Ecological Best-Practice Livestock Production Guidelines

for the Namakwa District






Produced by the Karoo Consortium

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List of Acronyms

CARA	-	Conservation of Agricultural Resources Act, No. 43 of 1983
DEAT	-	Department of Environmental Affairs and Tourism
DoA	-	Department of Agriculture
DTEC	-	Northern Cape Department of Tourism, Environment and Conservation
EIA	-	Environmental Impact Assessment
LSU	-	Large Stock Units
NEMA	-	National Environmental Management Act, No. 107 of 1998
NEMBA	-	Biodiversity Act, No. 10 of 2004 (NEMBA)
NSG	-	Non-Selective Grazing
SSU	-	Small Stock Units

WfW – Working for Water

DWAF – Department of Water Affairs and Forestry (Now DWEA)

DWEA – Department of Water and Environmental Affairs

Structure of this Document

This document comprises two basic parts, an introductory section and the guidelines themselves. The first part of the introduction describes the scope, relationship with other similar guidelines and the methodology employed in the production of the guidelines. The second half of the introduction provides a brief description of the ecological context of the guidelines. This includes a brief description of the broad-scale vegetation patterns, conservation status and biodiversity threats in the region as well as a short summary of our current understanding of vegetation dynamics applicable to the region. The guidelines themselves fall under eight main themes with numerous subheadings. The applicable state policies and best practice guidelines are described under each topic. Key references and sources for further information are provided at the end of each section.

It is our hope and intention that this document evolves into the future as additional information becomes available and the needs of the end-users change. As such, we would appreciate your views on this document. Please send your comments or queries to Simon Todd: Simon.Todd@uct.ac.za

Introduction to the Ecological Best-Practice Livestock Production Guidelines

Scope

The purpose of the Best-Practice Livestock Production Guidelines contained within this document is to summarize our current state of knowledge regarding industry standards and best practice activities within the livestock production industry. The focus of these guidelines relates specifically to activities associated with the ecological and conservation impacts of livestock production in its' broadest sense. The various activities addressed in the guidelines are considered primarily within a local ecological context and broader impacts such as the release of gasses associated with climate change are not directly considered. Although more broadly applicable, these guidelines were developed with specific reference to the Namakwa District Municipality. Activities associated with livestock production but which do not have direct biodiversity implications such as human safety, animal welfare and social responsibility are not considered. These activities are comprehensively addressed in the *Best Practice Reference Manual for Wool Sheep Farming in South Africa* to which we refer users for guidelines on these activities.

Various attempts have been made to develop guidelines or certification criteria for different sectors of the agricultural sector. Significant examples of such guidelines include that developed for the Biodiversity and Wine Initiative (BWI) and the Best Practice Reference Manual for Wool Sheep Farming as well as several guidelines focussed on predator management. The primary challenge in developing useful guidelines with associated criteria and indicators appears to lie in striking the correct balance between developing criteria linked to as many specific activities as possible and retaining sufficient generality to accommodate the variety of farming practices likely to be encountered in the real world. However, since many important variables can only be assessed at the farm level, it is frequently impossible to make highly specific or quantitative recommendations for certain activities. Since it will not usually be possible to quantify such variables for each farm, the only viable approach appears to be to define the underlying principles behind best practice and ensure that compliance occurs at least on this level. Furthermore, particularly within arid and semi-arid regions, guidelines should avoid becoming overly prescriptive as this is likely to impinge on the flexibility inherently required for farmers to effectively deal with and adapt to the vagaries of nature and climate.

Although we have tried to make these guidelines as comprehensive as possible, we acknowledge that there are likely to be topics or activities that we have not adequately addressed. However, as with all such guidelines, they should be living, evolving documents which incorporate new information as it becomes available. Thus, any omissions in this draft of the guidelines can and should be remedied in future drafts if these guidelines are to remain relevant and useful. Finally, although these guidelines have been developed with certification in mind, they do not include an operational certification framework.

Methodological Approach

The best practices described in this document were derived from two sources. Firstly, the literature pertaining to livestock management and its relationship with natural resource management was reviewed. The Karoo Bibliography, which is a database of literature pertaining to the Karoo which has been compiled by Timm Hoffman (available for download at http://www.pcu.uct.ac.za/resources/databases/karoobibl/karoobibl.html) was used as a basis for the review, although a large amount of additional information from other recent sources was also incorporated. Secondly, the expert opinions of various scientists, extension and conservation officials were sought and incorporated. The expert opinion and expertise was gathered at a group workshop and ranking exercise, as well as through a more detailed questionnaire.

Relationship with Other Industry Guidelines.

There are currently a range of different guidelines which have been developed for the farming industry. However, most of these guidelines are either narrow in scope, dealing only with certain aspects of the farming industry or very broadly based, paying only superficial attention to many important aspects. Consequently, the environmental impacts of the livestock industry have not been adequately addressed and an opportunity exists to provide such guidelines for the industry, which if adopted will have positive conservation outcomes. As such, these are the first guidelines to focus specifically on those activities within the livestock production industry which impact biodiversity and ecosystem function. It is the intention of these guidelines to be in harmony as far as possible with the other guidelines that have been developed. We have thus consulted many of these guidelines and directly or indirectly incorporated the relevant important activities highlighted by these documents. Since the guidelines contained within this document deal only with those activities which directly impact biodiversity and ecosystem function, it is also not the intention of these guidelines to supersede any of the existing guidelines, but rather to complement them by providing a greater level of detail on this specific area.

The Need for Best Practice Guidelines

The need for best practice guidelines in the Namakwa district is twofold. There is an increasing demand from consumers for products which are produced in an environmentally sound and sustainable manner. Allied to this is the need to develop certification schemes which firstly ensure that member producers do indeed adhere to sound practice and secondly provide an environmentally-friendly label with which products can be associated and consumers readily identify. Although the above may provide the primary incentive for most producers to join such a certification scheme, the biggest potential benefit of such guidelines lies in their potential to improve land use practices in the Namakwa District. The need for biodiversity-compatible land use is imperative in the Namakwa District, due to the exceptional biodiversity of the region. The Namakwa District contains a large proportion of the Succulent Karoo which has been identified as a globally significant hotspot of plant and animal diversity. Furthermore, it contains all or the majority of five of the nine SKEP (Succulent Karoo Ecosystem Programme *www.skep.org/*) geographic priority areas. The majority of this exceptional biodiversity occurs outside of protected areas and so the long-term persistence of this biological wealth relies heavily on favourable land-use practices. Following from this latter point is the need to provide government officials with information that will enable them to assess the potential impact of policy and landuse changes within the district.

Intended Audience

This document is aimed at anybody involved in livestock production or conservation and natural resource management within the Namakwa District. As such, this includes farmers, extension officers, government and municipal officials and those from conservation agencies and NGOs involved in the sector. This document should also be of use to anybody aiming to develop biodiversity-based certification systems in the region. This document does not itself contain a certification framework with activities linked to specific indicators, but serves rather as an information source from which such a framework might be derived.

The Potential of Grazing Guidelines as a Conservation Tool

Where applied, the guidelines contained in this document should result in farming practices which maintain biodiversity and ecosystem function as far as is possible within the agricultural landscape. However, the Namakwa District is not homogenous and certain areas contain far greater biodiversity than other areas. Consequently, attempts to promote such guidelines among the farming community should focus on those areas with the greatest potential to maximise the biodiversity benefit. In practice, this means those areas within the Namakwa District that fall within the Succulent Karoo and Fynbos Biomes. A large proportion of the Namakwa District consists of Bushmanland which falls within the Nama Karoo Biome. This area contains

considerably lower diversity both at a local and a regional scale than the winter-rainfall portion of the District. There are however certain unique ecosystems and vegetation types within Bushmanland that contain a larger number of rare and endemic species and which warrant special attention. This includes parts of the Koa River valley and the Bushmanland Inselbergs.

Limitations and Future Directions for Biodiversity–Based Certification

When certification is activity based, it is important to recognise that the activities identified are in fact surrogates and while they should, there is no certainty that they will in fact maintain or promote biodiversity. In the longer-term, certification should aim to be outcome based, that is the biodiversity itself should be monitored. Although this may sound daunting, in practice this is the only way to ensure that biodiversity is being conserved and it also has the added benefit of allowing the farmer potentially unrestricted management of his property. This allows for greater flexibility and allows farmers to decide which management actions they would like to follow, rather than ensuring that they follow the dictates of the certification scheme which may not provide the optimal solution for their circumstance. An outcome-based scheme allows farmers to use unorthodox approaches without being penalised. The bench-mark approach that has already been extensively developed in the grassland biome for veld condition assessment and monitoring could provide the basis for biodiversity-based certification. Monitoring intervals need not be every year, but could be every five years or more frequently if the farmer thinks that he has made a rapid improvement and can justify sampling sooner. Sampling for such a method could also make use of indicators, species known to indicate different conditions or guilds of species from different taxonomic groups. An additional twofold advantage of this approach is that it would firstly help to identify those areas with maximum diversity and secondly temporal changes in diversity could be related back to associated farming activities.

Ecological Context

Broad-Scale Vegetation Patterns in the Namakwa District

The Namakwa District occupies an area exceeding 126 000 km^2 of the semi-arid region in the north-western corner of South Africa (Figure 1). The region is physically and climatically diverse, extending from sea level along the Atlantic Coast to over 1500m in the mountain ranges which divide the coastal plain from the Great Escarpment in the interior. The western margin of the region is characterised by relatively cool summers, warm winters and a predominantly winter rainfall regime. The eastern margin experiences more extreme temperature conditions and mainly summer rainfall which frequently occurs as intense short-duration thunder showers. The diversity in environmental conditions is also reflected in the vegetation which apart from being

exceptionally species rich is also functionally diverse, and over 90 different vegetation types from four different biomes (Table 1) have been recognised.

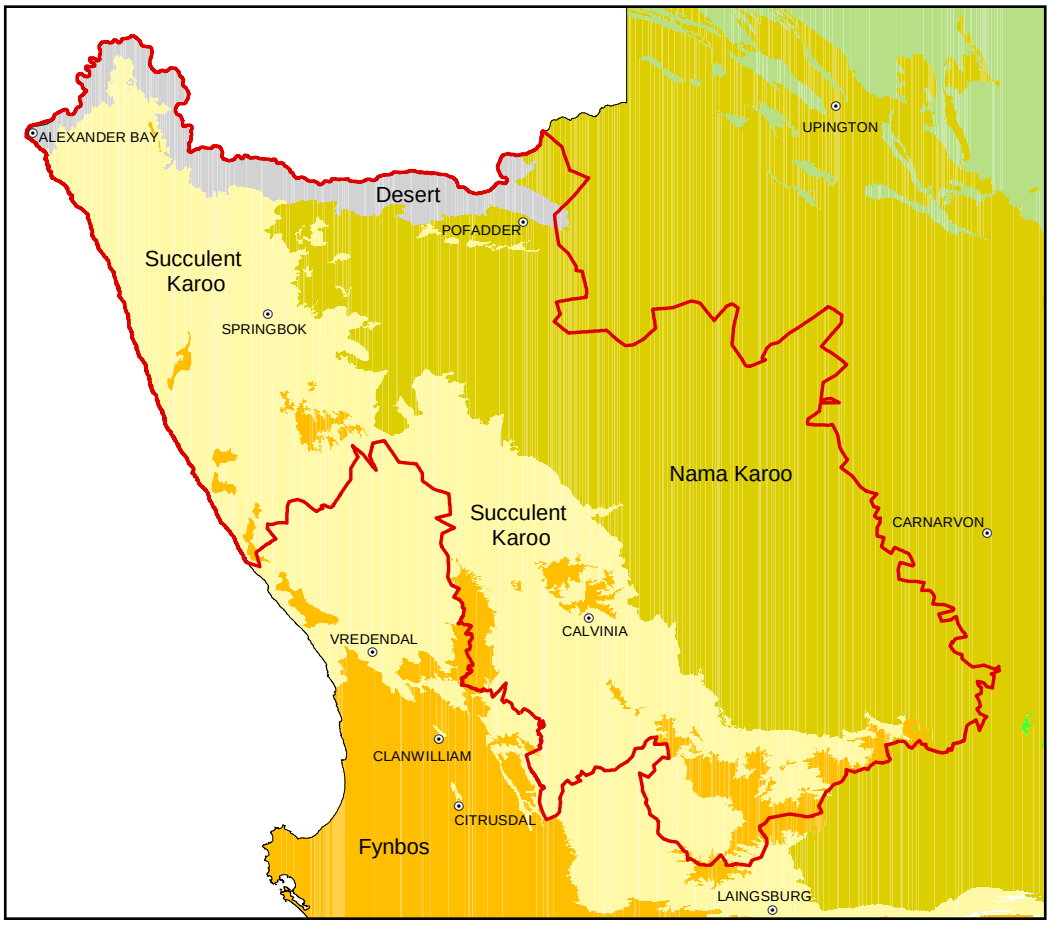

Figure 1. The Namakwa District with major towns and the different biomes of the region.

