you find is that many of the rare species are not the most conspicuous plants.
This is an example of a rare grassland plant, *Brachystelma incanum*. It is only known from one locality, just one little spot near Wolmeranstad. There is little of the plant above ground. A person doing and EIA is unlikely to see it. Its in flower, its got a little black flower. You will step over this plant, and it is only there for about two or three weeks. You are lucky to see the little black flower. It sort of blends in with the grasses. You can not walk every meter.
Because one of the golden rules is that:-:"*organisms do not occur where they cannot, but often they do not occur where they might*".
And that you can see so well with rare species. There is no reason why that species should not grow there or there or there,, but would only grow here in this one little spot, nowhere else. There is no reason why but it will never grow there, at least, not in one's life time, because all niches are occupied, the grassland is stable. All niches are full. And unless something die or is taken out, there place can not be taken. Okay, if you remove some of the plants next to the road the annuals could still come in.
But then you may ask why do these plants still produce seeds, is the seeds still needed? They are all re-sprouters and can grow very old, but what we think is that these seeds have assumed another role in nature, they are fulfilling another function, they feed the ecosystem. Many rodents probably depend on seeds produced by these plants. So the plant has almost become 'generous' in donating some of its resources to sustain other elements in the biome.
So this 'modelling' that people do, to find out where are rare plants likely to occur must always be followed by work on the ground. Because the only thing you can say with certainty is where the organism will not grow , where the habitat is not suitable. But if the habitat is suitable, if the computer tells you that you have to go specifically an inspect In the majority of cases, I can guarantee you that it would not be there, if they follow this rule.

**Grassland Conservation**
If we look at the conservation of our biomes you will see that of all the biomes, grassland is the most transformed. There is actually relatively little also conserved. So grassland is not only the most threatened biome in the world, but, also the most threatened biome in South Africa. We are lucky, in that we still have more grassland than most other parts of the world because grassland and man evolved together here and we have not destroyed the grassland as dramatically as in those parts of the world where plants and animals tend to be ecologically naïve towards man, like as in Madagascar or the prairies.
In the prairies. they have devastated the natural fauna, I mean North America had a

natural fauna far bigger than southern Africa, far more species, different kinds of elephant, all sorts of predators, big horses, all sorts of things. 70% - 80% have been wiped out by man only in the last 12 000 years. Africa is the only continent where the mega-fauna is still intact. So we have a resilience that we much appreciate, and thanks to that we have more of our grasslands left than most of the other, I would say all of the other temperate grassland areas. So much more.. It is a very precious commodity which we should take care off.

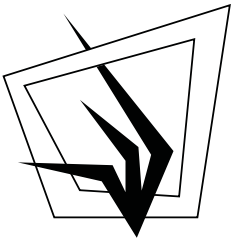
I get very concerned as a Taxonomist, when I travel in rural areas and I see these rows upon row of little pine trees and eucalyptus springing up in the grasslands.
And I must stress that I am **not AntiForestry** but I am **Pro-Grassland**. And I think we need more people that's pro-grassland. I am proud to be pro forestry, it is a very essential, a very important activity, but at the least I think the timber industry could do is to also adapt their attitude and become pro grassland. If I can be pro forestry, it should not be too difficult for them to become pro grassland.

***(Laughs & Comment from audience): "But you can not make money from a grassland"***

Well, you can make money.. People say, what do you make out of grass? **But, in a sense, we all eat grass,** because all flesh is grass, we just harvest the grass with harvesting machines in the form of cattle, sheep and other animals, we utilise the milk, we all live from grass, its food . We must still find a way to process pine and eucalyptus to make food out of them. At least you can cook your food on them, and that I appreciate!
(***Lots of Laughs)***
And I think there is more than enough wood in South Africa, Its just that the wood goes to waste, it is in the wrong place. I see piles of wood, cut offs, being burnt, in forestry areas. Why is that wood not transported to rural areas where people need the wood? Why must they now plant timber, small timber plantations there? Its just a matter of moving these things where they are needed, instead of burning them.

We have an arbor day, started by the timber industry as part of their propaganda campaign. These days it has assumed sort off more, acceptable objectives. Why can we not have a national grassland day to counter that? Where is the timber industry? I would like you to become pro-grassland also and that is one way to show it. Call it 'national grassland day' and Arbor Day and appreciate and emphasise the importance of both components.
Because there are also millions of people making their living from grasslands, and lots of farmers that live from grasslands in the form of cattle farming and sheep farming.
And I hope that just as we now have the guidelines for wetland management, I am encouraged to hear that there is now plans to produce guidelines for grassland management.
I think for the timber industry to admit the problem is the start of the cure.
And I must say that over the years I have witnessed a change in the attitude from some timber companies. I have a lot of dealings with people like Ricky Pott and others who seem to be really concerned about what they are doing, but we would like to see more of that. We would like to see the industry admitting that it has a problem and talk to others to see how they can find solutions so that we can all be pro-forestry, and pro grassland.

Thank you very much.



# THE KNOWLEDGE NETWORK FOR BIOCOMPLEXITY

***Second collaborative meeting Community Dynamics in South African Savannas***
*Skukuza February 2004*

*Sandy J. Andelman[1], Melinda Smith[2] and submitted by Mike Peel[3]*
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The Knowledge Network for Biocomplexity (KNB), a research collaboration between the National Center for Ecological Analysis and Synthesis (NCEAS; www.nceas.ucsb.edu), the Long-Term Ecological Research Network Office (www.lternet.edu), the San Diego Supercomputer Center (www.sdsc.edu), and Texas Tech University, is developing software tools to advance ecological understanding through remote discovery, access, retrieval and management of ecological and environmental data (http://knb.ecoinformatics.org).Ê New tools alone are insufficient to meet current and future knowledge integration challenges in the environmental sciences. Therefore, to facilitate a transformation in the culture and conduct of environmental science, the KNB is training a cadre of investigators in new techniques for management and analysis of ecological information, with particular emphasis on multi-scale integration, synthesis and analysis. Our approach involves scientists (graduate and postdoctoral students and faculty and other senior scientists) at multiple institutions collaborating remotely using KNB software tools to investigate questions related to the importance of spatial and temporal scale in understanding the relationship between biodiversity and ecosystem function. In addition, participants in the project also collaborate directly during working groups.

