# BIODIVERSITY-FRIENDLY GRAZING AND BURNING BEST-PRACTICE FOR GRASSLANDS

***Achieving biodiversity and economic grazing objectives together in South Africa's grasslands.***

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## INTRODUCTION

This document is a summary of discussions held at a specialist technical workshop in the KZN Midlands (Fernhill Hotel, Howick – 8th October 2012), attended by agricultural specialists, grassland ecologists and conservation scientists (the list of attendees is in Appendix A). These notes were captured by Richard Lechmere-Oertel and thus reflect his perspective on what was said, and is in no way a verbatim record of the discussions. This document will be circulated to all attendees for comment and, upon completion, should later reflect a coherent best-practice opinion by this group of specialists.

The process from which this workshop and document emerges is nested within the SANBI Grasslands Programme (www.grasslands.org.za), and is aiming towards a published user-friendly version as part of the Agricultural Component of this programme.

This attempt to develop biodiversity-friendly grazing guidelines will build on the very extensive body of agricultural principles that currently guide grazing practice in South Africa. Some of the agricultural principles, such as rest, are complementary to what is needed for biodiversity conservation, and do not need to be re-articulated in any detail. Indeed, correct application of the agricultural best practice for grazing is a very good starting point for biodiversity-friendly grazing and fire requirements.

## DEVELOPING THE GUIDELINES

- The guidelines may need some form of matrix that will help the user decide which group of tools to use, i.e. the guidelines being one of them.
- The document needs to guide the user through the understanding of where their management approach sits within the spectrum of management scenarios.
- The guidelines could be developed in the form of an audit of the management approach and their impacts on existing biodiversity elements.

### Purpose and focus

The purpose of these grazing guidelines is to provide basic rangeland management best-practice that will allow the persistence of biodiversity across the large portions of the grassland biome that are used for extensive commercial and communal animal production. In terms of geographic area, the focus is on the grassland biome and not in the related Savanna and Karoo biomes, although there are likely to be some similarities in practice.

These guidelines will not address issues of animal production or how to be a successful business farmer as these topics are well covered in other literature.

These guidelines will aim for those management scenarios where economically-viable livestock production, veld condition and biodiversity conservation are parallel objectives in a coherent management plan. This document should thus be seen as a guide to expanding on the rangeland management aspects of an overall farm management plan.

## Audience

The audience will be confirmed during the process going forward. For now, the target audience for this document straddles the spheres of agricultural and conservation governance, extension and management, including some commercial service providers. It is not specifically aimed to landowners, although it will be accessible to them. It should be seen as a semi-technical document aimed at people who have some technical experience and influence in rangeland management, including:

- Extension officers.
- Landowners and managers.
- Governmental landuse decision-makers.
- Agricultural representatives for large agricultural companies.
- Subject-matter specialists at the co-operatives.
- University teaching staff.
- Vets who have an interest in the topic.

It may be that different documents or dissemination approaches will be needed for different facets of the audience.

## Land ownership context

Rangeland management takes place in a variety of contexts, including:

- Governmental spheres
- Land ownership and tenure
- Land management
- Commercial viability
- History of land use management

The published version of this document should have an introductory section that covers all these issues in some detail to provide sufficient contextual background.

It is recognised that there are several higher-level drivers of biodiversity loss in the rangeland context, including issues of governance, patterns of ownership and land tenure systems, and the history of land management. These contextual drivers may well have much greater influence on the biodiversity of grasslands than on-the-ground management, but it is beyond the scope of this document to describe these drivers or to provide solutions for them. **Furthermore, the principles of biodiversity-friendly range management apply across all ownership and tenure systems, although the extension approach and likelihood of successful extension may differ considerably.**

The following issues should be addressed in generating an overall context for rangeland management:

- Overall management objectives
- Biodiversity (e.g. provincial biodiversity plans and local biodiversity surveys)
- Veld condition