Table 1. The different biomes that occur within the Namakwa District, the number of vegetation types that occur within each biome, and the total area of each biome within the Namakwa District (From Mucina and Rutherford 2006).

Biome	No. Veg Types	Area (Ha)
Azonal Vegetation	9	539 076
Desert Biome	15	707 039
Fynbos Biome	12	663 854
Nama-Karoo Biome	9	5 679 603
Succulent Karoo Biome	48	5 083 128
Total	**93**	**12 672 701**

The vegetation of the Namakwa District is fairly evenly split between the Nama Karoo and Succulent Karoo biomes, with small proportions of the other biomes represented as well (Table 1). However, it is important to notice that while there are only 9 vegetation types recognised within the Nama Karoo, 48 are recognised within the Succulent Karoo, clearly demonstrating the biological significance of this biome within the region. Furthermore, the Desert and Fynbos Biomes also contain a disproportionately large number of vegetation types relative to their area. The twenty most extensive vegetation types within the Namakwa District are listed in Table 2. Together, these vegetation types comprise 83% of the area of the district. Again, this table illustrates the extensive nature of the Nama Karoo vegetation types compared to vegetation types from other biomes.

Table 2. The 20 vegetation types which each occupy more than 1000km^2 of the Namakwa district. Various other statistics such as the total extent of each vegetation type and the proportion of that within the Namakwa District have also been included. (From Mucina and Rutherford 2006)

Name	Biome	Total km^2 in SA	Total km^2 in Namakwa	% in Namakwa	% of Namakwa area
Bushmanland Basin Shrubland	Nama-Karoo	34 691	21 879	63	17.4
Western Upper Karoo	Nama-Karoo	17 150	15 013	88	11.9
Bushmanland Arid Grassland	Nama-Karoo	45 479	14 193	31	11.3
Namaqualand Klipkoppe Shrubland	Succulent Karoo	10 936	7 765	71	6.2
Hantam Karoo	Succulent Karoo	7 464	7 461	100	5.9
Roggeveld Karoo	Succulent Karoo	5 656	5 647	100	4.5
Tanqua Karoo	Succulent Karoo	6 988	3 659	52	2.9
Bushmanland Vloere	Azonal Vegetation	4 707	3 427	73	2.7
Namaqualand Blomveld	Succulent Karoo	3 809	3 303	87	2.6
Roggeveld Shale Renosterveld	Fynbos	2 917	2 805	96	2.2
Upper Karoo Hardeveld	Nama-Karoo	11 734	2 720	23	2.2
Eastern Gariep Rocky Desert	Desert	2 569	2 545	99	2.0
Namaqualand Strandveld	Succulent Karoo	3 916	2 472	63	2.0
Namaqualand Heuweltjieveld	Succulent Karoo	2 536	2 362	93	1.9
Western Bushmanland Klipveld	Succulent Karoo	2 297	2 297	100	1.8
Bushmanland Sandy Grassland	Nama-Karoo	2 283	1 848	81	1.5
Eastern Gariep Plains Desert	Desert	1 578	1 506	95	1.2
Tanqua Escarpment Shrubland	Succulent Karoo	1 321	1 225	93	1.0
Central Richtersveld Mountain Shrubland	Succulent Karoo	1 200	1 200	100	1.0
Koedoesberge-Moordenaars Karoo	Succulent Karoo	4 715	1 084	23	0.9

Conservation Status of Vegetation Types

Only five vegetation types that occur within the Namakwa District are listed as vulnerable or threatened (Table 3). However, it is important to recognise that these statistics can be misleading as to the true status of a vegetation type. For example, Bokkeveld Sandstone Fynbos is classified as Least Threatened, however, within the vegetation type, the deep sandy habitat that contains as many as 60 endemic plant species, is highly threatened by Rooibos Tea cultivation. In addition, some of the vegetation types that occur along the Namaqualand coast are not listed as threatened but are highly disturbed by mining activities and associated degradation resulting from sand mobilised by mining activities. Thus any listed activity such the establishment of a new cropland should consider the impact on the habitat being transformed rather than the vegetation type as a whole. Namaqualand Blomveld provides a good example of this principle as it is extremely rare to encounter any of this vegetation type which has not been highly impacted by grazing or cropping within a lowland environment, the remaining portions are largely restricted to rocky areas unsuitable for cropping and where the rocks may provide some refuge to plants from grazing animals.

Table 3. Vegetation types within the Namakwa District that are classified as either Vulnerable, Endangered or Critically Endangered.

Name	Biome	Status	Extent (Ha)	% Remaining
Cape Vernal Pools		Critically endangered	20	Unknown
Lower Gariep Alluvial Vegetation	Azonal Vegetation	Endangered	16 978	50.30%
Namib Seashore Vegetation		Vulnerable	1 286	86%
Nieuwoudtville Shale Renosterveld	Fynbos	Endangered	15 923	51.30%
Vanrhynsdorp Gannabosveld	Succulent Karoo	Vulnerable	4 063	79.50%

Current threats to biodiversity in the Namakwa District

Of all the commonly reported threats to the biodiversity of the Namakwa District, livestock grazing is the most pervasive as well as the most pernicious. While mining and cropping are severe and conspicuous, their extent is limited. Less than 5% of the Namakwa District is transformed by mining and cropping. Other threats include illegal collection of plants, alien invasive plants and unsustainable water abstraction, all of which are restricted to certain species or habitats. The importance of these threats should however not be overlooked because the impact they have is often severe, resulting in the local extinction of affected species or extensive transformation of habitats. More than 90% of the Namakwa District is however utilized for livestock grazing, making this by far the most widespread landuse. Although well managed livestock grazing is

compatible with biodiversity conservation, poor grazing management can lead to degradation and significant biodiversity loss at the landscape scale. Changes in vegetation composition associated with grazing are frequently not obvious and as a result, grazing as a threat to biodiversity is frequently underestimated or overlooked. Furthermore, despite being reported as a threat to many vegetation types, the actual impact of livestock grazing livestock is very difficult to quantify at a broad scale and most assessments rely on remote sensing or anecdotal evidence to gauge grazing threat.

Perceptions of Biodiversity Threat in the Namakwa District

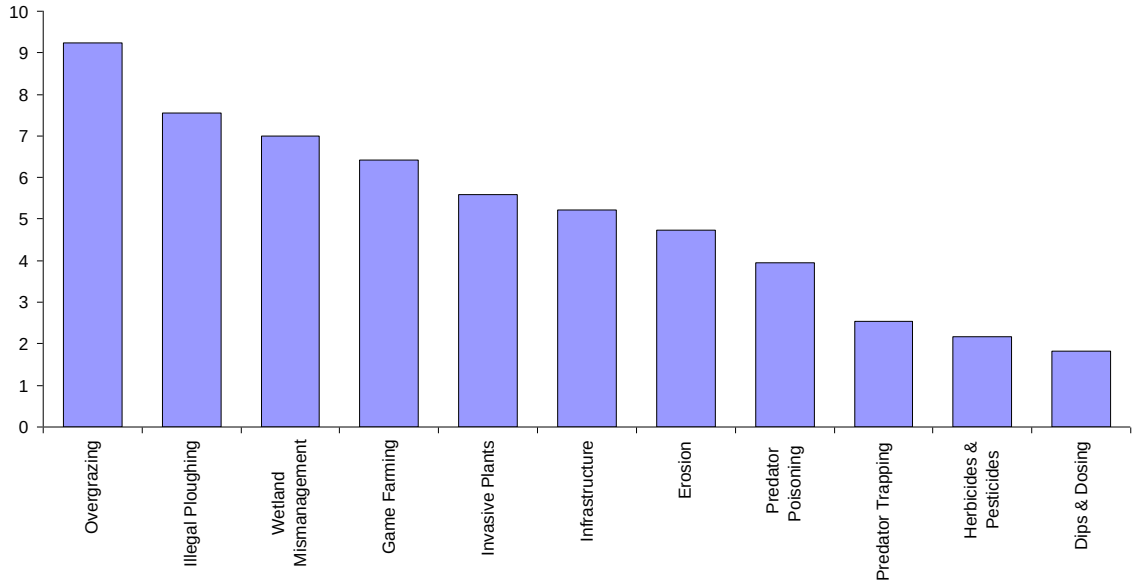

Figure 2. Priority ranking of threats to the biodiversity and ecosystem function of the Namakwa District, as ranked by scientists and conservation officials working in the region. Higher scores represent greater importance, the maximum potential score is 11.

Based on a survey of experts in the field of livestock production, overgrazing was overwhelmingly identified as the primary threat to biodiversity and ecosystem function in the region (Figure 2). Ploughing was identified as the next most significant threat to biodiversity with wetland management and game farming also emerging as important threats. Alien plants were only ranked fifth, perhaps reflecting the positive impact that programs such as Working for Water have had on the perception of alien plants as a continued threat to biodiversity. The use of traps for predator management and the use of pesticides and livestock remedies were identified as the lowest threats.

Livestock Grazing and Rangeland Dynamics

When considering livestock grazing impacts in arid and semi-arid regions, no discussion is complete without paying due attention to the current debate around the non-equilibrium theory of rangeland dynamics. The non-equilibrium theory holds that the rangeland dynamics of semi-arid and arid regions is driven primarily by unpredictable climatic events such as rare droughts or occasional exceptionally wet years. The implication of this idea is that livestock do not have a large impact on rangeland condition in arid areas as their numbers are regulated by drought events rather than by a tight relationship with the amount of plant biomass being produced each year. The non-equilibrium theory holds that livestock numbers are frequently reduced to very low numbers during extreme drought events, thereby giving the vegetation a chance to recover during the ensuing years while livestock numbers slowly build up again. This argument has been extensively used to argue that there is no ecological benefit in limiting livestock numbers in arid areas. Although this effect may hold in the arid parts of east and north-western Africa, where rangelands are dominated by annual grasses, no evidence has emerged to date which strongly supports this effect within the Namakwa District, or for that matter anywhere else in South Africa. On the contrary, there is an emerging body of evidence that suggests that although unpredictable climatic events play an important role in arid ecosystems, livestock can play a dominant role and can in fact modulate the outcome of such rare climatic events. Furthermore, within most parts of South Africa, livestock numbers are supported during drought events by supplementary feeding or by restocking immediately after the drought, thereby limiting the opportunities for vegetation recovery in the post-drought period. However, to be clear, we do not wish to imply that the idea of a predictable Clementsian succession provides a more realistic picture of rangeland dynamics in South Africa. Rather we recognise that neither the classical succession concept or the more recent non-equlibrium theory are able to adequately explain the dynamics of vegetation within South Africa. Current evidence suggests that vegetation within the arid regions of South Africa displays complex dynamics which may sometimes be characterised as equilibrial while at other times it is non-eqilibrial. Whatever the case may be, it is best to remain circumspect and critically evaluate the theory underlying our current understanding of vegetation dynamics and the implications this may have for rangeland management. In the case of the current guidelines, we have chosen an evidence-based approach and as such, do not require or directly invoke any underlying conceptual basis of rangeland dynamics for the best practices we outline.