To date, a total of 105 participants, including 83 graduate students, 2 undergraduate students, 6 postdoctoral researchers and 14 faculties from 9 US universities have participated in the KNB's educational activities. Participants gain a broad understanding of the scientific question being addressed (the productivity/diversity relationship), participate in synthetic research to address this overarching question, develop collaboration skills, and become familiar with tools and methods to facilitate integration of heterogeneous data and metadata and analysis of heterogeneous data sets.ÊIn addition, participants provide important input to the design and evolution of the KNB software tools.

**KNB - South Africa Collaboration**

To expand the geographic scope of the KNB and associated distributed seminar model, as well as to diversify participation by the ecological community in KNB research and education activities, and software development, we are initiating a collaboration between the KNB, Kruger National Park Scientific Services, ARC-Range and Forage Institute, and graduate students, postdoctoral researchers and faculties from several universities in the US and South Africa.
This international research and education collaboration will examine relationships between biodiversity, community structure and ecosystem function, and how key drivers influence these relationships in savannas and grasslands. South African and US participants will synthesize and analyze data

from multiple spatial and temporal scales, relating to: 1) patterns and dynamics of biodiversity and community structure; 2) the drivers of these patterns and dynamics; and 3) the consequences of and interactions between these patterns and dynamics and key drivers for ecosystem functioning and management of natural systems.

The collaboration will use long-term datasets from Kruger National Park and adjacent game reserves (Range and Forge Institute), as well as from a variety grassland sites in North America, and from long-term fire experiments in both North America and South Africa. We will synthesize and analyze empirical data from a range of spatial and temporal scales for several sites arrayed along similar environmental gradients in North America and South Africa. Our goal is to understand how patterns of species diversity and community dynamics respond to similar drivers (fire, grazing, and climatic variability) and the consequences of these dynamics for productivity, a key ecosystem process in grasslands and savannas. In additional to analysis of empirical data from multiple sites, we will synthesize and analyze data from long-term (>10 years) controlled burn experiments in North America and South Africa to understand how the timing, frequency and intensity of fire, and their interaction with other biotic and abiotic drivers, affect biodiversity at multiple spatial scales.

Under the framework above, the specific questions we are interested in are:

**Long-Term Patterns of Community Change:** change in different components of community structure, such as species richness, composition, abundance and turnover of dominant and subordinate species, IN SPACE and over time.

**Drivers of Biodiversity:** how fire (frequency, scale, intensity and timing), large herbivores, climatic variability and potentially other drivers (e.g., soils) interact to influence changes in plant community composition IN SPACE and over time.

**Consequences of Community Dynamics for Ecosystem Functioning:** the relationship between fire, species diversity, community dynamics, large herbivores, and climatic variability, and how these interact with and influence above-ground plant productivity (biomass), a key ecosystem process in grasslands, over time.

Grasslands and savannas are ideal systems for examining these patterns and processes because they are highly variable in space and time and are subject to multiple disturbances, such as periodic drought, fire, and intense periods of herbivory by ungulates, invertebrates and numerous species of small mammals. Spatially discrete soil disturbances (e.g., burrows, wallows and termite mounds) are also important. Together these disturbances interact to create spatial heterogeneity and temporal variation in resource availability, community structure and ecosystem processes.

Although the impacts of fire, grazing and climate on community and ecosystem structure and function have been well-studied for particular sites, comparative analyses of data from a range of sites is required to understand whether the patterns and causes of species dynamics observed at individual sites or within individual plant communities are general among grassland and savanna systems.

Understanding the causes and consequences of long-term patterns and dynamics of biodiversity and community structure is needed to help increase our ability to predict responses of communities to natural and anthropogenic change. This understanding is critical for informing management decisions. Furthermore, this knowledge will help elucidate the controversial relationship between biodiversity and the functioning and stability of ecosystems.

Participants:
**US:** Sandy Andelman (NCEAS), Scott Collins (University of New Mexico), Katherine Gross (Michigan State University), Melinda Smith (NCEAS), Alan Knpaa (Colorado State), Mike Willig (Texas University).
**Kruger National Park:** Harry Biggs, Judith Kruger, Nick Zambatis.
**ARC-Range and Forage Institute:** Mike Peel
**University of Fort Hare:** Winston Trollope

# Flocks and Herds or Flerds - the choice is yours

Rangelands are characterized by many different kinds of plants. Therefore, profitable and ecologically sound stewardship of these landscapes must involve reasonable methods for turning range plants into food and fiber. Mixed-species stocking with domestic cattle, sheep and/or goats is one of the preferred methods. Mixed-species stocking tends to spread vegetation utilization across all plant life-forms (grasses, broad leaf and woody plants) since cattle prefer eating grass, sheep normally choose to graze forbs (weeds) while goats prefer browsing on twigs and leaves of many woody plants. Furthermore, with mixed-species stocking, animals tend to distribute themselves across a landscape in an attempt to satisfy their dietary preferences. However, the benefit of mixed-species stocking is frequently unrealized because the more vulnerable sheep and or goats (small ruminants) are the first species lost to predators. In the Western United States, coyotes (*Canis latrans)* are the major predators to small ruminants. For information on coyotes and their role as predators readers are referred to http://www.canids.org/SPPACCTS/coyote.htm and http://www.cws-scf.ec.gc.ca/hww-fap/hww-fap.cfm?ID_species=58&lang=e and for information on predation losses and how predators can be controlled check out http://attra.ncat.org/attra-pub/predator.html.

