Sustainable Mohair Production Guidelines

CERTIFIED SUSTAINABLE MOHAIR

SA Mohair Growers Association
SA Sybokhaarkwekersvereniging

MOHAIR SOUTH AFRICA

Green Choice
Serving Nature's Bounty

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Foreword

The world is faced with desperate challenges to overcome the effects of climate change and the over utilization of our natural resources. In support of this, a new look at the measures of sustainability with on-farm production systems is necessary to install confidence in the broader consumer markets wanting to know that products were produced in systems where the natural resources are not depleted and wasted. These guidelines demonstrate such best practices for economical, environmental, animal care and social accountability and are supported by a voluntary assessment model that allows producers to assess their farming practices.

The main drive is for Mohair producers to be committed to a continuous plan to improve their practices and to be in a position to demonstrate that they are actively working at moving in the right direction. Linked to this is a drive to develop efficient technologies that will enable producers to make progress in ensuring a sustainable supply of the Mohair Fibre. I would like to thank Mohair producers and the various institutions that enthusiastically contributed to the development of the guidelines and assessment checklist.

These guidelines will contribute to a more **profitable** and **sustainable** Mohair industry.

Deon Saayman
Executive Director of Mohair South Africa

Preface

South Africa produces ± 53% of the world's Mohair and Mohair South Africa (SA) assumes a leading role in the development of the global industry. The industry aims to expand still further. It is taken into consideration that Goat *grazing can lead to the degradation of some thicket types within the Subtropical thicket vegetation, which is irreversible without intervention*[24]. If the Mohair industry is to be sustainable, this and other agricultural and biodiversity resources must be conserved and where necessary and possible, restored. The existence of global climate change adds to the imperative of sustainable agriculture use. The purpose of this document is to describe sustainable good practice standards to serve as a foundation for audit and certification systems of Mohair producers, brokers, processors and manufacturers. Suggestions are made regarding the involvement of producers in participatory action research to help conserve our agricultural resources. The guideline will be regularly updated to reflect ongoing research.

Compliance with integrated, industry standards will add to the credibility of the South African Mohair industry as world leader in ethical and sustainable Mohair production.

Introduction

Mohair production in South Africa is largely extensive in nature, with many production landscapes being rich in plant and wildlife. As a result the Mohair industry has considerable potential as custodians or stewards of these landscapes, both in terms of the agricultural resource (vegetation, soil and water) as well as biodiversity assets. The Mohair producers have expressed the need for a production and market integrated approach that differentiates the Mohair industry as a sustainable, biodiversity-friendly, clean and ethically compliant industry. This is in line with changing national and international markets where sustainability is increasingly a requirement for market access.

As a result, these guidelines comply not only with social and environmental legislation but also recognize the transformation of Subtropical thicket, the vegetation upon which the Mohair industry largely depends. In addition, these guidelines take climate change and energy sources into account.

Mohair is mainly produced in the south-eastern and western regions of South Africa. This is an area of ca. 9.8 million ha and represents no less than 6 biomes (AGIS, 2008). Albany thicket, Succulent Karoo, Grassveld and Nama Karoo can be regarded as the most important of these. The main Mohair producing region in South Africa (Fig. 1) can be described as being unique with a huge diversity of plant and wild life. Large game, e.g. kudu, is ubiquitous in this region and protected predators such as leopard roam the Southern mountainous regions. Farmers are also confronted with predators, e.g. jackal and caracal, which are ideally managed in a non-lethal manner.

The following on-farm principles are addressed in this document:

1. Economic
2. Environmental
3. Animal-wellbeing
4. Social

Each of these **principles** is expanded into various **criteria** and **indicators**. It is intended that this guideline will ease the path of producers on their journey towards good agricultural practice, while enabling producers to prepare for third party audits should they choose to certify their products. Independent industry assessments or certification hav e become the norm with the application of track and trace models like 'Historic Futures', which trace products from production to retail level. The guide will likely also enhance communication between various sectors within the industry.

The guideline text provides background information on the principles, criteria and indicators while **self assessment checklists** incorporate all the principles of the main text by listing the suggested indicators, thus enabling a quick self-audit of compliance. Where applicable, reference is made to organic production indicators. In all sections of this document, Mohair producers must comply with the relevant legislation referred to in this document.