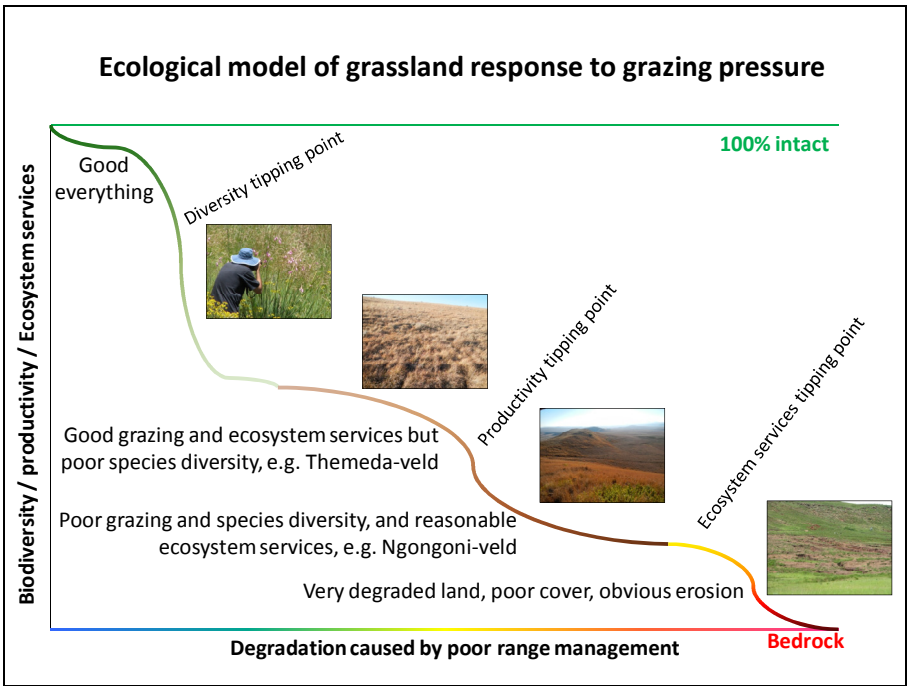
- Soil condition
- Agricultural economics
- History

## Commercial viability

One of the most fundamental questions that will be addressed in this document is whether or not biodiversity persistence and viable red meat production can be compatible? The document will need an upfront statement that all other aspects of farm management (such as managing herd genetics or health, fodder requirements, licks, business plans, etc.) are assumed to be viable in themselves and are being well-managed. There are other resources available through relevant government agriculture, organised agriculture and private sector agriculture. Some of the documents produced by the SANBI Grasslands Programme also deal with overall management best practice.

It is assumed that there are levels of compromise that are needed to balance livestock production, veld condition and biodiversity objectives. Part of the question will be to understand what levels of compromise are required to achieve these parallel objectives, and are these levels of compromise acceptable to each parallel objective.

## DEGRADATION OF GRASSLANDS




There was general agreement that degradation of grasslands loosely follows a variation of the diagram above (a modification of the tipping point hypothesis). Although there was general agreement that the nature of the curve is non-linear, and that it is very difficult to reverse non-linear degradation, there was legitimate caution that the final document should be extremely careful of having this hypothesis treated as fact, which it is not.

Indeed, the more detail presented in this hypothesis, the more likely it will attract legitimate criticism, and the document needs to be explicit that many of the statements will not be empirical, but rather based on expert opinion. There should be a general disclaimer that highlights the weakness of the science at this point, due to a paucity of data. Grasslands are very complex systems about which we have insufficient knowledge to make absolute ecological statements, and we thus need to be very cautious about our statements. Although the ecological science is not definitive, we can rather focus on management drivers and indicators, and adopt a precautionary approach.

It may be best to use a series of case studies to show the nature of degradation and how difficult it is to reverse these impacts. These case studies could separate out the likely responses of grasslands to various livestock types: e.g. sheep, cattle, goats, horses, concentrate-grazing game species.

It would be better to focus on the states and not the tipping points, emphasising that the system can move into different states, each with a biodiversity consequences, including sections on the following:

- The management drivers that move grasslands from one state to another.
- Description of the indicators that show the early warning signs of change. There are indicators that are specific to the different ecosystems, although there are few successful predictive indicators, e.g. unnatural Ouhout (*Leucosidea sericea*) or *Acacia spp*. dominance.
- Description of the ecological and grazing dynamics associated with changing states, e.g. if unpalatable species are coming in, or basal cover is decreasing, and stocking rate remains constant, then the effective stocking rate is increasing and the rate of change is likely to increase.

## DIFFERENCES IN DEGRADATION ACROSS THE GRASSLAND ECOSYSTEMS

All the mesic grasslands behave and respond in a similar manner to grazing.