One approach to controlling coyote predation on sheep and goats involves altering the behavior of small ruminants so they consistently stay near cattle under free-ranging conditions and thus receive protection from canine predators. Would you consider implementing this behavioral based methodology developed on the Jornada Experimental Range (JER) operated by the United States Department of Agriculture Agricultural Research Service if it had additional management benefits beyond protecting sheep and goats from coyotes? If you answer "yes," **flerds** might be a management option to consider.

**What is a Flerd?**

Etymologically the word flerd is the contraction of **fl**ock and h**erd** but more importantly a flerd is a mixed-species grouping of animals that consistently stay together under free-ranging conditions. This association offers management benefits not found when managing flocks and herds. In flerds, cattle, as group leaders, tolerate the close presence of the smaller ruminants initiated and maintained as a result of behavior modification. In smaller ruminants that have not had their behaviors modified groups of sheep and or goats stay together as a flock that is dissociated from cattle groups or herds.

The concept of creating flerds came from observing the reaction of cattle when worked by dogs trained to voice and hand signals. If a dog became too aggressive towards a cow, the cow would often stand its ground or retaliate by kicking or chasing the dog. This aggressive behavior on the part of cattle toward dogs made us ponder the following scenario. Because dogs and coyotes are both canines, if we could get small ruminants to consistently stay with cattle, would this close association offer the small, more vulnerable animals predator protection from coyotes?

Over a period of 14 years a number of studies were conducted on the JER to investigate how to modify small ruminant behavior, what challenges might be expected from modifying sheep and or goat behavior, and how this behavior modification might facilitate mixed-species stocking.

To evaluate if small ruminants were actually staying near to the cattle a Border collie dog trained to voice and hand signals was used. Numerous tests examined the response of foraging animals to the approach of controlled canine aggressiveness. The initial response was for foraging to cease and the group to coalesce into one or more dense groups that would attempt to run from the dog.

If the group was not a flerd, the animals would immediately split into intraspecific groups. Cattle were normally the first animals to stop running, and turn to face the dog. The small ruminants, now separated from cattle, would usually continue to run. Often one or more of the small ruminants on the perimeter of the group would become separated, and these lone animals became the focus of the dog's pursuit. At this point the dog was called back by its handler, thus ending the test. Had the pursuing canine been a coyote, most likely the isolated sheep and or goat would have been the first animal to die.

In contrast, if the group was a flerd, only a single group of animals was observed running away from the pursing dog. Cattle were normally the first species to stop running followed immediately by the small ruminants. The cattle in attempting to keep the dog in sight at all times would form a circle facing outward. Within this configuration, the sheep and or goats would appear between pairs of cattle. At this point, the test ended and the dog was called back by its handler. To get from flocks and herds to flerds requires a process termed bonding.

**What is bonding?**

We define bonding (or cross-specific attachment formation, as it is referred to in scientific literature) as the process by which sheep and or goat behavior is modified such that animals consistently associate with cattle under free-ranging conditions rather than form intraspecific flocks that normally remain separated from cattle herds. Bonded small ruminants consistently remain within line-of-sight of one or more cattle at all times. Bonding occurs regardless of the number of groups of cattle because the bond forms at a species level rather than with individual cows. If this were not the case bonding would have little practical value for a producer and loss of individual cows would result in a break up of the flerd.

The bond appears to be unidirectional, i.e., cattle appear to tolerate the presence of small ruminants but do not appear to have their behaviors modified. Once small ruminants are bonded, all that is required for a flerd to develop is cattle tolerant to small ruminants.

**How do you create bonded animals and eventually a flerd?**

Bonding is a time sensitive process requiring a close association of small ruminants with cattle during which time their behavior is modified to prefer to associate with cattle even when given the opportunity to separate from them. The first published study on bonding Rambouillet- Polypay crossbred sheep to cattle began in 1985. Lambs 45, 62 and 90 days of age that had been weaned at 45 and 62 days of age were placed with 8 to 9.5 month-old heifers for a period of 60 days in pens having solid sides. Following 30 and 60 days of pen confinement, lamb heifer pairs and groups consisting of seven lambs and six heifers were taken to a remote location, placed in a corral, allowed a few minutes to become accustomed to their new environment, and then released into a paddock and observed for eight consecutive hours. Three estimates of aggregation or dispersion were recorded every 15 minutes; the diameter of the smallest circle enclosing each species together with the shortest distance between the perimeters of these two circles. Following 30 days of pen confinement the 45 and 90 day old lambs remained five times closer to cattle compared to control lambs that had not seen cattle before the eight hour field testing was

conducted. From these data we concluded that 30 days of pen confinement were sufficient to bond 45 and 90 day old lambs to cattle. In addition, separation between the 62-day-old lambs and the heifers was much greater than the separation observed for the 45 and 90 day-old lambs. This unexpected finding was eventually traced to a physically abusive heifer that would kick and butt the lambs when they approached the feeder. It was only evident during the feeding of hay to the penned animals. Based on these observations, a study was designed in which 75-day-old lambs were confined with abusive and non-abusive heifers for 55 days. Bonding was evident following 20 days of pen confinement in the treatment composed of non-abusive cattle. However, bonding did not occur in the pen of lambs with abusive heifers. Physical abusiveness in pen confined animals appears to be most prevalent during feeding. If bonding does not occur during pen confinement there may be a problem due to one or more abusive animals that should be removed from the group.