This document has been aligned with industry relevant standards such as Mohair SA standards, several certification systems (organic; EU; Global GAP) as well as the generic Living Farms Reference[23] (a Green Choice project produced as a partnership between the World Wide Fund for Nature and Conservation International) and has been developed with the support of the following institutions:

- The Mohair Growers Association of South Africa
- Mohair SA
- The National Woolgrowers Association of South Africa
- Department of Agriculture, Forestry and Fisheries – Grootfontein
- Department of Agriculture, Forestry and Fisheries – Pretoria
- Elsenburg – Provincial Department of Agriculture, Forestry and Fisheries (Western Cape)
- Ecocert
- The Livestock Health and Production Group of the South African Veterinary Association
- Cape Nature
- Conservation International (via the Green Choice Alliance project)
- World Wide Fund for Nature (via the Green Choice Alliance project)
- The Biodiversity and Wine Initiative
- Endangered Wildlife Trust
- The NSPCA
- Woolworths

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Contents

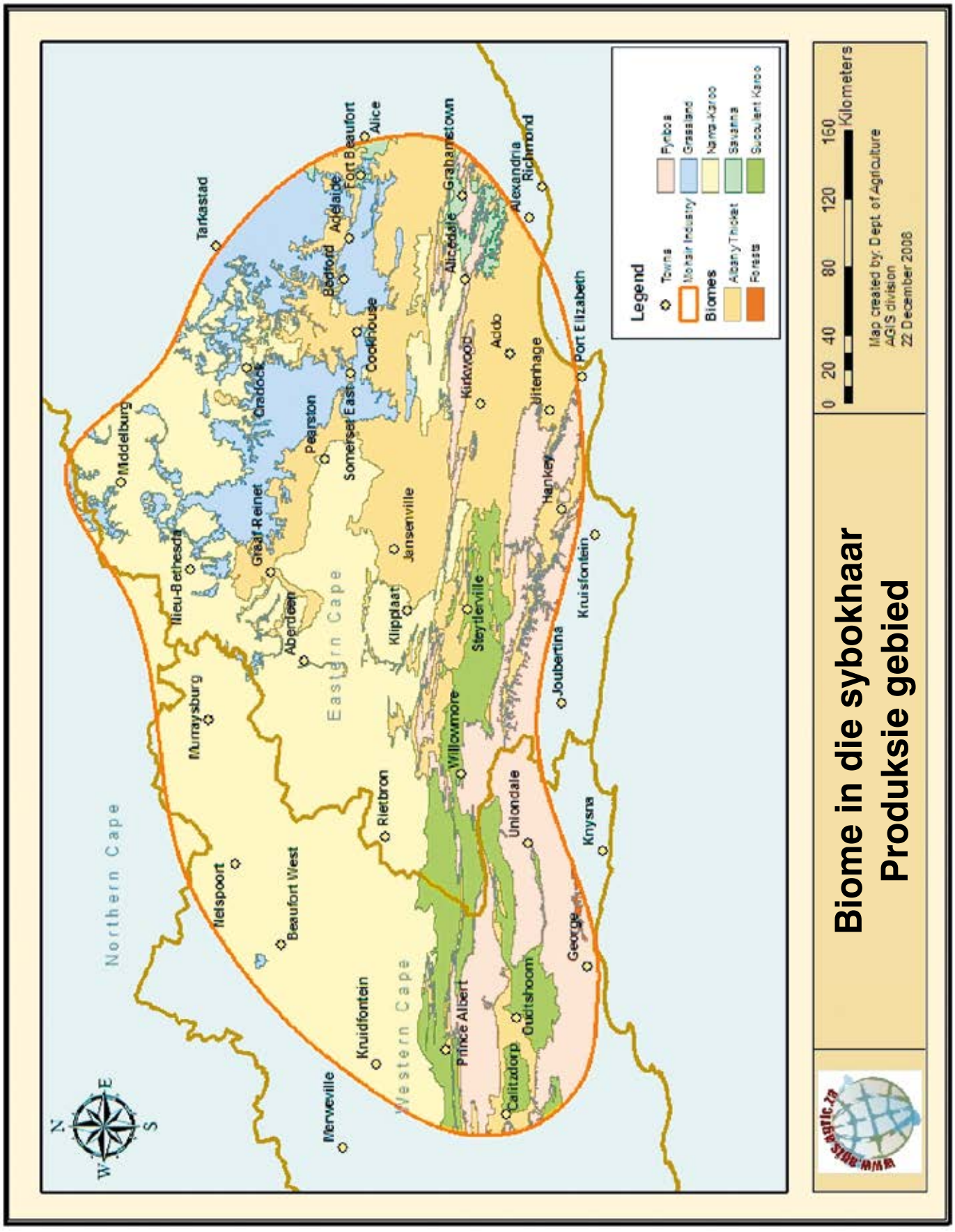


Fig. 1 Biomes in the Mohair production region of South Africa. For a detailed vegetation map as defined in the STEP (Subtropical Thicket Ecosystem Project) go to http://bgis.sanbi.org/step/vegetation.asp. Register on the website beforehand.