The principles of grazing and burning in the Dry Highveld are similar to the mesic grasslands, although the detail of rotation and burning will be different. The primary ecological difference between the dry and mesic grasslands seems to lie in the inherent capacity of the grasslands to recover from disturbance. The dry grasslands have a reproductive biology more adapted to disturbance, and thus recover relatively rapidly from a soil seed bank, even if the adult plants have been killed. Mesic grasslands recover very slowly from any disturbance that kills the adult plants. This difference in disturbance recovery will have significant consideration when discussing grazing strategies.

The coastal grasslands should be split into two, with the Pondoland grasslands being lumped with the mesic grasslands (due to very similar underlying sedimentary geology), while the Maputaland marine-geology grasslands should be considered separately.

## IS FIRE OR GRAZING A NECESSARY GRASSLAND DYNAMIC?

There are some in the agricultural sector that advocate withholding fire altogether from grassland, based on the premise that grazing and/or mowing can replace fire in terms of preventing unhealthy accumulation of biomass (which would lead to moribund grassland). However, it was very apparent at the workshop that this practice is considered very damaging for grasslands:

- Grazing is a partial substitute for fire in that it reduces biomass and makes for a different fire regime. However, although this practice is acceptable for a few years, it shouldnt' remain the only mechanism

for defoliation, because fuel load accumulation and burning are vital to controlling woody plant encroachment.

- There is no evidence to show that commercial-scale grazing is a positive ecological dynamic in natural grasslands (especially in mesic grasslands).
- Mowing cannot replace fire as the primary defoliant in a biodiversity-friendly manner. Mowing really damages forbs, especially if done during the growing season. Furthermore the compaction damage to the soil is very evident.

There are others (particularly of the Holistic Grazing Management and High Intensity Grazing groups) who advocate that grazing is a necessary ecological driver in grasslands and that grazing is a vital aspect to the ecology of grasslands, and that withholding grazing is a problem. However, in the workshop, there was general consensus that grazing is NOT a necessary ecological dynamic in our grasslands and that there are several examples of grasslands that have been protected from grazing for more than 80 years that have maintained their ecological character and species composition - including the exclusion of Ngongoni grass. These areas were burnt with a biennial spring burn. This is a contentious topic and the contention largely arises from the absence of conclusive research across the grassland ecosystems.

## BURNING AND BUSH ENCROACHMENT

Fire is vital for the suppression of bush encroachment and, in the absence of fire, livestock grazing makes bush encroachment even more likely to occur. Once established, bush encroachment of any sort is very difficult to reverse. Braam van Wyk has material that proves this.

The key to controlling bush with fire is to ensure there is enough fuel for a hot fire. This means camps that are being burnt for bush control should have been rested from fire and grazing for at least two years or more, depending on the rainfall. It may mean having to wait for a few years until there is a very wet season followed by higher than average growth.

Unfortunately, the best fires for controlling bush are those that might occur on the more risky burning days when permission to burn is not likely to be granted by the local fire protection officer. Most farmers thus mitigate fire risk by managing for cool fires, which can lead to bush encroachment. Such situations should be planned for and discussed in advance so that adequate protection can be organised in the form of enlarged fire breaks or such.

## IS THERE AN IDEAL BURN & GRAZE SOLUTION?

### Burning

There are so many options when it comes to burning grassland responsibly that it is difficult to provide absolute rules for all situations. The key to biodiversity-friendly burning seems to lie in the variability. Any regime that does the same type of burn, in the same area, under the same conditions and in the same season (i.e. very low variability), is likely to cause levels of diversity to decrease. Any management that is flexible enough to allow variability in time, space and type of fire will be better, especially if it includes variability in the grazing regime.

The best approach is for the manager to be a 'student of the veld', making annual observations and adapting their management to suit. That said, there are some practical guidelines that emerged from the workshop:

- Annual burns can be a problem for important invertebrates that live in the leaf detritus, such as the larvae of monkey beetles, which are primary pollinators in the grasslands. Thus annual burns other than the fire breaks are not recommended.
- Only graze recently-burnt areas if they were rested the year prior to the burn.
- The season of burning is determined by the start of active growth as it is best to burn just before growth is going to start. Growth is normally initiated through the combination of increasing water availability and day length.
- When burning and grazing the land, rather use a measure of biomass build up (at least 1,500 kg per ha) to help decide when to burn. However, mesic grassland should be burnt at least every 2-5 years, depending on whether it is mesic (more frequently) or dry (less frequently).
- Many forb species only grow and flower late in the season and are damaged by intensive late season grazing.
- It is possible to use a triennial burning programme to manipulate livestock grazing rotation around the land in the absence of fencing.
- In the Dry Highveld grasslands, a similar set of principles can be applied, but with a fire frequency extended to about every 4-5 years.