Within the Namaqualand part of the Namakwa District, livestock grazing impacts has become a particularly contentious issue. This stems from the perception that the communal areas of the region are heavily impacted as a result of livestock grazing and the apparent resulting conflict between conservation and the need to address the current inequalities in land ownership within the region. That the communal areas are highly impacted as a result of

continuous heavy grazing is not in doubt and has been amply demonstrated by numerous ecological studies within the region. However, the controversy stems largely from a divergence in the focus of the argument between ecologists and social scientists. While ecologists continue to highlight the impact that high grazing pressures have had on the vegetation of the region, few social scientists actually dispute the fact that substantial vegetation change has taken place but rather focus on the fact that the vegetation is still able to support a long-term average stocking rate of nearly twice that of the private rangeland. Thus while the ecologist sees a degraded landscape in need of some sort of remediation, the social scientist sees an altered landscape that continues to provide goods and services at an acceptable rate. From a conservation perspective, a mosaic of heavily and lightly grazed areas maintains the greatest diversity. A proportion of the flora is however intolerant of heavy grazing pressure and so within each vegetation type there should be at least some lightly grazed areas that can act as a refuge for such species. The implications of overgrazing is thus scale dependent and the negative effects of overgrazing begin to become increasingly felt as the ratio of heavily to lightly grazed areas increases. Once a large proportion of the landscape has become severely overgrazed, the connectivity of the landscape will also become affected as such overgrazed areas with very low perennial plant cover represents an inhospitable habitat for many species. Since recruitment of many plant species is severely reduced under heavy grazing, continually overgrazed areas represent a barrier to the movement of such species and reduces their ability to respond to climate change. Finally, reduced plant cover exposes the soil to erosion and alters hydrology, consequently extensive overgrazed areas can impact the ability of the landscape to provide ecosystem services such the delivery of clean water at a regional scale.

Current Patterns of Landuse within the Namakwa District

Currently the majority of the Namakwa District falls under private land tenure, with a smaller proportion under communal land use and about 3.5% under formal conservation and 2.7% under mining permits. We are unable to assess the amount of private rangeland that is being used for wildlife as opposed to livestock ranching, but to our knowledge, it is also a relatively small area as the district does not contain a large amount of habitat conducive to wildlife ranching.

We have tried to make the guidelines contained in this document as generic as possible while still addressing as many specific issues as possible. However, we acknowledge that the applicability of the guidelines to communal landusers is problematic. Given the vast disparity in available resources and contextual situation between private and communal land-users, it is difficult to see how the two can be reconciled in terms of a single set of guidelines. However, to try to tackle this issue at the level of the guidelines themselves would entail either creating a double-standard or compromise the integrity of many guidelines. The distinction in the context and ability of different

types of land-users to meet various guidelines would be better met and incorporated into the certification framework.

Some scientists have argued that there is no scientific evidence for the benefits of rotational grazing in the region, particularly in Namaqualand. However, one should be cautious of such blanket statements, as they are themselves driven by a lack of evidence and frequently an underlying political agenda. While there may well be a lack of scientific studies which unequivocally demonstrate that rotational grazing has no benefit, it is even more important to recognise that there are no studies which demonstrate that it does NOT have a benefit. The situation is one of imperfect knowledge and the precautionary principle dictates that we should adopt the strategy which entails the least risk. This is beyond any doubt whatsoever, rotational grazing. It has also ably demonstrated that communal areas are, in practice, continuously grazed and are overstocked for at least a proportion of the time. As a consequence their vegetation composition is considerably poorer than adjacent private rangeland which is rotationally managed.

Biodiversity can be defined as “all the genes, species, ecosystems and processes that allow life to persist over time.

Carrying Capacity. We have avoided using the term carrying capacity due to various contentious issues around its meaning. The primary objection to the term in the literature stems from its apparent implication that there is a fixed number of animals the vegetation is able to support and which will maintain the animals and vegetation in a good condition. Clearly the carrying capacity (ability of vegetation to support various types of livestock and wildlife) fluctuates from year to year depending primarily on the amount and timing of rainfall. However, it is also important to recognize that the vast majority of authors in the scientific literature who use the term are well aware of this fact and use the term to refer to an average long term stocking rate that is not likely to result in vegetation degradation.

Degradation refers to the long-term loss of productive potential of the rangeland resulting from over-use. This may be readily visible as a decline in the perennial plant cover on the rangeland or less conspicuous as changes in the composition of the vegetation from palatable to less palatable or toxic species without major changes in the actual amount of vegetation. There is some debate in the literature as to the most appropriate definition of degradation in terms of the extent to which it is reversible. In the definition that we employ we use degradation to refer to negative changes which are not likely to remedy themselves even under appropriate management within a generation (25 years).

Large Stock Unit. This is used as a measure of the amount of animal biomass and grazing pressure that is being applied to the veld. One Large Stock Unit is equivalent to a 450 kg steer gaining 500g per day.

Stocking Rate. The number of animals per unit area. This is usually calculated at the level of the entire farm and not at the level of the specific camp that is being grazed. When considering the grazing pressure experienced by a specific camp on a farm it is more customary to refer to livestock grazing days. Stocking Rate is usually calculated as ha/LSU or ha/SSU where LSU are Large Stock Units and SSU are Small Stock Units.

Sustainability - Unless otherwise specified, by sustainability we mean the long-term ecological sustainability of the mentioned activity where sustainability is the ability to continue an activity or intervention indefinitely without leading to losses in species, complexity or productivity of the natural or semi-natural ecosystem.

Veld Condition – We refer to veld condition in terms of its ability to support livestock production on a sustainable basis. Veld in good condition is able to support at least the recommended

stocking rate, is composed of the variety of species and plant growth forms that can be expected for the veld type and maintains a good cover of perennial vegetation even during times of moderate drought. Veld in poor condition is generally not able to support the recommended stocking rates for the vegetation type, is dominated by thorny, unpalatable or annual plant species and cover may decrease substantially during times of drought due to the ephemeral nature of a large proportion of the vegetation.

Relevant Legislation

There are a number of acts and government policies which regulate the farming industry. These are administered by several different government departments. Best practice should always ensure that it is first and foremost within the bounds of the law. The different acts, policies and discussion documents relevant to the livestock production section are listed below, along with the associated administering departments. There are a number of policies which are currently under review or out for public comment, and so the legislation around farming activities is currently dynamic and further changes and regulations can be expected in the near future. All Acts and government policy documents are available at the following websites:

For all policies administered by the DoA see

http://www.nda.agric.za/docs/legislative_mandate.htm

All Acts, policies and documents for public comments can be found here:

The most important Acts regulating the agricultural sector are the following

- DEAT - National Environmental Management Act, No. 107 of 1998 (NEMA)
- DEAT - National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA)
- DEAT - National Environmental Management: Protected Areas Act 57 of 2003
- DoA - Conservation of Agricultural Resources Act, No. 43 of 1983 (CARA)
- DEAT - Environmental Conservation Act, No. 73 of 1998
- DoA- Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act 36 of 1947. (See also the more recent policy documents.)
- DWAF - National Veld and Forest Fire Act, No 101 of 1998
- DWAF - National Water Act, No. 36 of 1998
- DEAT - Protected Areas Act, No. 57 of 2003
- DoA - Subdivision of Agricultural Land Act, No. 70 of 1970
- DoA - Fencing Act, 1963 (Act no 31 of 1963)
- The various provincial nature conservation ordinances.

Policy Documents

There are a number of recently developed or revised policies relevant to the livestock production industry. Several policies are still in draft format and are currently under review and out for public comment.

- Policy on Stock Remedies In South Africa. 2006.
- Policy on Game Farming for Public Comments. 2006.

Other Best Practice Guidelines

Below is a list of other best-practice guidelines that have been developed for various regions and sectors of the agricultural industry. For guidelines relating to animal health and welfare as well as social responsibility we refer users to the Best Practice Reference Manual for Wool Sheep Farming in South Africa.

Best Practice Reference Manual for Wool Sheep Farming in South Africa. 2008/9. National Woolgrowers Association of South Africa. Available at http://www.elsenburg.com/trd/animalprod/woolgrowing.html

Karoo Landowner Conservation Guidelines. 2008. Nama Karoo Foundation. PO Box 140 Richmond, Northern Cape, 7090. www.namakaroo.org

IPW Manual for Biodiversity. Biodiversity & Wine Initiative. 2006. www.bwi.co.za

Biodiversity Best Practice Guidelines for Rooibos Production. Rooibos Biodiversity Initiative. 2008. Gerhard Pretorius – South African Rooibos Council. http://www.cepf.net/Documents/rooibosguidelines.pdf

Other Useful Information Links:

Grootfontein Agricultural Development Institute - http://gadi.agric.za/

Agricultural Research Council (ARC/LNR) - http://www.arc.agric.za

National Department of Agriculture (DoA) - http://www.doa.agric.za/

South African National Biodiversity Institute (SANBI) - http://www.sanbi.gov.za/

GreenChoice – which is an alliance that aims to upscale sustainable (biodiversity-responsible) agriculture and fisheries production in South Africa, by driving best practice across supply chains. Managed by WWF-South Africa and Conservation International, GreenChoice aims to reverse the negative impacts caused by food production and consumption and demonstrate that sustainable production is necessary, possible and viable.
GreenChoice (WWF & Conservation International partnership) Tel: +27(0)21 799 8832, Fax: +27(0)21 761 5462, E-mail: info@greenchoice.org.za

1. Livestock/Grazing Management

The number of livestock (and wild herbivores) on a farm and the manner in which they are managed are the single most important factors determining the ecological impact of livestock in an extensive farming system. Not surprisingly, a large amount of research has been dedicated to establishing firstly how many animals the different veld types within South Africa can support and secondly, the best way to manage the frequency and timing with which they are moved from camp to camp. Most research on grazing in the karoo was conducted by the DoA at Grootfontein in Middelburg and at a number of satellite research stations at various Karoo sites such as at Carnarvon. Research into grazing management peaked during the 1960s and 1970s and has decreased since the 1980s.

The ultimate purpose of grazing management is to maintain long-term rangeland productivity while maximizing the output of animal products such as wool, meat or milk. From a practical point of view, grazing management functions to maintain a consistent forage supply to livestock while ensuring that certain areas of veld do not become over-utilised. This aspect of livestock production lies at the core of the farming enterprise as it determines the number and quality of animals that will be produced as well as the long-term sustainability of the grazing strategy. The two main variables under the direct control of the landowner which determine the outcome of his grazing management strategy are the stocking rate and grazing system. The stocking rate refers to the number of animals per unit area which are maintained on the farm and the grazing system refers to the frequency and length of occupation of the animal flocks within the different camps on the farm.

The important factors to consider with regards to stocking rates and grazing systems are discussed in greater detail below.

Stocking Rate

Stocking rate must be considered the single most important determinant of the ecological sustainability of the farming enterprise. This is because the stocking rate is the primary determinant of the amount of vegetation biomass that will be removed by the livestock on the farm each year, and hence the impact that the livestock will have on the vegetation. The exact pattern in time and space in which this biomass is removed will be determined by the grazing

system. The main advantage of using an effective grazing system is that greater animal productivity can be achieved without negatively affecting the vegetation.

Recommended stocking rates have been developed for whole of South Africa by the DoA. However, these are derived from the mean annual rainfall and are applicable only at a very broad scale. More specific stocking rate trials have also been conducted for many of the veld types within the Karoo. In these trials veld is grazed at different animal densities for an extended period and related to the performance of the animals. The recommended stocking rate is calculated as the stocking rate at which peak animal performance occurred, where performance is measured in terms of mean daily weight gain. Thus the recommended stocking rates are the stocking rates at which maximum animal production is likely to occur, and not the maximum number of animals that can be supported. Although there has been much debate about them, by and large the recommended stocking rates have, over the years, proven to be highly efficient both in maintaining high animal productivity, and in preventing veld degradation, or even improving veld condition on farms. The recommended stocking rates provided by the Department of Agriculture are however only a rough guide and to determine the appropriate stocking rate of a specific farm, local factors such as the nature and abundance of different veld types must be taken into consideration

There are number of factors which can reduce the actual sustainable stocking rate from the ideal maximum and which should be taken into account. These include the following:

- **Veld degradation.** The carrying capacity of degraded veld is generally less than that of veld in good condition. This results from a lower plant biomass and hence lower total annual production or from changes in the composition of the veld from good to poor condition (poor condition veld will have less forage plants for livestock). Veld in a degraded condition should be stocked at a lower rate than similar veld types in a good condition.

- **Drought.** Dry years, particularly when they occur in succession can reduce perennial plant cover and hence reduce the number of animals the veld is able to support. It is recommended that livestock numbers be reduced during extended drought periods as it has been shown that high grazing pressures during drought periods has a large negative effect on veld recovery after drought.