1. The Economic Principle

The economic principle is that an economically viable farm production is maintained or enhanced, i.e the agronomic, livestock, veld and forage resources and practices of the farm are all integrated with the climate, soil, water and topography to maintain or enhance sustained economic return to the producer. Criteria within this principle were drawn from various sources[14,15] and can be expanded as:

1.1 A record keeping strategy is in place

Records should be kept of the various facets on the farm with the focus on Integrated Livestock Management, which means active record-keeping by the producer of animal well-being, veld condition, pests and diseases. Record keeping also facilitates good practice in terms of traceability which is increasingly becoming a marketing requirement.

1.2 A written land use plan exists

The farmland should be mapped and environmental risk factors like buffer zones should be identified. Climate change should be recognized and strategies for mitigation and adaptation should be developed and implemented.

1.3 Profitability of the farming operation is planned annually

To be economically sustainable it is necessary that a farm vision, farm land use plan, marketing strategy and accompanying financial plan is developed and annually revised. Production information and records of production, losses, assets and liabilities, as well as income and expense must be continuously recorded. Financial year records must be kept to calculate the value of short- and long-term production decisions, also in relation to other farming activities on the land. This will enable continuous improvement and active management of the farm. This can be as simple as keeping one's own records, or be more complex where staff who utilize financial software are employed, depending on the size of the operation.

1.4 Production potential of the land is maintained and ecosystems are protected

A sustainable business is dependent on sustainable land use. Tax incentives are offered to farmers entering into stewardship agreements.

1.5 A climate change strategy is in place

The effects of climate change are recognized (e.g. reduced or increasingly erratic rainfall) and where possible a strategy to mitigate or adapt is formed. Where SA producers can show their soil carbon percentages have increased, a future *potential* exists for economic returns from carbon trading.

1.6 An energy strategy is in place

Energy efficiency and reduction in green house gas emissions is practiced by e.g. employing renewable energy resources (solar, wind).

Financial opportunities for good land management

Reduced rates
Participation in The Stewardship Programme by proclaiming a Nature Reserve will give you zero based rates.

Reduced risk
By belonging to Fire Protection Agencies (FPAs) one receives support in fire management and is not liable for fire damage.

Ecosystem Services
Ecosystem services are the benefits that humans obtain from ecosystems. The vast majority of these services are usually taken for granted, but they are essential for human wellbeing.
The Millenium Ecosystem Assessment divided ecosystem services into four categories and this has provided a framework for ongoing studies of ecosystem services:

- Provisioning services (e.g. water, food, drugs and genetic resources)
- Regulating services (e.g. flood attenuation, herbivory, pest control and pollination)
- Supporting services (e.g. primary production, nutrient cycling) and
- Cultural services (e.g. recreational, spiritual and cultural benefits)

2. The environmental principle

Society derives many essential goods and critical, life-supporting services from ecosystems.

In an extensive livestock industry such as Mohair production, proper management of agricultural resource (soil, water and veld) will contribute to maintenance of biological diversity, ecosystem functioning and thus, ecosystem goods and services. If conducted properly, livestock production is often the most appropriate land use for range and grasslands.

There are concerns regarding the grazing of goats in the Subtropical thicket, as goat grazing has in some places in the past led to extensive transformation of this vegetation. While restoration of thicket has been undertaken by some producers, others remain unaware of the unsustainability of converting an intact, closed canopy succulent thicket into a so-called pseudo-savanna, where only a few remnant trees remain. Producers may even consider this pseudo-savanna better for production, being unaware that this state of the vegetation is unstable and merely represents an intermediate stage in a trajectory towards a highly degraded state where only the ephemeral grasses and forbs persist[24].

Producers are urged to restore succulent thicket where possible and to become involved in participatory action research (see text box).

In addition, these guidelines aim to promote setting aside of conservation areas with producers ideally belonging to a stewardship program so that fauna and flora are protected into perpetuity. Besides the protection of critical ecosystems, appropriate fire, soil, water, alien plant eradication, reduced waste, reduced fertilizers will protect the biological and agricultural resources alike.