In 1987, an attempt was made to bond 5-month-old mohair kid goats to cattle with and without bonded sheep. Two groups, each containing seven kid goats and three gentle cattle were penned together for 60 days. An additional 14 days of pen confinement occurred when previously pen- bonded sheep were added to half of the kid goats; the remaining seven cattle-exposed kids were put in pens having only cattle. Following 74 days of pen confinement, a short-term (four consecutive hour) field test to evaluate dispersion or aggregation was conducted on these two groups plus a group of six mohair kids and six lambs that had no previous exposure to cattle. During this test, cattle-exposed kid goats remained less than 30 meters from cattle while the non cattle-exposed kids and lambs were separated from cattle by 30 meters more than 60 percent of the time. A 21-day field test was then conducted. Only the group consisting of cattle-exposed kid goats together with bonded sheep avoided serious death loss from coyotes (only the smallest kid goat was lost). The mohair kid goats that had been with only cattle and not sheep had only one kid goat remain unharmed. Losses by this group of kid goats that were previously bonded to cattle were similar to losses from the non cattle-exposed control group in which all the mohair kids and one lamb was either found missing or dead within 10 days after the field test began. These results suggest that bonding of mohair kid goats to cattle did not produce as enduring a bond as that formed between sheep and cattle. However, the weaker bond of the mohair kid goats to cattle was strengthened as a result of the affinity formed between the kid goats and sheep that developed during the 14 days of socialization preceding the 21-day field test.

Two years later, we evaluated aggregation or separation between Spanish (meat type) kid goats, lambs and cattle in a five hour field test following 30 days and again following 60 days of pen confinement. The Spanish kid goats ranging in age between 45 and 100 days-of-age and lambs between 41 and 105 days-of-age were penned with 8 to10 month-old heifers for 60 days. The Spanish kid goats and the lambs had similar affinities for cattle over a 5-consecutive-day test in which no physical separations among animals were observed. However, as the bonded Spanish kid goats matured, they demonstrated a greater degree of independence from cattle than did bonded lambs, and were often found separated from the cattle-sheep group. Thus Spanish goats do not appear to have as enduring a bond to cattle as do sheep. Furthermore, Spanish goats do not appear to form bonds with the sheep as did the mohair goats. Thus Spanish goats may offer significant management challenges when part of a flerd.

In 1999 we demonstrated that bonds can form between yearling ewes and cattle regardless of the cattle age (eight months to 8 years-of-age) in as little as 14 days. Earlier studies suggested that lambs will associate with

cattle within 24 hours following birth, and some bonding may be seen as early as seven days after beginning pen confinement.

An alternative to pen-bonding is to create bonded animals by addition to an existing flerd in the field. In November 2001, 37 lambs approximately 9-months-of-age (36 females and one wether, a castrated male sheep) were gradually added to an existing flerd of 17 ewes, 13 mature beef cattle and five replacement heifers. Lambs were added to the flerd at a number and rate based on their demonstrating a preference to remain close (cohesiveness) to the core flerd. The first addition to the existing flerd was a single lamb. The next additions involved pairs of lambs added seven, eight and six days later, respectively. A group of three lambs was then added seven days later followed by a 21-day period during which time no lambs were added (Christmas-New Years Holiday). The next addition began on January 7, 2002, with the addition of four lambs followed by a three-day period of observation when three additional lambs were added. In the next two additions, two groups, each consisting of four lambs, were added four and three days apart, respectively. Five days later, six lambs were added and the final group of six lambs was added six days later on January 28. Although this study was not replicated, our results suggest the art involved in expanding the size of a flerd using field-bonding is based on individual lamb behavior as it affects the rate at which lambs could be added to the core flerd and have cohesiveness maintained.

Line-of-sight to the flerd cattle was never observed to be broken between the 37 lambs throughout the 71 day period. Over the following 366 days, only two of the original 37 lambs were lost, presumably to coyote predation, while none of the mature sheep were lost. In addition to the cattle and bonded sheep, Turkish Akbash guard dogs provided additional predator protection to the bonded sheep. This minimal death loss is in contrast to March and August 1986 on the JER where non-bonded sheep were lost at the rate of one every five days, presumably from coyote predation.

Prior to development of flerds we relied on gunning, trapping, snares, electrified fences and guarding dogs to protect sheep and goats from coyote predation. We now use flerds in combination with Turkish Akbash guard dogs. However, guard dog management offers its own set of husbandry challenges. For example, if sheep and goats break into more sub-flocks than there are guard dogs some sub-flocks will be unprotected. Furthermore, if dogs are not spayed or castrated, their reproductive cycle can cause them to periodically leave the small ruminants unprotected while searching for a mate to satisfy their physiological drives. For additional information on predator protection tools and techniques the reader is referred to:
http://www.wildlifemanagement.info/publications/predators_7.pdf and http://www.ext.colostate.edu/pubs/livestk/01218.html

**What are the benefits in managing flerds?**

Based on our research, the consistent close association of small ruminants with cattle provides predator protection from coyotes in addition to providing other time and money saving management benefits including: **1)** Time required to locate small ruminants on a rangeland landscape is reduced because these smaller animals (sheep and goats) are always in the presence of cattle. This can be especially important in paddocks with dense woody plant cover (brush) or during foggy or snowy weather when the taller cattle are much easier to locate than the smaller animals. **2)** Because sheep and or goats in a flerd are always with cattle, internal fencing adequate to control cattle will also control the location of the smaller animals. Read the 2004 issue of Grass Roots Vol. 4(1):10-13 (http://www.gssa.co.za) to understand how this characteristic of flerds could fit into managing livestock using Directional Virtual Fencing (DVF™). **3)** Cattle tend to range

over more area when foraging than do sheep and or goats. Therefore, flerds distribute foraging over a larger area of the paddock than possible with flocks and herds.