- **Livestock Breed.** Certain types of livestock have a greater impact on the veld than other breeds, and hence should not be stocked at the same rate. This is due largely to the

different behavioural and grazing habits of different types of animals. In general, animals with more selective foraging behavior will have a greater impact on the veld than animals with broader diet preferences. This is because animals with broad diet preferences spread their impact across a greater number of species and hence a larger proportion on the vegetation. This effect is particularly important with regards to game ranching where different game species can have very different diet requirements. Although certain breeds of sheep are often identified as being very hard on the veld, the difference in diet preference and foraging behaviour between different sheep breeds is minimal and management rather than breed has an overwhelming influence on veld condition. The assertion that certain breeds such as Dorper sheep are more prone to overgraze the veld stems from the fact that wool sheep are prone to develop a break in their wool which greatly reduces its value. The break in the wool occurs if the veld is grazed too heavily and the nutritional value of the forage becomes too low, consequently, wool sheep must be kept on a more even plane of nutrition (and therefore veld condition) than meat sheep.

- **Grazing System.** Certain grazing systems are not able to support as many animals as others on a long-term sustainable basis. In particular grazing systems which employ continuous or near-continuous grazing should be stocked below the recommended stocking rate if they are to avoid causing veld degradation. This is because, given free range, grazing animals move widely over the rangeland selecting only high quality food such shoot tips and flowers. Repeated removal of these plant parts reduces plant growth and reproduction. Limiting grazing to one part of a ranch gives plants in the rest of the area an opportunity to grow and produce seed.

- The stocking rate should be calculated at the level of the whole farm, and include each years' lamb crop in the calculation. A 4 month old lamb uses about two thirds of the forage of an adult ewe, and so the forage utilisation of the growing lambs should be taken into consideration when calculating the stocking rate. Although it is common practice to sell of the current seasons lamb crop at an age of 4-6 months, many farmers keep lambs longer in order to achieve a greater sale weight or hold some animals back in order to take advantage of seasonal increases in the market price. In most instances, these animals are not factored into the calculation of the stocking rate and so the actual stocking rate on the farm may be seriously underestimated.

Grazing Systems

The grazing system used by a farmer refers to the pattern with which camps are alternatively grazed and rested. At the most basic level, grazing systems can be divided into two categories namely, continuous grazing and rotational grazing.

Continuous Grazing

Continuous grazing is the simplest grazing system that can be applied. The only aspect that can be adjusted is the stocking rate. In this system the animals have continuous access to the same area of vegetation. Animal performance under continuous grazing can be very good at low stocking rates, but both animal and veld condition suffer at the stocking rates that are required to make livestock farming economically viable. Although continuous grazing is not commonly practised by private livestock farmers in the karoo today, the increasing trend towards game farming means that it is, in effect, again becoming increasingly prevalent. Continuous grazing is also generally the grazing pattern prevalent on the communal areas that occur within the Namakwa district. Continuous grazing is not recommended as a grazing system. Firstly, it is unlikely that suitably low stocking rates will be maintained and secondly even at very low stocking rates, animals will preferentially use certain areas which may become overgrazed.

Rotational Grazing

A wide variety of rotational grazing systems have been developed in South Africa over the years. Rotational grazing systems can be broadly broken down onto two categories, namely those that utilize short grazing periods of less then a month and those that utilize longer grazing periods. The grazing systems that make use of short grazing periods are Non-Selective Grazing (NSG) and Holistic Resource Management (HRM) which is also sometimes known as Short Duration Grazing. The grazing systems that make use of longer grazing periods are the Multi-Camp Grazing Systems that have been developed largely by the Department of Agriculture at Grootfontein. The rationale behind rotational grazing systems is that the alternating periods of rest and defoliation allow plants to recover, grow and reproduce following grazing events, and when the grazing events are seasonally staggered, this allows plants with different growth cycles, such as shrubs and grasses, to complete their life cycle.

Since this is such an important aspect of veld management, the different grazing systems commonly utilized in the Karoo will be briefly described below. A clear understanding of the different grazing systems is a prerequisite to understanding the manner in which they relate to different recommended best practices.

Short Grazing Duration or Multi-Camp Systems

Non-Selective Grazing

The concept of Non-Selective Grazing was developed by John Acocks, who wanted to develop a grazing system that would mimic the pattern of grazing the karoo would have experienced from the large migratory herds that moved through the karoo during pre-colonial times. In this system animals (preferably mixed herds of livestock) are grazed at very high stocking rates for a short duration, generally less than two weeks. The reasoning behind the system is that by stocking at a high densities, selective grazing is minimized and stock are forced to eat even the 'unpalatable' species, eliminating the competitive advantage they have under selective defoliation. In order to achieve the high animal densities required by the system, very small camps or electric fencing is required. After being grazed, camps are rested for a period of at least a year or more.

Holistic Resource Management (HRM)

HRM is similar to NSG in that the grazing periods are also short, but the aims of the two systems are quite different. The basic reasoning behind HRM is twofold; by grazing palatable species often, HRM tries to stimulate plants and increase their annual production and; by using large numbers of animals, HRM tries to stimulate ecosystem processes such as decomposition and nutrient cycling. Grazing intensity in HRM may vary from heavy to lenient depending on the season and growth phase of the plants. Rest periods in HRM are usually quite short, usually in the order of 2-3 months depending on the rainfall. The wagon-wheel camp layout is also frequently associated with HRM, but it is not an essential requirement of the system.

Few Camp or Long Grazing Duration Systems

The traditional types of rotational grazing that are practised in the karoo were developed by the Department of Agriculture at Grootfontein over the last 70 years. In these systems, grazing periods of two to six months are alternated with relatively long rest periods. Rotational Grazing Systems have been developed for any number of camps from two to eight or more camps. Usually, the grazing and rest periods are staggered such that each camp is grazed during a different season each year. The alternating periods of rest and defoliation allow plants to recover and grow following defoliation while the seasonally staggered grazing periods mean that plants active at a certain time of year are not repeatedly impacted. This latter principle is well demonstrated by the Summer vs Winter grazing trial at Grootfontein (Fig). The Group Camp Approach developed by the DoA is usually associated with these systems. The Group Camp Approach is simply a conceptual framework which simplifies the application of any rotational grazing system by assigning different groups of camps to different flocks of animals.

In practice, it can be difficult to classify every farmer's system among those described above. This is because almost every farmer applies his own variations to the basic system and often utilises a combination of different approaches. Thus in reality, there are as many grazing systems in the karoo as there are farmers. However from a conceptual point of view, all grazing systems have five basic parameters which can be adjusted to a greater or lesser extent by the farmer

- **Stocking Density.** This is number of animals per unit area. The most important consequence of stocking density is that it affects the rate at which plant material is removed from the veld and consequently largely determines how long animals can stay in a camp.
- **Grazing period.** The amount of time animals are kept in a camp determines along with stocking density, the degree of veld (or plant) utilisation that occurs while the stock are in the camp.
- **Rest period.** While the rest period is often determined by the grazing period, this is not so in situations where a camp is grazed several times a year. The rest period and coinciding seasonal conditions determine the extent of veld recovery from grazing. Obtaining the right balance between the degree of veld utilisation and the rest period is perhaps the most important factor for successful veld management.
- **Herd composition.** This affects the pattern of veld utilisation because different types of livestock tend to utilise different components of the vegetation.
- **Camp size.** Although not as readily adjustable as the above parameters, camp size is an integral part of a grazing system as it determines the range of stocking densities and grazing periods that are possible.

Which Grazing System is Best?

While each grazing system has its proponents and detractors, the majority of claims made by the advocates of each system remain largely untested and based on circumstantial evidence and personal experience. No consistent relationship has been demonstrated between the grazing system that a farmer practices and the long-term condition of his veld. This highlights two important factors. Firstly it suggests that no grazing system is vastly superior to another. Secondly it indicates that the management activities of the specific farmer play a greater role in determining veld condition than the grazing system he uses. The two high intensity grazing systems, NSG and HRM, do however require greater levels of management expertise and as they maintain higher stock densities than the other systems, it is possible that incorrect management under these systems is not only more likely, but may also result in more severe degradation than the less intensive systems. Any grazing system can result in veld deterioration

when improperly applied and similarly all commonly used grazing systems appear to be able to maintain vegetation in a good condition when managed correctly. Consequently, no single grazing system can be promoted as best practice. Rather, several principles that lead to long term sustainable grazing can be identified. These basic principles, which can be considered best or at least minimum practice, can be outlined as follows:

- Forage plants must be provided with opportunities to set and disperse seed. In most instances this is achieved through rotational grazing, which gives plants a respite from grazing during the periods when the livestock are not in the camp. It is therefore important that rest periods firstly coincide with the growing season and secondly are long enough to allow preferred species to grow, flower and set seed. Clearly, it is not usually possible to rest every camp during the same growing season, therefore it is important that the grazing system allows different camps to be rested over consecutive growing seasons.
- The stocking rate should be at or near to the recommended stocking rate for the farm. Although innovative grazing systems can increase the long term sustainable stocking rate to a small degree, overstocking will inevitably lead to degradation over the long term.
- The rest period between grazing events should be proportional to the grazing pressure that has been applied. If a camp has been grazed for a long time or by a large number of animals then it should be rested for an amount of time sufficient to recover the lost biomass.
- Supplementary feeding should be used to address mineral or energy deficiencies rather than subsidize livestock bulk fodder requirements. Over-feeding with supplements enables livestock to have a severe effect on the vegetation as their condition is no longer related to the quality of the veld.
- The grazing system must be able to accommodate flexibility in that grazing and rest periods can be adapted to suit unexpected climatic events and other unforeseen circumstances. In practice this generally means that a forage reserve is maintained which can support at least the breeding stock on the farm for several months.

Monitoring and Record Keeping

In order to implement an effective and sound grazing system, reliable and accurate farm maps are essential. Such maps may be those produced for farmers by the DoA or aerial photographs which can be obtained at low cost from the Surveyor General. Such maps should indicate the boundaries between camps on the farm as well as the extent of each camp and the location of water points within the camp. An accurate assessment of the area of each camp is required in order to set the appropriate stocking rates. Furthermore, since different camps may contain

different veld types with different potentials, the grazing potential of each camp should be individually assessed and the stocking rate adjusted accordingly. Allied to this should be a simple veld condition monitoring system. Monitoring is essential to assess changes in veld condition that may require stocking rates or other management activities to be adjusted. The monitoring system can involve actual measurements of veld condition as detailed in Esler, Milton & Dean 2006 or be more reliant on other indicators such as repeat photographs taken at several predetermined sites across the farm. A record-keeping system should also be in place which captures at least the following details:

- The date the livestock entered the camp
- The date the livestock were removed from the camp.
- The type and number of livestock that were used.
- Any other related activities such as whether or not the animals were provided with supplementary feeding.
- Any livestock mortality that occurred while the animals were in the camp and the suspected reason for the mortality.
- A record of the rainfall at the farm, preferably on a daily basis should also be kept. However, if this is impractical weekly or monthly records are also useful. (Hint: In order to prevent rainwater evaporation from rain gauges, a small amount of cooking oil can be maintained in the rainfall gauge. This will form a slick on top of any rainwater and prevent evaporation until the rainfall can be measured.)

Drought Management

Droughts are a natural and regular phenomenon within the semi-arid regions of South Africa. A drought management strategy must be implicitly incorporated into the grazing system. Several potential strategies can be employed to reduce the impact of drought, both on the livestock as well as the vegetation. These include:

- Reducing livestock numbers during drought periods. In the post drought period, increased livestock performance will to some extent compensate for the reduced numbers.
- Incorporating an extended rest period for certain camps into the grazing system. Rest for longer than a year has been shown to be highly beneficial for karoo veld, and the camps set aside for the extended rest can be rotated among all the camps so that the whole farm eventually benefits. These camps can forgo their extended rest during drought periods and be used as an emergency fodder supply.
- Drought feeding. Here it is important to distinguish between supplementary feeding and drought feeding. The aim of supplementary feeding is to ensure optimal animal

performance by supplementing nutrient deficiencies which occur as a result of deficiencies in the vegetation. This type of feeding occurs when the supply of forage bulk material exceeds demand, but the quality is low. The purpose of drought feeding on the other hand is to keep animals alive and commences when bulk material (roughage) supply declines to a level sufficient to supply only about 30% of the nutrient requirements of the livestock. It is not usually economically viable to feed non-producing animals for an extended period, however if the condition of the ewes is maintained, reproductive and income losses may be reduced. However, it is important to manage such feeding carefully or ensure that it occurs within the confines of feedlots or on croplands, as supplemented animals can cause severe overgrazing and trampling degradation when ranging freely in the veld during drought conditions. Drought feeding can become very costly and uneconomical if not managed properly. It is beyond the scope of these guidelines to provide recommendations on optimal drought feeding strategies, and appropriate information on drought feeding can be obtained from extension officers as well as most commercial feed-supply companies.