Thus, the environmental principle is that (i) agricultural and biodiversity resources are protected/sustainably used, (ii) critical ecosystem services and ecological processes are maintained and (iii) natural assets are conserved. Criteria within this principle were drawn from various sources[1, 2, 3, 8, 14] and can be expanded as:

2.1 Agricultural and biodiversity resources are protected/sustainably used

Section 29 of the Conservation of Agricultural Resources Act, Act 43 of 1983 (CARA) allows the Minister to publish certain regulations that achieve the objectives of the Act, viz. to provide for the conservation of the natural agricultural resources by the maintenance of the production potential of the land, by the combating and prevention of erosion and the destruction of the water resources, and by the protection of the vegetation and the combating of weeds and invader plants. Regulations have been published (GN R1048 GG 10029 of 25 May 1984 as amended – GN R280 GG 22166 of 30 March 2001).

Participatory Action Research

Your help is needed to develop better management guidelines for Subtropical thicket.

Contact: HJ Hawkins (hhawkins@conservation.org)

2.1.1 A written land use plan exists

A land use plan should identify erodible soils, waterways, vegetation types, alien plant infestations, topography and farmed and conserved areas. Different soils have different erodibility potential and can be categorised accordingly (well-structured soils with a high clay content tend to be more resistant to erosion than sandy non-structured soils). Usually the land use plan would comprise of a map and depending on the scale of operation, this would be supported by text.

2.1.2 Soil health is maintained or, where necessary, improved

The CARA legislation aims to ensure that soil health is maintained or improved through appropriate agricultural practices. Soil health is a concept that embraces the chemical, physical and biological functioning of soils (Lanz, 2009), a proxy of which is soil carbon (according to Leu, 2007). Farming practices that may result in increased carbon include: Minimum and mulch tillage, try to maintain cover at all times, use of nitrogen sources with a carbon source such as composts, animal manures, green manures and legumes; reduced use of biocides that affect beneficial micro-organisms that build humus, suppress diseases and make nutrients available to plants.

> *"Increased soil C resulted in higher livestock production"*
>
> Richardson D 2009 Presentation at GreenChoice – Grasslands Sustainable Livestock Forum

However, the first step towards maintaining soil health is to minimize soil erosion and this is the only soil parameter that can be reasonably legislated, most of which apply to cultivated land. Most Mohair production in SA is extensive and these measures are explained eslewhere[14]. Soil erosion may however be influenced by infrastructure on-farm: Heavy machinery, should be avoided when conditions are wet as compaction can occur, breaking down the soil structure; roads must be sited, constructed and maintained to minimise soil loss. Routes should be selected to avoid sensitive areas such as indigenous forests, special natural plant communities, breeding sites, wetlands, archaeological or historical sites and other natural assets. Construction of river crossings should not result in concentration of the flow of the water in the river, and roads should not interrupt the hydraulic flow of a wetland. Roads should cross watercourses at right angles and the approach and departure verges should be grassed. All roads must be adequately drained, and the drains either grassed or paved. The correct number of drains must be constructed to meet the slope requirements of the road. Road culverts and farm bridges should accommodate 1:10 year flood or 1:20 year flood (primary road). Should a bridge, culvert or road affect the watercourse in terms of section 21(c) and 21(i) of the National Water Act, it may be necessary to apply for a water use licence. However, there is a provision under the General Authorisations which may ease the need for licensing under certain conditions (GN 26187 GG 398 and 399 of 26 March 2004, www.dwa.gov.za).

2.1.3 Water resources on the farm are managed to conserve water and that water use is legal

The National Water Act 36 of 1998 (NWA) is the primary legislation regulating water use in South Africa and recognizes that we need to use our water supplies efficiently and effectively. Producers should determine which categories of water use (as listed in section 21 of the Act) are applicable to their farming enterprise (www.dwa.gov.za).

Ecosystem goods and services

Goods:
- Fodder
- Wood
- Water
- Wildlife

Services:
- Water purification
- Prevent erosion
- Soil nutrient cycling
- Soil carbon storage
- Pollination of crops by birds, insects and mammals
- Control of pests

Tools to use water sustainably include indicating waterways and sources on the land use plan, removal of infestations of invasive alien plants, monitoring of groundwater levels, effective irrigation, dam construction, inter-basin transfers to bring water from areas of surplus to areas experiencing shortages as well as water trading and relocation of water use by compulsory licensing.