## Grazing

It is meaningless to separate out the management of fire and grazing, and they must be considered together. However, there are generalisations that can be made about the impacts of grazing on biodiversity.

There is no shortage of systems of rotating grazing animals at a farm scale, all with their pros and cons, and it is difficult to draw absolute rules for all grassland ecosystems for all situations. However, there was general consensus that there is a continuum of grazing types that range between:

- High intensity grazing (HIG), where the stocking rate approaches 60 LSU/ha for very short periods (a few days).
- Low intensity selective grazing (SG), where the stocking rate approaches 0.5 LSU/ha for long periods (many weeks or months).

The consensus in the workshop was that both extremes are bad for plant diversity (but not necessarily for agricultural condition), but for different reasons. HIG is very bad for long-lived, low-reproductive output, or fleshy plants; primarily through trampling, which physically damages and kills the plants. Considering that in the majority of grassland ecosystems (especially mesic grasslands), plants are long-lived and do not easily re-establish from seed, HIG can be quite destructive. However, under certain circumstances such as in degraded dry grasslands, HIG can be beneficial for veld condition and thus animal production.

SG is also very bad for plant diversity as the animals are allowed to be very selective about which species they eat, resulting in significant losses in plant diversity and changes from palatable to unpalatable species composition.

Biodiversity-friendly grazing is very difficult to describe in absolute rules and it seems to hinge on a few principles more than the articulation of rules:

Without debate, REST is one of the most important factors in conserving plant diversity in grazing lands. In order to achieve rest, it is vital to have a system of rotating the livestock through a series of camps that meets animal production, veld condition and biodiversity objectives. Generally this will mean that approximately 20-

40% of the farm every year (always less than 50%) should be burnt and grazed, with the remainder being rested or very lightly used. It is very important to have **a clear definition of rest**, which is a full growing season with no grazing at all. This is very different from the concept of recovery in high utilisation grazing, which is the few weeks the veld is given to re-grow after a grazing event.

- Avoid any practice that damages the soil surface. It is very important to avoid grazing steeper slopes during wet periods to avoid permanent damage to the soil.
- Avoid any form of high-intensity or selective grazing system in areas important for plant diversity.
- Employ an adaptive management system that responds to the veld condition and changes in plant diversity.
- Plan the camp and water point configuration to aim for rotation of impact in time so that the camps are grazed at different seasons in different rotations.
- In mesic grasslands with strong seasonality, the spring period is very vulnerable to grazing pressure as this is the peak growing period for grasses and forbs, which are impacted by trampling and grazing.
- No extensive sheep grazing in areas important for biodiversity, especially in the dry highveld. Rather manage sheep very intensively in pastures or sacrificial camps.
- Manage sheep in conjunction with cattle, aiming for very low ratio of sheep to cattle (at least 1:6).
- Never leave sheep to graze rocky areas for extended periods of time. These areas are often the last remaining refugia for plant diversity.
- Avoid all exotic game species, especially selective grazers such as fallow deer.

### *Livestock type*

Sheep have a much higher impact on plant diversity compared to cattle. The reality is that sheep will cause a significant decline in plant diversity if introduced in areas where it is currently relatively high. There is a strong interaction between sheep and potential to burn too frequently as sheep are susceptible to poor quality graze and need the green flush that results from burning.

Although much less problematic for plant diversity than sheep (if grazed at reasonably stocking rates), cattle can cause a lot of damage because of their weight and the resulting hoof action and trampling, especially on steeper slopes in the mesic grasslands. It is thus important to avoid grazing steeper areas during the wetter periods, which is difficult as this is the primary grazing seasons in the higher-lying (and steeper) grasslands.

### *Other animal types:*

Most grassland game species are concentrate grazers (blesbok, red haartebeest, black wildebeest, fallow deer). Blesbok create their own grazing lawns and are very difficult to manipulate their movements. All these animals should be included in the carrying capacity calculation as they do have an effect. All the game concentrate grazers should be considered as the equivalent of sheep.

## A farm-scale approach to burning and grazing

The following camp rotation is offered as a recommended example of the sort of system that would allow for maintenance of plant diversity on a commercial grazing farm. There are many variations of this theme, although the principles remain valid, such as rest.