- Whether feeding for drought survival or to increase animal performance, the most important issue regarding feeding is that the ultimate effect should be a lower overall grazing pressure on the vegetation rather than an increased pressure.

What are the Most Deleterious Grazing Practices?

- **Overstocking** which inevitably leads to overgrazing and veld degradation.
- **Continuous grazing** which prevents palatable species from flowering and producing seed, ultimately leading to changes in veld composition towards spiny and unpalatable species.
- **Repeated grazing** in the same season each year which reduces the abundance of species that grow and flower at that time year in favour of species which grow and flower during other seasons.
- **Incorrect animal/game breeds** can lead to veld degradation due to an insufficient supply of suitable forage for the particular animals.

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Rehabilitation

Where possible, highly degraded veld should be rehabilitated. By rehabilitation we mean that the variety of species that naturally occur in the ecosystem should be reestablished and the ecological functioning of the area restored as far as possible. Many farms contain areas that are degraded as a result of previous management, which may have taken place decades before. Due to changes in soil properties, a lack of seed, as well as other physical changes and barriers to plant establishment, degraded areas do not recover easily even when they have been rested from grazing for long periods. Active rehabilitation is often the only way to improve the quality of veld in these areas. However, rehabilitation is often unsuccessful as a number of basic principles tend to be ignored. In particular, there is often a tendency to apply short-term solutions, such as simply adding fertilizer, which encourages a short-term increase in plant cover but fails in the long term to significantly increase perennial plant cover. Since successful rehabilitation requires technical expertise and is costly, it is advisable to seek specialist advice on the most appropriate rehabilitation techniques for your area.

As far as possible, rehabilitation attempts should:

- Use seed of species which occur in the area naturally
- Use locally sourced seed or plants
- Seek to promote the establishment of perennial plants. Not only highly palatable plants should be established, but the mix of perennial plants that occur in the natural ecosystems should be reestablished. The mix of species helps to make the ecosystem resilient to future disturbances such as drought and temporary overgrazing (i.e. the ecosystem as a whole is buffered and bounce back from these disturbances).
- The sensitivity of rehabilitated areas should be taken into account and grazing in these areas should be managed carefully in order to avoid these areas reverting back to a degraded state as a result of too much grazing.
- Avoid interventions such as large-scale clearing, poisoning or brush-cutting of poisonous or unpalatable plants. Total removal of plants can cause soil erosion and increase the harshness of the environment, making the establishment of desirable species even more difficult to achieve.

Bush Thickening

Bush encroachment by thorny *Acacia* species is not a typical problem within the Namakwa district. However, other large woody shrub species such as *Rhigozum trichotomum* may become dense as a result of poor grazing management. The persistence of these species reduces the grazing value of the veld and some farmers may desire to control them chemically or mechanically. However, unpalatable woody species should be controlled only if their density results from a historical effect rather than current management practice. Removing the symptoms of poor management is not a long-term solution nor an acceptable substitute for good management. Before attempting control develop a post-control management plan. The control measure should be as selective as possible and caution should be exercised to ensure that effects on non-target species are kept to a minimum. Furthermore, in highly degraded vegetation, there is likely to be a paucity of seed of other perennial species and removing the dominant plant species is likely to dramatically increase the proportion of bare ground and could exacerbate degradation problems.

The post control plan should address:

- Grazing patterns after control measures have been implemented. Removing a large proportion of the plant biomass and then heavily grazing the vegetation is likely to cause erosion, weed establishment and further veld degradation and is therefore not desirable.
- Whether or not active seeding of desirable species will take place.

Extreme caution should be exercised if control is to be achieved through the use of herbicides as the potential for ecosystem effects is potentially high. For example, herbicides containing Tebuthiuron are commonly registered for the control of Rhigozum and other woody species. However, Tebuthiuron is highly persistent in the soil, with reported field half-lives from 12 to 15 months in areas with over 1000 mm annual rainfall, and longer half-lives expected in drier areas or in soils with high organic matter content. Thus in areas that still contain a reasonable abundance of non-target woody species, the use of non-selective herbicides is highly undesirable and physical control measures are preferable.

For more information on Rehabilitation contact

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Alien Plant Control

Alien plants pose a threat to biodiversity as they take up space and use resources that would otherwise have been used by indigenous species as well as disrupt many ecological and hydrological processes. Alien species are regulated under the CARA Act which lists species under four different categories.

- Declared weeds (category 1 plants) Alien species prohibited on any land or water surface in South Africa; must be controlled or eradicated where possible.
- Declared invaders (category 2 plants)(commercial and utility plants) Alien species allowed only in demarcated areas providing there is a permit and that steps are taken to prevent their spread.

- Declared invaders (category 3 plants)(ornamentals) Alien species that may no longer be planted; existing plants may remain provided that all reasonable steps are taken to prevent their spread; prohibited within the floodline of watercourses and wetlands.
- Declared indicators of bush encroachment Indigenous species that under certain circumstances e.g. overgrazing may cause bush thickening; CARA prescribes management practices aimed at preventing bush encroachment, and at combating it where it already occurs.

Alien species should be controlled and activities which promote the spread of alien species should be limited as far as possible. Alien species should be managed in an integrated manner, which is to say that control efforts should simultaneously address several aspects of the life cycle or utilize more than one control method. For example, a particular alien species may be controlled through active removal of established plants, however if the seed source of that species is from imported feed, then removal of the established plants alone will not be a long term solution to the problem and the importation of the seed with the feed will need to be addressed. Furthermore, since livestock are acting as the vector for the seed, the manner or timing in which the feed is given to the animals may also need to be changed.

For certain species, assistance in their removal can be obtained from organizations like Working for Water. Working for Water (WfW) provides guidelines on the appropriate herbicides and application methods for the control of most important alien species. WfW also subsidises herbicides for use against invasive alien plants.

Alien plant control methods should be used that are appropriate for the species concerned as well as to the ecosystem in which they occur. For example it may be inappropriate to use certain herbicides within a wetland environment where the water is likely to become contaminated and aquatic diversity negatively affected. One or a combination of the following control methods can be used: uprooting, felling, cutting, burning, treatment with registered herbicides, biological control or any other recognised and appropriate method. Repetitive follow-up actions will be required before effective control is achieved.

When controlling weeds and invaders, damage to the environment should be limited as far as possible. Negative ecological side effects associated with the removal or control of alien species can take several forms, the following common problems associated with alien control activities should be kept to a minimum:

- Herbicidal or physical damage to non-target plants
- Chemical pollution of soil or water

- Irresponsible use of fire
- The creation of a fire hazard by allowing flammable material to accumulate in fire-sensitive areas
- Excessive disturbance or exposure of the soil, especially on riverbanks or slopes
- Failure to rehabilitate denuded areas so as to prevent soil erosion and invasion by other undesirable species
- Other actions that might upset the local ecology
- Coarse droplet nozzles should be fitted to avoid drift onto neighbouring vegetation. Where possible, herbicide should be applied to cut stumps rather than used as a foliar spray.

A few alien species warrant species mention as they are a particular problem within the Namakwa District and pose a significant threat to biodiversity. These species are discussed further below.

Mesquite or Prosopis

The various Prosopis species and their hybrids that occur within South Africa are classified as Category 2 invaders. This implies that they should be maintained within a demarcated area and steps taken to ensure that they do not spread from this area. Prosopis has already taken over an estimated 1.8 million hectares in South Africa, and ranks among the top invaders in the country. A large proportion of its distribution falls within the Namakwa District and as a result, this species warrants special mention especially given that many farmers view this species in a positive light as it provides valuable forage during the late summer and autumn, a time when there is often little other quality forage available. However, the advantages of this species are often short-lived as stands may become very dense to the extent that even small stock cannot enter or become trapped in the dense thickets.

In principle, maintaining this species in demarcated areas would be acceptable, however, the seed is spread by animals, including livestock, which eat the seed pods. It has been estimated that a single tree may produce as many as 1 million seeds in a single year. From a practical point of view it is consequently almost impossible to prevent the dispersal of seed from any planted areas into the surrounding veld. As a result, purposely maintaining stands of this species does not constitute good practice. Existing stands should not be allowed to spread and should be cleared, at least gradually if funds do not allow. WfW is also active in many areas where this species is a problem and can be approached for assistance in clearing dense or extensive tracts of Prosopis.

Annual Grasses

Alien annual grasses have been identified as a particular threat to the biodiversity of the winter rainfall region of South Africa. Within the Namakwa District they are a significant problem in the Renosterveld vegetation types that occur in the southern parts of the District such as the Hantam-Bokkeveld Plateau and the Roggeveld. The dominant species include Wild Oats, *Avena fatua* and various *Bromus* species. Although these species are often problematic on old cultivated fields, they also occur in the uncultivated veld and are symptomatic of poor management, particularly overgrazing and excessive disturbance. Control of these species is best achieved through correct veld management. In densely invaded areas, selective herbicides can also be used to reduce the abundance of the grasses. However, since these grasses maintain a long-lived seedbank, a single application of herbicide is not likely to achieve effective control unless a herbicide with a residual action is used, which retards subsequent germination of the seed. As with most alien removal repeated follow-up action will be needed in order to have any lasting impact. If herbicide is to be used, then all the precautions associated their use, as listed in the above, should be followed.

Useful alien clearing contacts:

Landcare: www.nda.agric.za/docs/landcare

Working for Water: www.dwaf.gov.za/wfw

Weedbuster Hotline: 0800 005 376, weedbuster@dwaf.gov.za

Harvesting of Plants or Plant Parts from the Veld

Harvesting of veld products is controlled by the Conservation of Agricultural Resources Act and permits are required for collecting, cultivation, transport or export of veld products. It is illegal to harvest threatened or listed plants such as the Kokerboom (*Aloe dichotoma*) and *Hoodia* species, from the veld. Furthermore any trade in such species requires a permit.

All harvesting should be conducted in a manner which ensures that the amount harvested is sustainable and does not negatively affect the survival or reproductive ability of the plants. The removal of whole plants is not acceptable practice, even when there appear to be a large number of plants available. Recruitment (seedling establishment) events in arid areas are infrequent and so a single cohort may be the only link between current and future generations.

Plants destined for sale should be grown from seed or cuttings under nursery conditions. The nursery must also be registered with the DTEC Northern Cape.

Harvesting of wood for use as fuel should be limited to dead material and a minimum of 10% of dead wood should be left in the veld for use by various insects and birds that depend on this resource for food or nesting sites.

Fire

From an ecological perspective, fire only plays an important ecological role in the Fynbos and Renosterveld veld types associated with the high elevation uplands of the mountainous regions of the District, particularly the Kamiesberg, Hantam and Koue Bokkeveld ranges. Coastal fynbos and arid Renosterveld veld types do not appear to require fire in order to maintain their dynamics. In those areas where fires are a natural phenomenon, active management of fire regimes is not likely to be required as the natural fire frequency in these areas are likely to be low and natural ignition sources are likely to be sufficient to maintain fire-related ecological processes. As such, frequent fires from artificial sources should be avoided and where possible unintended fires should be extinguished. Frequent intentional fires set to improve the grazing value of the veld are extremely damaging to the long-term condition and diversity of the vegetation and this activity should be strongly discouraged. Heavy grazing of the vegetation for at least the first year after fire should also be avoided as this has a negative effect on the development of the vegetation thereafter.

Where intentional fires are to be set, they should take the natural dynamics of the vegetation into account and the following precautions taken:

- Alien vegetation should be cleared before a burn

- Fynbos vegetation should not be burnt until at least 50% of the population of the slowest-maturing species in an area has flowered for at least three successive seasons (About 10-20 years in the Kamiesberg).
- Burns should take place in early autumn, when temperatures have cooled down but before significant green growth has taken place.
- Not all the vegetation should be burnt within a single year. It is better to maintain a range of veld ages as this maximizes diversity and maintains a diversity of habitats for species such as tortoises which require some cover to avoid predation.
- Records of fire dates and maps of fire extents should also be kept.