Irrigation uses ca. 56% of all our water but is minimal in livestock production. Water for stock is a constitutional right in South Africa. Extensive livestock production, like dryland agriculture does not need authorisation for water use and is not, at present, controlled under the NWA.

The following is recommended:
- Sufficient veld cover must be maintained to retain moisture and to prevent erosion.
- Water resources must be sustainable and sufficient for farming requirements. Where necessary, water should be tested for quality and supply should be monitored e.g. boreholes should be tested and used to capacity.
- The quality of water must be sufficient for animal use.
- Windmills should be provided with automatic breaks to conserve water when dams are full.
- Contamination of water sources must be prevented and special care should be taken to limit or prevent harmful effluent.

The following categories of water use (as listed in section 21 of the Act) are applicable to a farming enterprise.

Schedule 1 Water Use

Water use is authorised in terms of that use being a Schedule 1 activity as defined in the National Water Act 36 of 1998 viz.
- water is taken from a water resource to which that person has lawful access for domestic use, small gardening not for commercial purposes and the watering of animals (excluding feedlots).
- water is stored and used from run-off from a roof.

It does not require that a user should apply for a licence.

Existing lawful water use

Existing lawful water use is consistent with use during the two years prior to the promulgation of the National Water Act on 1 October 1998. Water use must be registered with DWA who will in turn validate and verify that water use. Validation confirms how much water the user was actually using in the qualifying period, how much has been registered, as well as how much is currently being used. Verification determines the extent of existing lawful water use. In effect this determines if any previous laws would have limited the use on the qualifying period. If not, the use in the qualifying period is lawful. If not registered, water use is unlawful.

General Authorisation of Water Use

Water use is authorised in terms of a General Authorisation published under the National Water Act 36 of 1998.
- The taking and storage of water is within certain limits and satisfies certain conditions as outlined in the Government Gazette No. 26187 No.399 published on 26 March 2004.
- The disposal of waste in a manner which may detrimentally impact on a water resource is permitted provided that the disposal is within certain limits and conditions as outlined in Government Gazette No. 26187 No.399 published on 26 March 2004.
- Impeding or diverting the flow of a river in a watercourse is permitted provided that the action and use meets certain provisions and conditions as outlined in Government Gazette No. 26187 No.398 published on 26 March 2004.
- Altering the beds, banks, course or characteristics of a water course is permitted provided that the action and use meets certain provisions and conditions as outlined in Government Gazette No. 26187 No.398 published on 26 March 2004.

NB: The taking of water from a wetland is never permitted under a General Authorisation and therefore requires a licence.

Licensed Water Use

Water use is authorised in terms of a licence issued under the National Water Act 36 of 1998:
- Taking and storage of water should be licensed unless constituting a Schedule 1 use or unless in terms of a General Authorisation, in which case it should be registered.
- The impeding or diversion of the flow of water in a watercourse should be registered and licensed provided such use does not fall within a general authorisation (which may require registration) or an existing lawful water use.
- The alteration of the bed, banks, courses or characteristics of a water course should be registered and licensed if such use does not fall within a general authorisation (which may require registration) or an existing lawful water use.
- The disposal of waste in a manner which may detrimentally impact on the water use should be registered and licensed provided such use does not fall within a general authorisation (which may require registration) or an existing lawful water use.

2.1.3.1 Wetland and water course protection

Wetlands are defined in the NWA as "land that is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which or would under normal circumstances support vegetation adapted to water logged soil.

Wetlands, vleilands, marshes, water sponges and water courses are protected in terms of Regulation 7 of CARA and the NWA:

- Utilisation of vegetation in a wetland (vlei, marsh or water sponge) must not damage the agricultural resources (defined as the soil, the water sources and the vegetation, but excluding weeds and invader plants).
- Utilisation of vegetation within the flood area of a water course or within 32m (NEMA) horizontally outside the flood area must not damage the agricultural resources.
- No cultivation or drainage of wetland, including land within the flood area or within 32m (NEMA) horizontally outside the flood area of a water course is permitted, unless authorised by the executive officer of the appropriate agricultural department, and unless activities took place prior to 1 June 1984. However, land must still be protected against excessive soil loss due to erosion through the action of water.