**Practical suggestions when attempting to form bonds and maintain flerds**

*In General*

Every time you work with animals, you are training them. Strive to make the training an experience that will allow you to reach your management goals in the most time efficient and cost effective way possible.

Bond strength:
Bonding results from close associations. Bond strength (the enduring association of small ruminants to be with cattle) appears to increase as the length of time small ruminants are in contact with cattle. However, bond strength does not refer to the actual physical distance of separation between cattle and the smaller animals. In fact, the actual distance between cattle and bonded small ruminants may increase with "bond maturity." Though sheep and or goats tend to maximize their separation from cattle as bonds mature, even in mature flerds there is seldom line-of-sight separation between small ruminants and cattle.

Separation time:
Previously bonded small ruminants can be separated from cattle for up to two months, such as during dry-lot lambing, yet their association with cattle reestablishes after being reunited. However, the rule in managing flerds should be to never separate bonded small ruminants from cattle for longer than is necessary, and whenever separation of the small ruminants from cattle is observed under free-ranging conditions the flerd configuration should be reestablished immediately. Animals that have separated should be observed for cohesiveness for several days after they are returned to the flerd. If they stay with the flerd nothing additional needs to be done, however, if separations continue, on the third separation remove them permanently from the flerd. This is rarely necessary since sheep and goats are gregarious and normally stay with peers. Many of these peers will have developed strong bonds to cattle.

Paddock selection:
Dietary preferences for free-ranging cattle, sheep and or goats are not significantly altered by flerds. However, vegetation patterns across rangeland landscapes should be considered if given a choice in where to manage a flerd. A heterogeneous vegetation pattern without distinguishable patches would be preferred to a vegetation mosaic of large patches each containing only a single plant life-form. This later vegetation pattern could cause the flerd to split apart during foraging in order for each animal species to optimize its dietary preferences.

Because bonds are species-specific, it is essential that the paddock in which a flerd is located not be surrounded by livestock. If this were to occur, the small ruminants may attempt to follow livestock in adjoining paddocks if the fence is not sheep and or goat proof.

The first paddock in which the group of newly bonded animals is placed should be relatively flat, brush free and with only one drinking water site available at any time. The physical size and shape of the paddock should allow line-of-sight among all animals at all times. Once the flerd has "matured" to a field routine, it can be successfully managed in brush infested paddocks or those with undulating topography.

*Pen-bonding*

Pen-bonding is probably most suited for bonding lambs and kid goats to cattle. Several points should be considered when confining animals in pens in an attempt to eventually form flerds. **1)** Use sheep and goat breeds that exhibit flocking tendencies (white face sheep breeds may make better

candidates for bonding compared to black face breeds based on flocking tendencies). **2)** Select the youngest age and most docile sheep or goats that will easily fit into the management program. The ages of sheep used in the JER studies ranged between 45 days of age to 18 months. **3)** Select only docile cattle of any age and always use at least two cattle per pen to minimize their anxiety due to their being separation from peers. **4)** If physical abusiveness towards the lambs or kids is detected, remove the abusive animals immediately. **5)** Opt for the longest period of pen confinement that is economically and logistically possible to create the strongest bonds. Bonds have been observed with periods of pen confinement lasting between 14 and 80 days, however, a period of between 30 and 50 days of uninterrupted pen confinement is required to produce an enduring bond. **6)** Rectangular or triangular pens have successfully been used to create bonds with the area per animal ranging from 4.8 $m^2$ per animal to 17.5 $m^2$ per animal and the ratio of cattle to small ruminants ranging from 1:3 to 1:1, respectively. **7)** Pens with open vs. closed sides do not appear to affect bond formation. However, a pen area that is quiet with minimal activity is preferred. **8)** A creep area should be provided in each pen to allow the small ruminants a place to escape if threatened. The creep also provides an ideal location for supplementing the small growing ruminants and a perfect interface at which to begin the process of bonding. During the first 24 to 72 hours, hay can be fed on either side of the creep to allow close visual contact among animals yet provide a physical boundary between the larger cattle and the small ruminants during the initial stages of socialization. **9)** Bells can be placed on cattle; this sound will become familiar to the sheep and may help orient them to stay with the cattle when the animals are released into paddocks. **10)** Try to combine pen bonding with ongoing management practices to make the process as economical and efficient as possible.

*Field-bonding*

Bonding animals while they are in a paddock (field-bonding) is probably most suited for bonding older sheep and goats to an existing core flerd. Because feed no longer needs to be supplied to animals in pens, this technique provides a relatively low-cost method for increasing the size of an existing flerd. Many of the suggestions involving the creation of bonds using pen confinement apply to field-bonding as well. However, there are several unique requirements to consider when attempting to bond sheep and or goats to cattle under field conditions. **1)** As in pen bonding, always choose the most docile cattle and small ruminants. Eating and drinking water together will begin the process of socialization. Therefore, pen small ruminants with gentle cattle for at least 24 hours before you begin to add them to an existing free-ranging core flerd. **2)** Docile cattle, irrespective of physiological state, age and breeding, provide sheep equal opportunity to bond and appear to provide equal protection from canine predators. **3)** Choose paddocks without steep slopes or dense brush that would limit line-of-sight. **4)** Never allow more than one drinking water site or mineral supplement site to be available at any one time. A single water site forces animals to periodically come together. **5)** Bonded wethers form a closer association to cattle than bonded ewes; therefore, using one or more wethers in the core flerd may help to form a more cohesive group than using only ewes. In addition, it may be advantageous to have the wether(s) and several cattle wear bells as part of a core flerd. **6)** If separation is observed, it is always preferred to move the animals that have separated from the flerd back to the flerd, <u>never</u> move the flerd to the separated animals. Returning these animals back to the flerd is best accomplished using a trained dog. The dog should be worked in a manner that will return the separated animals back to the flerd with an experience that will help them remember why they should <u>not</u> leave the flerd! **7)** As a rule of thumb, new animals should not be added to a core flerd until the most recent additions have been