There is apparently very little active management of fires or fire risk in the Namakwa District. Fires and their consequences fall under the National Veld and Forest Fire Act of 1998 (Act No. 101 of 1998). An important aspect of the Act is that fires causing damage to neighbouring land may result in claims to the landowner if the requirements of this Act have not been implemented adequately. This Act places the duty on every owner on whose land a veld fire may start or burn, or from whose land it may spread, to prepare and maintain a fire break on his or her side of the boundary between his or her land and the adjoining land.

For more information refer to:

CapeNature's fact sheet on "Fire Management" & "The Landowner and Fire Protection Associations" (available for download on BWI website)

Department of Water affairs and Forestry CD: 'Resource materials on National Veld and Forest Fire Act No 101 of 1998'

3. Cropping & Fodder Production

Ploughing of New or Existing Fields

Legislation around cropping activities is covered by The Conservation of Agricultural Resources Act of 1983 (Act No. 43 of 1983) (CARA). This Act is administered by the Department of Agriculture, and the aim of this Act is to provide for the conservation of the natural agricultural resources of South Africa "… by the maintenance of the production potential of land, by the combating and prevention of erosion and weakening or destruction of water sources, and by the protection of the vegetation and the combating of weeds and invader plants". "natural agricultural

resources" is defined as the soil, the water sources and the vegetation, excluding weeds and invader plants and "water course" means a natural flow path in which run-off water is concentrated and along which it is carried away.

This Act provides that no land user shall, except on authority of a written permission by the relevant department:

- Cultivate any virgin soil
- Cultivate any land if it has a slope of more than 20%
- Utilise the vegetation in a vlei, marsh or water sponge or within the flood area of a water course or within 10 metres horizontally outside a flood area in a manner that causes or may cause the deterioration of or damage to the natural agricultural resources
- Drain or cultivate any vlei or water sponge or a portion thereof on his farm unit
- Cultivate any land on his farm unit within the flood area of a water course or within 10 metres horizontally outside of the flood area of a water course

Before issuing a permit, the issuing authority may in writing require the applicant to furnish it, at the applicant's expense, with such independent risk assessment or expert evidence as the issuing authority may determine. In other words, *before* any virgin veld is ploughed to make a cropland, authorization must be obtained from the DoA and DTEC. If the area (or cumulative phased area) exceeds 20 ha, a permit must be obtained from the DoA, part of which requires that a full Scoping and Environmental Impact Assessment (EIA) is conducted. For areas less than 20 ha, a Basic Environmental Assessment is required. Such Environmental Assessments should include a report from a qualified botanist who has determined that no threatened species occur or are likely to occur in the application area. It is also important to remember that old lands that have not been cultivated for more than 10 years are considered natural vegetation and also require the above permits to be cultivated again.

DTEC Northern Cape – Environment Section, Springbok office, Tel.: 027 – 718 1958.

Apart from the above regulations it is also important when cultivating established croplands to:

- Contour croplands that occur on slopes so as to limit erosion.
- Plough along the contour, so that water flow down the slope is decreased as far as possible, thereby reducing the erosion of topsoil from the cropland.
- Avoid cropping in areas which are known the harbour threatened (Red Data Book Listed) species, unique habitats or rare vegetation types.

- Minimum tillage practices are preferable to conventional inversion ploughing practices only under certain circumstances. Where slopes are quite steep or the soil erodible then minimum tillage practices are particularly important. Minimum tillage increases the water-stability of surface soil aggregates, thereby reducing the susceptibility of the soil to erosion. Minimum tillage also drastically reduces the amount of carbon (CO_2) released into the atmosphere from the soil. However, in some areas, weeds can become a problem with minimum tillage, necessitating greater reliance on the use of herbicides such as glyphosate (e.g. Roundup) or gramoxylin (e.g. Paraquat) to control weeds. In areas with significant weed problems, inversion ploughing can effectively be used to control weed problems and is preferable to the extensive use of herbicides.

Irrigation & Water Abstraction

All agricultural water use is covered by the National Water Act and all abstraction must be registered by the DWAF. In addition, each abstraction point must be fitted with a water meter and monthly records of use should also be kept. Such records must be kept in a log book and submitted to the relevant Water User's Association annually.

Although there is not an extensive amount of irrigated land within the Namakwa District, there are nonetheless some irrigated areas, particularly along the ephemeral rivers of the area. In addition to the above practices regarding buffer zones around riparian areas and wetlands, the following are recommended practices associated with water abstraction and irrigation:

- Abstraction levels should not exceed the sustainable yield of the aquifer being pumped. Pumping tests should be used to establish the sustainable yield as well as establish linkages with any other nearby boreholes.
- Particularly when water is being abstracted from an alluvial aquifer, an ecological reserve should be accommodated as excessive pumping can lower the water table beyond the reach of riparian vegetation, causing mortality of trees and other riparian vegetation.
- In order to avoid unnecessary abstraction, the water requirements of the particular crop being irrigated should be taken into account and the amount of irrigation applied adjusted accordingly. Over-irrigation is harmful as it ultimately leaches salts and excess fertilizers into the groundwater.
- The quality of the water being used for irrigation should also be assessed as the majority of groundwater in Namaqualand is of very poor quality and unsuitable for irrigation. The use of unsuitable water for irrigation results in salinisation of the soil and depending on the particular composition of the water there is also the potential for a build up of other toxic elements. The maximum recommended salt concentrations of water to be used for

irrigation should not exceed a Conductivity (EC) of 270 mS/m or Sodium level of 400 mg/l or Chloride level of 600 mg/l. Since groundwater quality can change seasonally as well as with the volume of water being pumped, quality measurements should be taken regularly.

- Boreholes levels should be monitored regularly in order to ensure that unsustainable draw-down is not occurring.

Key Information Sources

Karlen, D.L., N.C. Wollenhaupt, D.C. Erbach, E.C. Berry, J.B. Swan, N.S. Eash, and J.L. Jordahl. 1994. Long-term tillage effects on soil quality. Soil & Tillage Research 32:313-327.

Jonas, Z., 2004. Land use and its impact on the Succulent Karoo. M.Sc. thesis, University of Cape Town, Cape Town.

Titus, R., Pietersen, K., Williams, M., Adams, S., Xu, Y., Saayman, I. and Colvin, C. 2002. *Groundwater Assessment and Strategies for Sustainable Resource Supply in Arid Zones – The Namaqualand Case Study*. WRC Report 721/1/02. Water Research Commission, Pretoria.

Herbicide Use

Apart from the conversion of natural vegetation to croplands and the possible loss of valuable topsoil with poor tillage practices, perhaps the most important ecological issue associated with cropping is the use of herbicides to control undesirable plant species. When using herbicides, the following should be followed:

- Only currently approved herbicides should be used. Older herbicides that may have been stockpiled but have now been banned or discontinued on the market should not be used as these usually have a large negative effect on wildlife, even if properly applied.
- The instructions with regard to dosage and application methods as provided with the herbicides should be strictly adhered to.
- Herbicides should not be used for any purpose other than that stated on the package of the herbicide.
- Suitable health and safety precautions should be taken by all personnel handling or coming into contact with the herbicides.
- The weather conditions during and immediately following the application should be favourable for herbicide application in order prevent excessive amounts of herbicide being blown off the target area by wind or being washed away by rain.

- Unused or expired herbicide should be disposed of in a suitable and safe manner.
- The same herbicide should not be used repeatedly as this encourages herbicide resistance to develop. Alternating among two or more herbicide and alternative control measures greatly reduces the probability that herbicide resistance will develop.
- Where possible, non-chemical control measures such as burning crop residues or appropriately timed shallow ploughing should be used in preference to herbicides.

Fertilizer Use

Fertilizers can have extensive off-site consequences if inappropriately used. Excessive application rates are not only costly and inefficient, but can also lead to leaching of the nutrients into local terrestrial and aquatic ecosystems and groundwater systems. Excessive nutrient loading of aquatic systems results in eutrophication with associated declines in water quality and aquatic diversity. Nutrients such as nitrogen encourage the invasion of terrestrial ecosystems by alien species which disrupt or alter ecological processes and reduce local plant diversity. Fertilizers leaching into groundwater decrease the quality and potability of the groundwater and in some instances compounds such as nitrates can reach toxic levels, impacting both human and animal health. Consequently, in order to ensure that the appropriate nutrient levels are maintained, soils of regularly cultivated croplands should be tested. Furthermore, within croplands, plant nutrient uptake and leaching can lead to acidification of the soil. Many fertilizers contain large quantities of industrial salts and other by-products in addition to the required nutrients (e.g. N:P:K). These and fertilizers comprising an inappropriate mix of nutrients, can have unintended and harmful effects on the soils and surrounding ecosystems. Acidification interferes with plant nutrient uptake, reducing the efficiency of fertilizers and should be counteracted through the use of lime when encountered. For all these, and economic reasons, it is important to accurately calculate and apply only the minimum effective quantity of the appropriate fertilizer.

4. Animal Health Management

Dips & Dosing

A wide variety of different dips with different active ingredients are available today. Although most dips are more environmentally friendly than they were 30 years ago, if incorrectly used or when contamination of the environment occurs, a lot of damage can still occur. Due to human health concerns the current trend is that organophosphate dips are being replaced by synthetic

pyrethroids. However the pyrethroids are particularly toxic to aquatic life and so extreme caution is required to ensure that contamination of wetlands and water resources is avoided. The major avenue of environmental contamination is from sheep which have been drenched. The newer pour-on dips are recommended as considerably lower volumes are used and they are formulated to adhere to the animal much better. For most internal and external parasite problems the injectible macrocyclic lactones such as the avermectins are most preferable as the volumes used are very small and there is little chance of direct contamination. However, it is also important to avoid frequent and repeated use of a single remedy as this can lead to the development of resistant parasite strains. It is also important not to under-dose as this also promotes the development of resistance. Once resistance to a specific dip or parasite active ingredient has developed, it is permanent and cannot be reversed. Consequently, all dipping should be strategic and only take place when a need has been identified. Reliance on chemical control of endo- and ecto-parasites can be reduced through an integrated parasite management approach. This involves:

- Applying management options which reduce risks of infection such as trimming wool to reduce susceptibility to fly-strike.
- Genetic improvement, certain breeds and individuals are more resistant to parasites than other individuals and through selective breeding more resistant animals can be bred.
- Biological/environmental control such as the use of fly traps.
- Selective use of chemicals only when required.

5. Damage Causing Animals

A damage causing animal is defined under the NEMBA Act as an animal that:

(a) causes losses to livestock;

(b) damages cultivated trees or crops or other property;

(c) presents a threat to human life; or

(d) is present in such numbers that agricultural grazing is materially depleted;

Under this definition, damage causing animals includes livestock predators such as Jackal and Caracal as well as herbivores such locusts or porcupines which may damage crops or water pipes.

Problem animal control has become a contentious issue in recent years, with lobby groups raising public sentiment about the perceived cruelty associated with many problem animal control methods. Farmers have responded by highlighting the extent of the losses they incur, which

have been estimated to be as much as 9 billion rand annually to the livestock industry and an additional 4 billion to the game industry. Unfortunately, apart from the emotive issues, both sides of the debate have commonly passed off unsupported statements about the nature of certain control methods as scientific fact, clouding the issues considerably.

A lot of controversy currently centres around whether or not hunting or other lethal methods cause an increase in the total predator population by releasing sub-dominant animals from hormonal suppression of breeding. This idea stems from the observation that sub-dominant animals do not breed in areas with stable jackal populations. Also, jackal pairs mate for life and vigorously defend their territory against other jackal, removing the dominant jackal from an area creates an open space that may become occupied by several jackals. While some people have argued that the increase in jackal numbers arises from farmers using lethal control methods, this contention is disputed by farmers. A number of facts bring to bear on this issue

- Farmers have been using lethal control measures for many decades and so the recent apparent increase in their numbers cannot be directly related to lethal control. In fact, the widespread use of poisons has decreased substantially. The increase in jackal numbers parallels the increase in game farms and conservation areas in the karoo, suggesting that the increase stems from an overall lower level of persecution.
- At very low jackal density, there are very few or no sub-dominant animals and so hunting will reduce their numbers further and it is difficult to see how any kind of population stimulation can take place due to sustained hunting pressure alone. This is supported by the fact that jackal density is lower on farmland compared to adjacent conservation areas.
- Jackal litters may be larger at low jackal density due to minimal competition for food, but at high density, jackal are likely to become food limited and so increase the likelihood of jackal preying upon domestic livestock.
- There is little direct evidence that resident jackal do not prey upon domestic livestock or keep other jackal which are supposedly more likely to prey upon livestock out of their territory.
- In conclusion, it seems that hunting jackal may cause transient increases in their populations, however, this scenario is likely only under certain specific circumstances which have not been demonstrated to be the norm. Instituting an integrated predator management program using non-lethal controls but removing problem causing animals as they occur is the most prudent course to follow.