Aim for a combination of non-selective grazing (NSG) immediately after the burn and followed by controlled selective grazing for the remainder of the year. This should be done in a way so that the same camp is not treated in the same fashion on every cycle.

For example, the farm should be divided into four cells of approximately equal grazing potential (based on ecological carrying capacity). Each cell is then divided into camps based on natural features and existing fence lines. In any one year:

- One of the cells is entirely rested
- One is the primary grazing cell
- One is the secondary grazing cell
- The remaining cell is intended for rest but could used for very light grazing only if really needed because both the primary and secondary cells are exhausted.

The animals are moved around the camps in the primary grazing cell relatively often, following the availability of graze and ensuring a moderate NSG pressure. They are only moved into the secondary cell once all the graze is exhausted in the primary cell. As soon as the grass has recovered in the primary cell, the livestock are moved back there.

If the rest camp is needed on the farm by January, when 60% of growth has alreadyoccurred, then it is unlikely that the herd will survive through winter without supplementary feed. At this point, it would be better to destock in January, while market prices are high. The principle is: if the summer grazing is exceeded by mid-march, then there will be trouble in winter. These time-frames can vary depending on seasonal rainfall, and on different grasslands bioregions.

## Exclusion zones for high diversity areas

At any spatial scale there are natural hotspots of diversity and these should be managed with a separate biodiversity objective within the overall management context.

There seemed little doubt that areas that currently have high-levels of floristic diversity probably only are in this state due to some form of natural protection from the long-history of grazing pressure experienced across much of South Africa. Such areas should continue to enjoy protection from grazing as they are probably the last remnants of the original diversity.

There was general acceptance that even conservative levels of commercial grazing are not compatible with the maintenance of high-levels of plant diversity and that where there are instances of higher-than-usual diversity, these areas should not be included in the grazing rotation, but rather treated as exclusion zones.

Within any rotation system, it is important to identify those pockets of diversity within the farm that should be delineated and defined within the management plan as grazing exclusion zones. Furthermore, some animal species need areas of thick moribund grass (e.g. grass owl nests, oribi, quail, etc), while others need the 'cleaner' areas. This emphasises the need for a shifting mosaic of different ages since last burn / graze.

## Stocking rates and their calculation

Stocking rate

The stocking rate is a measure of the number of animals that are to be grazed across a known area for a defined period of time. For sustainable grazing to occur, the SR should never exceed the carrying capacity of the veld, which is generally calculated after an examination of the veld by an agricultural technician to determine how many animals can be carried by any one camp. However, biodiversity-friendly SR should be based on a more conservative approach that aims to protect the plant diversity. In such instances, one should have an understanding of the ecological carrying capacity that is determined by a detailed site assessment that includes:

- Species composition
- Slope angle
- Rockiness
- Weed infestations

Based on the ecological carrying capacity for the camps or farm (and not the average regional stocking rate) it is important to implement a conservative stocking rate. In KZN biodiversity stewardship sites (particularly where they are nature reserves), the figure of 70% of ecological carrying capacity has been used, but there is very little evidence to support or reject this rather arbitrary figure. Interestingly, it is possible to get higher performance per animal at lower stocking rates and it is better for the veld. It is possible to maintain an equivalent farm-scale level of animal production (kg of beef) even if the SR is reduced to 70%. The concentration of animals during the growing period is very important to consider as this is when plants are most susceptible to damage.

Carrying capacity should be calculated over a five-year period to allow for fluctuations in the herd dynamics.

It is important to realise that most of our grasslands cannot carry animals of any density over winter due to their low winter nutritional value, which leads to rapid decline in animal condition. Thus, in principle carrying capacity is calculated on the consumption over a specific period of time (i.e. the growing season). In situations where fodder is provided by bales or crop residues in winter, an artificially high SR can occur, leading to degradation of the veld. It is better to calculate carrying capacity over the full year and not to rely on hay imports, but rather to use the dry matter in the rest camps and supplement protein through licks. Much damage can be done in winter camps where hay is imported due to concentrated trampling around the feeding sites. Such an approach can also improve farm finances as money is not spent on supplementary food or in the production of bales (less equipment needed for hay production).