observed to remain with the core flerd for at least three to five consecutive days. **8)** Lambs born to bonded ewes, though tolerant of cattle, are not themselves automatically bonded. They must become socialized with cattle in order to consistently remain with them under free-ranging conditions. **9)** Sheep and or goats that rapidly form close and enduring bonds will assist other animals that do not form cohesive bonds due to their gregarious nature. Therefore, all small ruminants should be given the opportunity to become bonded. **10)** As with pen bonding, use the youngest age of small ruminant to begin the bonding process and use paddocks having the highest quality and quantity of feed for growing animals.

**Conclusions**

Bonding forms the base of a behaviorally based tool that can facilitate management of mixed-species stocking groups. Forming bonds requires physical association between small ruminants with cattle that changes the orientation of these sheep and or goats when together with cattle under free-ranging conditions. This bonding can be accomplished either through pen or field techniques. Husbandry skills involving a keen sense of observation and patience coupled with innovative and pro-active management choices are required to create bonded animals and maintain flerds.

Managing flerds offers a producer several tangible benefits including a reduction in sheep and goat predation losses from canine predators. As a result of the close and consistent association of small ruminants with cattle, the amount of time spent in locating livestock under free-ranging conditions can be reduced. Fencing adequate to control cattle will control small ruminants that have been bonded to cattle. Finally the consistent association of small ruminants with cattle will improve animal distribution over more of the landscape than if only flocks are managed.

For additional information on bonding and flerds please contact **Dean M. Anderson**; U. S. Department of Agriculture-Agricultural Research Service, Jornada Experimental Range; Las Cruces, New Mexico; U.S.A.; 88003-8003; deanders@nmsu.edu.

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# GSSA SOUVENIRS

To raise some funds for the GSSA, the Council organised some limited edition GSSA branded souvenirs to sell at the International Rangelands Congress held in Durban last year. For those of you who couldn't make it, now is your opportunity to get some for yourselves (and they make excellent gifts!!). All of the items are engraved with either the GSSA logo or one of Africa's "Big Five".

The sets of Schnapps Glasses or Glass Coasters are available with either all GSSA logos or with one GSSA logo and one each of the "Big Five". If you would like to order any of the items listed below, email admin@gssa.co.za, fax 033 390 3113 or phone Freyni on 083 256 7202. Postage is not included, but will be determined by how much is purchased.



| DESCRIPTION | PRICE |
|---|---|
| **6 Schnapps glasses in wooden gift box** | **R180.00** |
| **2 Whiskey glasses in wooden gift box** | **R130.00** |
| **6 Glass coasters in wooden gift box** | **R110.00** |
| **Stainless steel mugs (with GSSA logo and one of the "Big Five", or just GSSA logo, or just one of the "Big Five")** | **R25.00** |
| **Stainless steel glasses (with GSSA logo and one of the "Big Five", or just GSSA logo, or just one of the "Big Five")** | **R25.00** |

# Long-term burning experiments: Revisiting the Brotherton Burning Trial

*Alan Short*
*KZN Department of Agriculture and Environmental Affairs*
*Email: Alan.Short@dae.kzntl.gov.za*

In 1980, large portions of the Drakensberg were under the control of the Department of Forestry, who had a fairly regimented policy of burning the grasslands every second spring. Although this was a sound policy from the point of view of clean water production, there was very little information on the effect of this burning programme on plant species diversity. To answer this question, Colin and Terry Everson, researchers at the Cathedral Peak Forestry Research Station, together with Ed Granger, established the Brotherton Burning Trial on top of the spectacular Brotherton ridge. Twenty-four years later, the Eversons, together with a dedicated group of scientists and technicians from a variety of institutions and disciplines, returned to see what had happened in the intervening two decades.

The trial consisted of twelve replicated burning treatments in three blocks and a number of unreplicated demonstration treatments. The plots are 25x25 metres, and the treatments consisted of all of the commonly applied burning programmes in the Drakensberg. All four seasons were represented at annual or two-yearly burning intervals, as well as a fire-protected treatment and a five-year spring rotation, amongst others.

Between 1980 and 1990, the Eversons made many useful observations on the species diversity, productivity and growth patterns of the plants on the Brotherton trial. Those first ten years of data provide a fascinating insight into the behaviour of montane grasslands and their common species over time.

The former Natal Parks Board (now KZN Wildlife) took over the management of Cathedral Peak and the Brotherton trial in 1990. The forestry research station was dissolved and the researchers moved on to other jobs. Very little research work was done in the next few years. In the summer of 1999, several of the treatments were surveyed by Roger Uys, a MSc. student from the University of Cape Town; and the author surveyed some of the treatments in early 2001 using the same technique that the Eversons had used. Rob Scott-Shaw, a botanist at KZN Wildlife, also collected much data on key species affected by fire. None of these surveys fully addressed the original key question posed by the Eversons: what is the long-term effect of different fire regimes on plant species diversity?

As funding for KZN Wildlife began to diminish and the expense and toil of maintaining the trial became more burdensome, questions were asked about the usefulness of the trial. The journey from the offices at Cathedral Peak to the trial is a bone-jarring drive of well over an hour, depending on conditions, and this trip had to be made many times a year at great cost in labour, materials and fuel. Several of the treatments had to be discontinued for practical and logistical reasons.