Predator Management

Predator management is an important issue for many farmers as they may incur considerable losses if amelioration measures are not taken. Despite decades in intense persecution, farmers have failed to eliminate jackal and caracal, demonstrating the futility of attempting to eradicate them from farmland. Perhaps the most important factor with regards to predator control management is that it needs to be holistic and integrated into every day farm management, rather than being seen as an extraneous factor which must be dealt with when a problem arises. A combination of active and passive measures must be used in order to effectively reduce livestock losses to predators and randomly targeting predators is not a long-term solution. When problems arise efforts should be made to target only the problem causing individuals.

Predator management options include both lethal and non-lethal methods. The non-lethal methods should be used as far as possible on an everyday basis and the lethal methods as a last resort when problems are experienced. The potential positive and negative aspects of the different control methods are discussed further below.

Non-Lethal Methods

Non-lethal control methods have been extensively promoted by groups wishing to see more environmentally friendly and ethical control measures being implemented by farmers. The most popular control measures are discussed below.

Collars and Bells

Collars such as the King Collar work by protecting the neck area of the sheep or goat, thereby preventing or hindering predators from gaining a neckhold on the animal and suffocating it. When newly introduced, these collars are very effective, however, effectivity appears to decrease over time as predators, particularly jackal, learn to attack other parts of the animal. This can be very damaging as the hindquarters of livestock are frequently attacked and they are literally eaten alive, resulting in many severely damaged animals which must be euthanized as they are unlikely to survive within an extensive livestock system. Bells are similar in effect and work by keeping predators away from livestock because they are wary of the unfamiliar sound.

Fencing

A large amount of money and effort has been spent constructing so called ‘jackal-proof’ fences across South Africa. While a well constructed and regularly maintained fence may be effective at keeping jackal out of a specific camp, maintaining fences across an entire farm can be very difficult, especially if the terrain is rough. Such mesh fences not only limit the movement of jackal

but also other medium sized animals common in the karoo such as Aardvark, Aardwolf and Steenbok. Some farmers are known to kill digging animals such as Aardvark due to the damage they cause to the integrity of fences. This is an unacceptable practice as Aardvark play an important role in the ecology of arid areas. There is clearly a conflict between the need to keep jackal off a farm and the need to allow for the movement of other animals. Perhaps the most acceptable compromise is ether to mesh-fence only the outer perimeter of the farm or alternatively only certain camps which are used for lambing.

Electric fencing is commonly promoted or used as an alternative method of keeping predators out of certain camps. Electric fencing may appear to be an ecologically sensitive method of predator management, however in most instances the lowest strand of the electric fence is 10-20cm above the ground, and at this height it causes a lot of mortality among tortoises which withdraw into their shells when shocked and are eventually killed by the repeated electrocution. There are reports that pangolins are also electrocuted by low strands. If electric fencing is to be used then the height of the live strands must be carefully assessed so as to avoid the unnecessary electrocution of small animals.

Cage Traps

The advantage of cage traps over other traps is that captured animals are not injured and non-target animals can be released unharmed. However, unless trapped predators are relocated, the use of such traps clearly does not qualify as a non-lethal method. Furthermore, if cage traps are not checked at least every day, then there is a high risk that trapped animals will die of dehydration, and in such circumstances there is little difference in terms of animal cruelty between cage traps and gin traps. However, if checked regularly, cage traps are the method of choice when livestock are being attacked and the damage-causing animal needs to be captured or removed.

Guard Dogs and Other Guarding Animals

Guard dogs have been heavily promoted as an effective non-lethal solution for predator control. Guard dogs remain with a specific herd of animals and contrary to popular belief do not actively hunt predators but rather deter intruding predators either simply by their presence or by barking at them. Guard dogs can reportedly reduce losses to predators by as much as 80%. However, many farmers report that the dogs are not the panacea they are made out to be. This appears to be related to the fact that the dogs require extensive training in order to be effective and many farmers do not have the time or requisite knowledge on appropriate training methods. Numerous farmers report dogs either attacking the livestock they are supposed to be protecting, neighboring farmers' livestock, wildlife or even farm workers. Given the apparent high frequency of failures,

the practicality of dogs at least under certain situations must be questioned and the attacks on wildlife certainly don't qualify such dogs as biodiversity friendly. Guard dogs have been very successful and are a viable option, if the required training is undertaken.

Donkeys and Alpacas are also used as guard animals as they are more alert than livestock and are aggressive towards predators. However, a shortcoming common to all guard animals is that they can protect only a limited number of animals, reportedly in the order of around 200 smallstock. For larger operators this poses a problem as herds may number in excess of 1000 animals. Breaking larger herds into numerous smaller ones is not a practical solution as this results in management problems as well as compromises the ability to implement effective rotational grazing.

Shepherds

A return to human guarding of livestock has many advantages. Shepherds walking with livestock can deter predators that attack the herd and report on problems such as plant poisonings and illnesses, thereby pre-empting a number of causes of livestock mortality. Shepherding has had a revival in Europe and would have a better image if shepherds were trained as specialists and worked in shifts to allow adequate family and social contact. Additional costs may include provision of accommodation at a number of farm stockposts.

Lethal Control Methods

Poisons

The use of poisons is a restricted activity in terms of Section 57 of the National Environmental Management Biodiversity Act 10 of 2004. All legal poisons are regulated by the Hazardous Substances Act 15 of 1973. Abuse of agricultural chemicals is "controlled" by the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act 36 of 1947, with associated Government Gazette regulations 1716 dated 26 July 1991 and regulation 181 dated 7 February 2003.

The only poisons that may legally be used are:

- Sodium cyanide in "coyote getter" devices, subject to permit conditions;
- strychnine in meat baits, under permit via State veterinarians and provincial conservation authorities, and
- sodium monofluoroacetate (1080) in livestock protection collars.

Poisons have been a popular control method for predators, however the ecosystem effects of poisons are extensive and it is highly likely that the use of most poisons will be banned in the near future. It is already illegal to use poisons to control predators in the Western Cape and it is likely that other provinces will follow this example shortly. Practices which were widespread in the past such as poisoning whole carcasses are to some extent to blame for the current highly negative attitude towards poisons. The use of poisons has improved significantly since then and Single Lethal Dose Baits (SLDBs) are in common use for predator control in many parts of the world. However, such baits are not selective in terms of which individuals they target and thus cannot play a large role in problem animal control. The primary utility of such baits is in population suppression efforts. As such their use cannot be considered acceptable. Even with the use of pheromone lures which are species-specific, the value of such poisons is questionable. The use of agricultural pesticides to kill predators is illegal, causes the animals a painful death and is highly undesireable for a host of other reasons. Poisons such as organophosphates are transferred via scavengers and insects to many organisms in the veld.

Gin Traps/ Leghold Devices

The use of gin traps has also recently been banned within the Western Cape, however, due to opposition from landowners it is unlikely other provinces will follow suit in the immediate future. Gin traps are generally considered to be cruel and inhumane due to their non-selective nature and the damage they cause to animals' limbs. Recently, gin traps have been developed that cause less tissue damage, these are known as soft-hold traps and all conventional gin traps should be replaced with this type of trap. Problems with this type of trap do however still occur as certain animals have a tendency to chew off the limb caught in the trap. As with cage traps, gin traps should be checked every day, preferably early in the morning as well as the afternoon.

Hunting

Hunting at night with lights has been banned in the Western Cape, although hunting during the day is still permitted with a permit. However, hunting is one of the few control methods that is truly selective in that only certain species or individuals can be targeted. If properly done, hunting is an effective control strategy that has few ecological side effects. However, it is important to point out that hunting should not be used as a blanket approach to reduce predator numbers. As with other control strategies, only problem animals should be targeted. In addition, it is unacceptable to hunt smaller predators and insect eaters such as Cape Fox (Draaijakkals), Bat-eared Fox (Bakoor) and African Wild Cat (Groukat). These animals are known to only very rarely take newborn lambs and the limited damage they may occasionally cause does not warrant indiscriminate extermination.

Poison Collars

Poison collars are perhaps the only truly selective method in that they kill only the predators which attack the livestock. However their further use is under threat if a blanket ban on poisons comes into effect. Older-type collars with carbofuran as the active ingredient should not be used as these collars can lead to secondary poisoning. In one case, 22 vultures were poisoned after feeding on a sheep carcass fitted with one of these collars that had been killed by a jackal. Newer type collars with 1080 (sodium monofluoroacetate) as the active ingredient are preferable. However, as with all poisons, there is the potential for misuse and environmental contamination, and so care should be taken with their use and especially their disposal.

Hunting Dogs

Hunting packs of dogs have been used extensively in the past to track down and kill jackal and caracal. However, dogs are not selective and commonly kill other non problem causing animals such as Cape Fox and Bat Eared Fox. Hunting packs are no longer considered an acceptable control method.

Key Information Sources

Animal Damage Control Institute. http://www.jackal.co.za/

Endangered Wildlife Trust . Wildlife Conflict Management Helpline at cell: 082 802 6223.

Predators and Farmers. Endangered Wildlife Trust. For copies e-mail: wcpg@ewt.org.za, or contact them at tel: (011) 486 1102

Locust Control

Most parts of the Karoo and Northern Cape are subject to sporadic locust outbreaks. The outbreaks are to some extent unpredictable, but are associated with certain rainfall events and caused by one of four different locust species. The brown locust (*Locustana pardalina*) is the most common and significant threat to agriculture. Currently, control of locust swarms is managed by the National Department of Agriculture who contract control activities out to private spray operators who obtain the various pesticides used from DoA depots around the country. To give an idea of the scale of control that occurs in years when outbreaks occur, in the 1994/1995 campaign, more than 60 000 hopper bands and 10 000 adult swarms were controlled, amounting to an estimated 280 thousand million locusts.

Although the damage that locusts cause may appear severe and be detrimental to the individual farmer who's land has been affected, there are several issues that need to be considered

regarding their control. Firstly, the cost of control is usually an order of magnitude greater than the value of the forage that the locusts consume. Furthermore, control during one outbreak does not appear to reduce the severity of the following outbreak. Control continues despite these discrepancies because the cost of control is borne by the state while the benefit accrues to the farmer. Thus locust control occurs largely as a result of political expediency rather than economic consideration. Secondly, locusts play an important ecological role in nutrient cycling and form an important part of the food chain. In the past, the chemicals used for locust control were highly damaging to the environment and persist in the karoo environment today. These days, the chemicals used, primarily deltamethrin, has much less of an ecological side effect, with low toxicity on birds and mammals. These chemicals nevertheless impact other non-target invertebrates and so it doubtful that they can be considered to be as "ecologically friendly" as is sometimes claimed. Consequently, we consider the following to be best practices regarding locust and other insect pest control:

- Control should only be initiated when locusts become a serious problem. Natural predators will be attracted by smaller swarms and will bring them under control.
- Only the recommended pesticides should be used and only in the prescribed manner.
- No control should take place in sensitive ecosystems such as vleis and wetlands.
- As a general rule, chemical control of locusts on natural vegetation is not warranted. Physical control measures can be applied if desired and the locusts can even used as a fodder or fertilizer source.
- Pesticide use is warranted only when locusts threaten high-value cultivated crops.

Key Information Sources

Department of Agriculture. 1998. Policy for managing the locust problem in South Africa. http://www.nda.agric.za/docs/locustpolicy/locust.htm

Samways, M.J. 1999. Can locust control be compatible with conserving biodiversity? Editors: Lockwood, J. A., Latchininsky, A. V., Sergeev, M. G. Grasshoppers and grassland health: managing grasshopper outbreaks without risking environmental disaster. Proceedings of the NATO advanced research workshop on acridogenic and anthropogenic hazards to the grassland biome, Estes Park, Colorado, USA, 11-18 September, 1999.