Crop residues are often available to replace veld in winter, but it is important to avoid overstocking the summer capacity in such cases. Rest can help defend the summer capacity, but managers need to be careful if there is an abundance of winter supplementary fodder, because where there is a reliance of winter supplementary fodder, there is pressure to fully utulise the summer grazing every year - making rest very difficult. Where no supplementary fodder is provided, the summer grazing capacity exceeds the winter capacity and rest is easier.

*The overall principle is to determine the SR based on carrying stock over the whole year, without excessive supplementation, and without loss of animal or veld condition.*

### *What about using pastures to relieve pressure on the rangelands?*

Developing pastures to relieve veld pressure is not generally recommended as it is often incorrectly used. If the pasture is used to alleviate summer grazing then it is good, but it is often saved for winter, which allows the summer grazing pressure to be kept at too high a level.

## BIODIVERSITY-FRIENDLY MANAGEMENT OF WETLANDS

Wetlands cannot really be managed as a separate management unit and therefore should be treated as part of the management camp in an adaptive approach. On the whole, wetlands should be considered as part of the grassland matrix, with the following provisos:

- Fire is key, mostly in terms of seasonality for certain types (e.g. burning peatlands in dry seasons).
- Avoid burning wetland forests (Maputaland) more frequently than every 2-3 years.
- Wetlands in the mesic grasslands can be treated as part of the grassland matrix.
- Grazing of wetlands is to be avoided if the livestock are causing erosion paths (check WET-Sustainable Use guidelines)

The main issue is the potential for channel erosion due to grazing animals. The concern areas are those small seepage areas that may be prone to erosion damage. Wetland size is largely determined by landscape position. If erosion damage is being seen, then an urgent intervention to repair the channel damage is needed. In drought years, wetlands and riparian zones are very impacted by grazing as it is the only wet grass. Erosion followed by rainfall is very damaging.

Farmers will often burn wetlands in mid winter to obtain a green flush that is grazed until the wetland is too wet for the animals. This is often done annually, which is not ideal. Excluding fire periodically so that the wetland is not grazed in winter is a good idea. When burning, aim for cool patchy burns in late winter every 2-3 years, early spring, and avoid autumn/summer burns.

There are many animals that use wetlands seasonally for nesting, including rare species such as cranes and long-toed tree frog. It is important to avoid burning all of a wetland in one fire, but rather to try split it in two.

## CAN DEGRADED RANGELANDS BE REHABILITATED?

This document will not address the very complex issue of rehabilitation of degraded rangelands other than to make a few generalisations. Firstly, any form of rehabilitation is likely to be very expensive and time consuming, and will require clarity regarding the historic context and the current management scenario. The bottom line is that it is relatively easy and rapid to cause damage grasslands and wetlands, and extremely difficult and expensive to undo this damage. This emphasises the need for a precautionary approach.

## MANAGEMENT PLANNING AND ADAPTIVE MANAGEMENT ARE VERY IMPORTANT

It is clear that the implementation of any variation of biodiversity-friendly grazing and burning will need to be developed from a coherent management plan that is adapted annually to the current conditions. It is better to avoid a very strict rules-based approach and rather have an adaptive approach that takes cognisance of the season: "*The eye of the owner makes the cattle fat*". Management should move away from recipes and into a series of principles that applied within a management and environmental context that changes every year.

All management actions, including the movement of herds, and decisions to burn must emerge from a solid rationale rooted in the management objectives. The decision-making process should be very clear.

## APPENDIX A: WORKSHOP ATTENDANCE

| Name | Affiliation / specialisation |
|---|---|
| Richard Lechmere-Oertel | Consulting grassland ecologist |
| Brent Corcoran | WWF-SA Programme Manager |
| Cobus Botha | KZN DoA, agricultural ecologist |
| Tim O'Conner | SAEON, grassland ecologist |
| Alastair Patterson | Consulting animal production specialist |
| Mervyn Lotter | MTPA Ecologist |
| Damien Walters | Mondi Wetlands Programme, Wetland specialist |
| Rob Scott-Shaw | EKZNW, Botanist |
| Isabel Jonson | EKZNW Stewardship Programme, Plant ecologist |
| Sue Viljoen | WWF-SA |
| Kevin Kirkman | UKZN Rangeland ecologist |
| Greg Martindale | EKZNW Stewardship Programme, Grassland grazing ecologist |
| Johan du Preez | FS Dry Highveld grassland ecologist |
| Tsumbedzo Mudalahothe | SANBI Grasslands Programme |