In the winter of 2000, a huge wildfire swept through most of the Drakensberg, including the Brotherton ridge. At this point, the future of the trial looked decidedly shaky. Nevertheless, many people still felt that the trial had not been utilised to its full potential. So the trial was maintained, despite opposition from some quarters, for another three years.

It was against this background that, in the beginning of 2003, a small group of people came together at the University of KwaZulu-Natal in Pietermaritzburg to discuss what information could be obtained from the trial. Represented at the meeting were entomologists, soil scientists, botanists, grassland scientists, ecologists, geographers and managers from KZN Wildlife, the KZN Department of Agriculture and Environmental Affairs, the Agricultural

Research Council, the University of KwaZulu-Natal, the Council for Scientific and Industrial Research and the Maloti-Drakensberg Transfrontier Project.

The outcome of that first meeting, and months of planning thereafter, was a comprehensive survey of the Brotherton Burning Trial. At the end of January this year, a group of scientists and technicians from those various institutions booked into the new Didima camp at Cathedral Peak for what was to be a week of exhilarating and exhausting fieldwork.

Seven of the treatments are still applied (notwithstanding the wildfire of 2000): annual and biennial autumn, annual and biennial spring, alternating autumn and spring burns, the five-yearly spring burn, and the no-burn treatment.

Colin Everson (CSIR) and Terry Everson (UKZNP) surveyed the trial using the same technique as they had used before: a 200-point survey with the Levy bridge. Rob Scott-Shaw (KZN Wildlife) and Roger Uys (MolDrak) surveyed plant diversity using quadrat-based techniques to obtain frequency scores, combined with the dry-weight rank method. They also used $1m^2$ circular quadrats to survey a number of key species which may be good indicators of different fire regimes. Debbie Swanepoel (KZN Wildlife) surveyed all the treatments using Tongway's (undated) Landscape Function Analysis technique. The author surveyed basal cover in the plots using the method of Hardy and Tainton (1993), as well as taking undisturbed soil core samples from each plot at two depths to determine soil bulk density. John Usher and Jon Lawrence, from Cedara, took composite soil samples at four depths using beta samplers. These will be analysed at Cedara's Soil Fertility lab by Alan Manson and his team. Two weeks later, some of those people joined Michelle Hamer (UKZNP) for a day to help her auger holes and place pitfall traps to survey soil invertebrate diversity.

Of course, bitter experience has shown that data filed away in dusty archives can be worse than useless if they are not published. The Brotherton Project (for want of a better name) will be published as a series of papers, hopefully combined into a special issue of a peer-reviewed journal.

This project, small though it is, is an exciting multi-disciplinary and inter-institutional collaboration that will hopefully lead to lasting professional relationships between the institutions and people involved. In this age of shrinking budgets and retrenchments, no one doubts that this is the only way forward for ecological research in South Africa.

*Acknowledgments*

Many people were involved in the planning and surveying of the trial, and several others generously offered their services if needed. Among the latter were Drs Ed Granger and Trevor Edwards. Tad Dorasamy loaned the team undisturbed core samplers and associated equipment. Petros Ngwenya and Henry Hlela's botanical knowledge helped speed up the fieldwork greatly, while Anita Ramkisson, Carol Goge, Sonja Kruger, Derek Ruiters, Alan Manson, Charmaine Uys and Saskie Lovell assisted with scribing and many other tedious tasks. A large part of the planning was carried out by Ian Rushworth, Richard Lechmere-Oertel, who provided funding and other support, and Craig Morris, who provided invaluable statistical advice and helped to keep us focused on the scientific objectives of the trial. In addition to the above, the following people were present at the original planning meeting, and provided much valuable input: Prof. Mike Wallis, Charles Hunter, Richard Kinvig, Doug van Zyl and Prof. Kevin Kirkman.

*References*

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***NB: see pictures on back page***

# Royal Society / BIOTA Colloquium: Adaptations in Desert Fauna and Flora

Apollo Theatre Victoria West 26th-29th August 2004

Collaborative Multidisciplinary research in the Arid Zone has been progressing for some years under the impetus of the BIOdiversity Monitoring Transect Analysis in Africa funded from Germany and including independent studies by southern African biologists.

In order to publicise Arid Zone research in southern Africa, the Royal Society of South Africa in conjunction with BIOTA, are hosting a Colloquium on Adaptations in Desert Fauna and Flora in Victoria West at the end of August 2004.

The preliminary agenda includes sessions which focus on the botany, zoology and ecosystems of the desert as well as multidisciplinary sessions. Plenary speakers include Prof. Gretel van Rooyen (Department of Botany, Pretoria University), Prof. Peter Grubb (Plant Sciences Department, University of Cambridge UK), Prof. Sue Milton (Department of Nature Conservation, Stellenbosch University), Dr. Richard Dean (Fitzpatrick Institute of Ornithology, University of Cape Town), Prof. Graham Mitchell (Department of Zoology and Physiology, University of Wyoming), and Dr. Guy Midgley (NBI Kirstenbosch).