Stewart, D.A.B. 1997. Non-target grasshoppers as indicators of the side effects of chemical locust control in the Karoo, South Africa. *Journal of Insect Conservation* 2: 1-13

The Northern Cape Nature Conservation Act is currently being drafted and is currently available for public comment. The Act will regulate the wildlife and hunting industry in terms of fencing specifications and the corresponding animal species that may be kept as well as the regulations for professional hunters, wildlife translocators, taxidermists and vermin hunters. The Act does not however prescribe maximum stocking rates, appropriate species or any other factors regarding the ecological management of wildlife.

Wildlife has become an increasingly important component of many farming enterprises. However, the commonly-held perception that wildlife represents a more ecologically-sound form of landuse is definitely not a valid generalization. The use of inappropriate species, overstocking and poor management mean ranching with wildlife often poses the same threats to biodiversity as livestock farming and in fact veld condition on game farms is frequently lower than that on adjacent livestock farms. The major ecological problems associated with wildlife management generally centre around the use of inappropriate species and managing the distribution of wildlife impact.

The major factors that need to be considered with regards to game farming or keeping game as part of a mixed enterprise include the following:

- So-called game farms which are not internally fenced should be large enough to accommodate the ecological processes required to sustain free ranging game. This includes a consideration of the minimum area required to maintain a socially functional group of each species.
- Appropriate species should be used. In many cases species are introduced due to their esthetic appeal and ability to attract tourists rather than their ecological suitability for the area. Species kept beyond their natural distribution are known as extra-limital. This is a particular problem with larger herbivores which can cause considerable ecological damage to an area. Extralimital species are defined and legislated against in the latest National Biodiversity Act legislation dealing with alien invasive plants and animals.
- There should be sufficient forage available for each species present. In some cases species are introduced without proper consideration of their dietary requirements, resulting in over-use of the browse or grazing resource utilized by the specific species. In some cases, such animals end up being supplemented with forage such as lucerne in order to keep them alive. Such a situation is clearly not a sustainable practice and can lead to long-term damage to the vegetation.

- Stocking rates must be properly considered in terms of the different animal species present as well as the available habitat likely to be utilised by each species. Appropriate stocking rates can seldom be calculated based on the entire area of the property as there are frequently different landforms or vegetation types present, some of which will be avoided by different types of animals.
- Stocking rates for game should be more conservative than those recommended for livestock. Livestock are intensively managed and rotated through numerous camps during the course of a year, giving the vegetation of each camp time to recover. It is usually difficult to control the movement of game and so grazing under game is effectively continuous. This can have a large negative effect on long-term vegetation composition if stocking rates are not very low.
- It is important to recognize that only certain game species need to drink water. While the distribution of these animals can be regulated by changing the availability of water, it will have little effect on the water independent herbivores such as gemsbok.
- Providing fewer, widely spread water points is preferable to many water points. This ensures that that some lightly grazed areas between water sources remain which can be used exclusively by water-independent ungulates and other non-game wildlife, as well as serving as refuges for grazing-sensitive plants. Since most water-dependent game species range 8-10 km from water, water points should not be closer than 16 km apart. Such a large distance is seldom available on the average private farm and represents one of the largest obstacles to sustainable wildlife ranching.
- As with traditional livestock ranching, good monitoring and record keeping is essential. This should involve regular veld monitoring as well as game counts on at least an annual basis. If large browsers are present, veld monitoring should also include the available forage on large trees, which is not normally an important component of rangeland monitoring for livestock.

Key Information Sources

Coetzee, K. 2005. Caring for natural Rangelands. University of KwaZulu-Natal Press. (order book from books@ukzn.ac.za or contact author Ken Coetzee, Conservation Services Tel 044 –870 8472, consken@mweb.co.za)

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7. Infrastructure

This includes infrastructure associated with farming activities, such as roads, dams, watering points, quantity and type of fencing and livestock handling facilities.

Roads

In general, the construction of farm roads does not require authorization, except if the road is wider than four meters or if it occurs within a critically endangered or endangered ecosystem. However, whenever a new road it to be constructed the local authorities should be consulted as the legislation covering these activities is currently under review.

The construction and maintenance of all farms roads should strive to meet the following criteria:

- Have a minimum impact on the environment and be visually unobtrusive.
- The potential for erosion should not be underestimated.
- Erosion can be minimized by avoiding constructing roads on steep slopes, or where this can't be avoided the design; construction should include appropriate erosion control and water diversion structures.
- Bulldozing of farm tracks should be avoided as removal of plants in the "middelmannetjies" results in death of roots that hold soil and thus increased erosion risk.
- Wetlands, riparian areas and other sensitive habitats such as quartz patches should be avoided.
- Existing roads should be maintained to prevent their erosion.
- Measures should be taken to facilitate the rehabilitation of disused roads that channel water leading to donga development..

Watering Point Design

The concentration of livestock impact that is associated with watering points is usually visibly manifested as a loss of perennial plant cover around watering points. This can increase the susceptibility of these areas to erosion. In arid regions, watering points also often attract a lot of

birds and wildlife which can be negatively affected by poor watering point design. To avoid such negative effects, the construction of watering points and associated reservoirs should take the following factors into account:

- Avoid being located in areas such as steep slopes where they will promote erosion.
- Should be able to provide water at an adequate rate for the number of animals that typically use the watering point. If the watering point is too small or the flow rate into the trough too low, then it causes animals to linger in the area for longer as they wait for an opportunity to drink. This promotes trampling and overgrazing around the watering point.
- In very large camps there should be more than one watering point so that less animals use each watering point. Alternatively, the water supply can be alternated between two or more watering points, so that animal impacts are concentrated around a different watering point during each grazing event.
- Reservoirs should either be covered with shadecloth or some other material that prevents wild animals from gaining access to the reservoir or should have some kind of mechanism such as a pole within the reservoir, that can be used by animals and birds to drink from or escape from the reservoir should they fall in. It is common for large raptors such as vultures to drown in reservoirs or for animals such as dassies and baboons to fall into reservoirs while trying to get water.
- Watering points surrounded by a small fence (ca 20x20m) also helps to prevent animals from lingering around the watering point and reduces the extent of the highly disturbed area.
- Troughs should be designed so that animals such as tortoises cannot get into the trough or so that they can easily get in and out the trough. It is common for tortoises to climb into low watering troughs and then get stuck and drown in the water.

Groundwater Pollution Risk

Infra-structure such as kraals, watering points and dip tanks represent potential sources of groundwater pollution. The poisons in dip tanks can contaminate groundwater, while kraals and watering points create sites with high dung densities which can cause nitrite pollution of groundwater. In both cases, such pollution represents a risk to the environment as well as a health risk to humans and animals drinking such groundwater. The risk of pollution is related to soil texture as well as the permeability of the bedrock and the depth of the groundwater. Coarse sandy soils, typical of much of the Namakwa District, increase the risk of pollution as do highly permeable basement types such as limestone. Shallow aquifers such as occur along most of the ephemeral rivers of the Namakwa District, are also particularly vulnerable to pollution due their shallow nature as well as the coarse sands that usually overlie these alluvial aquifers. The

construction of any infra-structure likely to pose a potential threat to groundwater quality should avoid such sensitive areas.

When choosing a site for dipping tank, an animal kraal or livestock watering point:

- Choose areas that do not have a shallow water table.
- Choose areas that are not close to a borehole, well or spring.
- Choose areas that are not upslope of a borehole, a well, a spring or exposed fractured bedrock.
- Areas with low permeability soils are preferable to sites with coarse sands, or gravel or areas underlain by fissured bedrock.
- Avoid sites where runoff from a kraal is likely to enter a stream or wetland.
- If a kraal is likely to receive or generate a lot of runoff then rainfall runoff diversion ditches should be constructed upslope and down-slope of the kraal. The upslope diversion ditches are to lead runoff water away from the kraal, and the downslope ditches should divert contaminated water into a treatment facility such as an oxidation pond.
- Stock dipping tanks must be located far away and not upslope of any borehole, well, spring, sinkhole, quarry or exposed fractured bedrock.
- Stock dipping tanks should be located over impermeable soils, and the seasonal high water table should be at least 3 meters (in impermeable soils) below the ground at the base of the tank.

For more information on groundwater use and protection best practices, DWEA (Previously DWAF) has a number of handbooks and information resources available for download from their website:

http://www.dwaf.gov.za/default.asp

Key Information Sources

Coetzee, K. 2005. Caring for natural Rangelands. University of KwaZulu-Natal Press. (order book from books@ukzn.ac.za or contact author Ken Coetzee, Conservation Services Tel 044 –870 8472, consken@mweb.co.za)

DWAF. 2004. Guidelines on Protecting Groundwater from Contamination. Published by Department of Water Affairs and Forestry. http://www.dwaf.gov.za/dir_ws/tkc/vdFileLoad/file.asp?ID=213

Rivers & Wetlands

Rivers and wetlands are sensitive habitats that are rare in the landscape and often experience heavy land-use pressures. Intact rivers and wetlands provide key ecological services such as maintaining a clean water supply and preventing soil erosion. Rivers and wetlands should receive special management attention. In particular, the following should be activities should be addressed

- In view of the national water shortage, all water abstraction from a river or underground source must be registered with the Dept. of Water Affairs & Environment (DWAE).
- All water catchments, including wetlands, are protected and may not be disturbed or polluted in any way that will impede their natural function.
- It is illegal to interfere with the flow regime of a river or wetland by canalizing waterflow, digging drainage ditches or infilling by dumping soil and rubble, without written permission from the relevant authority.
- Buffer areas of undeveloped land that are free of alien plants should be retained around wetlands and along water courses.
- The buffer width around wetlands depends on the characteristics of the wetland, but 25 - 75m is recommended.
- Buffer zones along rivers and water courses (riparian zones) should ideally be 30 – 40m wide. The well-being of river ecosystems is largely dependent on the health of the adjacent natural vegetation (or “riparian habitat”). Riparian vegetation stabilises the riverbank, filters pollutants, helps maintain a natural water temperature, contributes organic matter in support of aquatic life and acts as a buffer to adjacent land uses.
- Farm dams with a capacity >10 000m^3 must be registered and dams with a capacity >50 000m^3 must be licensed with Department of Water Affairs & Forestry.
- Grazing pressure in wetlands should be closely monitored to avoid overgrazing and erosion. Ideally wetlands should only be grazed from mid-summer to autumn (December to April). Grazing of wetlands by cattle during the winter and spring can be especially damaging due to the negative effects of their hoof-action on the soft soils and should be avoided.

For Wetland delineation: Use 'A practical field procedure for identification and delineation of wetlands and riparian areas' (DWAF 2003) at www.dwaf.gov.za

Rare Species & Conservation Awareness

Many farmers are privileged enough to have populations of rare or endangered species on their properties. Especially within the Succulent Karoo portions of the Namakwa District, there are many such species which do not occur inside any conservation areas and rely entirely on favourable landuse for their continued survival. Farmers should strive as far as possible to learn about the different vegetation types on their properties and whether or not there are any rare habitats or species on their properties. Typical examples of sensitive habitats which often contain an abundance of rare or endemic species include quartz patches, rocky inselbergs and springs or other types of wetlands. Examples of rare and endemic species that occur in the Namakwa District include the Riverine Rabbit, Padloper tortoises and many small succulents such as Conophytums and Lithops.

Farmers should strive to contribute as far as possible to the conservation of such species and habitats. This includes the following actions:

- Identify any sensitive or unique areas on their farms.
- These habitats should be carefully managed and if necessary, even fenced off.
- Understand how their management practices are likely to impact these species or habitats.
- Do not allow indiscriminate access to such sites. Although these species can often serve as an incentive for tourists to visit the area, the impact of tourism should also be carefully monitored as increased access to such areas can encourage illegal collection of reptiles or succulent plants.

Other general management guidelines that every farmer should implement include

- Educate farm labourers as to the benefits of wildlife occurring on the farm and do not allow any hunting or trapping of wildlife on the farm.
- Do not allow dogs to roam free on the farm.
- Ensure that all hunting on farms is in accordance with the provincial nature conservation legislation.

Finally, all farmers should strive to establish conservancies in their districts, not only does this encourage communication and information sharing among farmers, but there are also several advantages to belonging to a conservancy. Nature conservation officials are obliged to attend conservancy meetings as well as advise the conservancy on any matters relating to conservation or legislation. Furthermore, conservancies have more leverage in obtaining state aid for alien clearing programs or rehabilitation efforts, and greatly increase the marketing potential of a district.

For any information about conservancies or how to establish a conservancy visit the homepage of the National Association of Conservancies/Stewardship South Africa: http://www.nacsa.org.za/