Please register before 10 June 2004. Prof John Skinner and BIOTA can be contacted for further details. Email address john.skinner@up.ac.za as well as contact@biota-afric

# REGIONAL NEWS

## KwaZulu-Natal - Region

### Prestige Grazing Symposium: Grassland Management in South Africa Yesterday, Today, Tomorrow.

*By Caryn Rauff*

Grassland scientists, agricultural advisors, representatives from KZN Wildlife, foresters, environmental consultants, interested parties and university students met on the 10th March at the Neil Tainton Arboretum at the University of KwaZulu-Natal, Pietermartizburg to chew over issues relevant to grassland management today and discuss ways to improve the grassland management of tomorrow. The University and the Grassland Society of southern Africa in association with the KwaZulu-Natal Department of Agriculture hosted the symposium. Speakers included Dr Terry Olckers (School of Biological Sciences UKZN), Prof Kevin Kirkman (HOD Grassland Science UKZN), Mr. Justin du Toit (Grassland Science UKZN), and Dr. Alastair Paterson (Stockowners). Mr. Richard Hurt chaired the programme and a panel of experts drawn from the various institutions initiated discussions around the topics presented. Both the presentations and the discussions that ensued were very interesting and raised some pertinent issues. Attendance on the day was also excellent, and the audience represented a wide range of activities including forestry, wetland management and commercial farming. Hard copies of the Proceedings are available from the Administrator for R20 including postage and a detailed summary of the discussion.

# Northern Cape - Region

## Southern African Wildlife Management Association Symposium 2004
## Innovations in Managing Wildlife Resources

*20 22 September 2004 - Kathu, Northern Cape Province*

The Southern African Wildlife Management Association is inviting all wildlife managers, scientists and decision-makers in the field of conservation and wildlife and interested parties to attend this year's symposium, to be held at the Sport & Recreation Hall, Kathu in the Northern Cape Province. Registration commences on the evening of 20 September and the presentations start on Tuesday, 21 September and continue until Wednesday, 22 September.

Julius Koen of the Department of Agriculture, Land Reform Environment and Conservation, Northern Cape will be hosting the event.

Kathu is one of the jewels of the Northern Cape. It was established in 1973 as a residential area for the new Sishen Mine, one of the largest open iron ore mines in the world. It is, therefore, a young and modern town. The town is built in a majestic Camel Thorn forest and this forest has been registered as a Natural Heritage Site during 1994. More than 200 bird species are to be found in the forest. The town also boasts with one the most beautiful golf courses in the country. Kathu is ideally situated for excursions into the scenic beauty of the Kalahari hinterland. Kathu is 47 km north of Postmasburg, 50 km south-west of Kuruman and 45km east of Olifantshoek.

The main theme of the symposium is **Innovations in Managing Wildlife Resources.** Efforts will be made to accommodate all contributions under the main theme, but the following subthemes are guidelines for papers and posters to be presented: resource economics; understanding and managing wildlife; threats and solutions; benefits to the people; conservation planning; conservation of aquatic systems; wildlife protection.

Address all enquiries to Elma Marais, Tel 021- 5541297; email: elma@mweb.co.za; Fax: 0866729882. **Register online at http://journals.sabinet.co.za/wild/.** Registration forms should reach the SAWMA secretariat before **27 August 2004**. Paper/poster titles should reach the SAWMA Secretariat by **31 May 2004**, in order to compile a provisional programme. A short abstract (about 350 words, but not more than 500 words) for papers and posters should reach the secretariat by **15 July 2004** for inclusion in the programme.

# Free State - Region

## *GSSA members at the Holistic Management Conference*

The South African Holistic Management annual conference was held at Tiger Kloof, Vryburg, from 30 March to 1 April 2004. Approximately 150 people attended, including a large contingent from Australia. The conference theme was "Handling Change". A very informative talk, "How plants handle the above ground application of the tools of fire, grazing and animal impact", was presented by **Prof Hennie Snyman** of the Department of Animal, Wildlife and Grassland Science, University of the Free State. This talk was very well received, and the comment was made that Holistic Managers need to make use of the information available to them from "conventional scientists".

# NOTICES

## Send news items for the various regions, to the addresses below:

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***East Africa***
Prof Elly Sabiiti, esabiiti@agric.mak.ac.ug

Regional representatives have not been identified for: **Northern Cape**, **Mozambique**, and **Zimbabwe**. If anybody from these areas would be prepared to co-ordinate news from their region, please contact the editor Graham Peddie, peddieg@dunrs.kztnl.gov.za

## COMPLETE YOUR JOURNAL AND BULLETIN COLLECTION!!

We've discovered that the demand for back issues is definitely out there. Thank you for the orders. The Discipline of Grassland Science at the University of KwaZulu-Natal has kindly let us have a storeroom for all of our back issues, which will be in use from the beginning of February. The administrator will publish a full list of the holdings in the next Grassroots, but carry on sending in orders and we'll see what we can do.

There was a bit of confusion about what the Society actually publishes. The Bulletin was mainly published as A5 booklets, and covered farmers' days and other smaller gatherings, as well as research notes. It is now incorporated into Grassroots, and so this is where you could send the odd thought or two today. The Proceedings and Journal of the Grasslands Society of Southern Africa were the previous names of the African Journal of Range and Forage Science. See "Journal News" in this issue of Grassroots for more information about the journal in its modern form. And then there were also some Special Publications, generally dedicated to specific workshops or conferences, such as the Proceedings of the First Valley Bushveld/Subtropical Thicket Symposium and Prestige Farmers' Days Proceedings 1991-1992.

Postage of the orders is not included but will be worked out based on how much you buy, and is pretty reasonable. Some issues are very rare, and only one or two are left, so orders will be treated as first come, first served. Email admin@gssa.co.za, fax 033 390 3113 or phone Freyni on 083 256 7202. Invoices will be supplied with all orders.

**Below:**
*Now this is the way to do field work! Alan Short and Sonja Kruger*

**Above:**
*How many researchers does it take? Debbie Swanepoel with her team*

**Left:**
*The 'berg.*

**Right:**
*Michelle Hamer and co-workers look for bugs*

**Left:**
*The Eversons hard at work. From left to right: Colin's hat, Rob Scott-Shaw's hat, and Terry's hat;*