2.1.3.2 Wetland Management

DWA have published a guide to the identification of wetlands using soils, vegetation and position in the landscape obtainable at www.dwa.gov.za. Wetland soils can be defined as an area that is flooded for a sufficiently long period for waterlogging to become the dominant factor determining the diagnostic characteristics of the soil, with the presence of mottling or gleyed horizons due to the anaerobic conditions.

Farmers should identify wetlands and watercourses, map them and protect or rehabilitate as appropriate. Thus wetlands should not be planted to crops, alien invader plants should be removed, and burning and grazing should be controlled.

2.1.3.3 Riparian zone management

The presence of riverine, fringing woody plants or reeds, bulrushes, sedges and hygrophilous grasses are clear indications of the presence of a watercourse that should not be planted to crops to within 10m of the banks of a watercourse (CARA, Regulation 7). Indigenous vegetation along water courses should not be removed, and where it has been removed the re-establishment of suitable indigenous plants should be considered.

2.1.3.4 Regulations of flow pattern of water

The flow pattern of runoff water is regulated by Regulation 8 of CARA:

- No run-off water from a water course may be diverted to another water course, unless authorised by the Department of Agriculture or National Environmental Management Act (NEMA) with approval by the Department of Water Affairs (DWA).

- The natural flow patterns of water on a farm may not be disturbed by obstructions, unless this obstruction will not cause excessive soil loss.
- Existing obstructions of the natural flow patter of run-off water may not be removed or altered if this would result in excessive soil loss.

2.1.3.5 Storage of water

Storage of more that 10000m^3 per dam requires registration with DWA. Dam safety requirements as specified in NWA, including routine inspections, must be complied with. Any dam with a wall height of less than 5m does not require registration in terms of dam safety. Registration in certain areas must be done for extraction.

2.1.3.6 Irrigation management

Irrigation is controlled by both the Conservation of Agricultural Resources Act and the National Water Act. The former requires that irrigated land is protected against water-logging and salination by as many of the following measures as are necessary for each particular situation:

- catchment dams, furrows and feeder channels used for irrigation water are impermeable.
- land is not irrigated with water that is too high in salt content.
- soil conservation works are constructed to draw off excess surface and subterranean water so as to dispose of it to prevent the water-logging and salination of lower lying land.
- fertilisers that could contribute to salination should be avoided.
- soil ameliorants should be applied to land showing signs of salination.

Existing irrigators (or water users) must register their water use with the Department of Water Affairs.

Best management practises should be implemented to ensure an efficient application of water:

- Timing and amount of irrigation should take account of the soil type, crop type and age and weather conditions. Scheduling techniques using either direct measurement of soil water status (soil auger, tension-meter or neutron probe) or estimated soil water content using computer model calculations and weather data should be used.
- Records should be kept: m^3/ha/yr
  Crop type
  Irrigation method
- Water usage should be metered to enable accurate quantification of water applied. Records should be kept to allow comparison against licensed allocated (or registered use) and actual use.
- New irrigation schemes should be designed in accordance with standards specified in the Irrigation Design Manual 1997, ISBN 1-919685-11-1 published by the Institute for Agricultural Engineering, Agricultural Research Council (www.arc.agric.za). Special consideration must be given to the soil water holding capacity, infiltration rate and chemical limitations of the soil or water source. Authorisation of new irrigation schemes is a requirement of DWA.
- Irrigation systems should be maintained and checked annually to ensure operation is in accordance with the design specifications.
- Quality of irrigation water must be regularly monitored to keep any soil degradation to a minimum and to sustain crops.
- Salinisation (accumulation of salts in the soil which adversely affects soil sustainability and thus crop production) is generally caused by poor water management such as inadequate drainage or over irrigation. Landowners must ensure that these causes are avoided.

2.1.4 Veld and forest fires are prevented

Fire can be both a friend and foe with regards to biodiversity management. Just one or two inappropriate fires at the wrong time of year, too frequent, or no fire at all, can cause local extinction of many species. As a landowner, you are responsible for the prevention and management of all fires that occur on your land, in terms of the National Veld and Forest Act of 1998. Where applicable you will be assisted in complying with these regulations if you and your neighbours form a Fire Protection Association (FPA).

FPA's are voluntary associations formed by landowners to jointly prevent, predict, manage and extinguish veld fires. The main advantage of an FPA is that no presumption of negligence can be used in civil proceedings due to fire damage if you belong to an FPA, even if the fire started on your property. Furthermore, resources can be combined more effectively with other landowners to manage fires more effectively and firebreaks can be placed where best for the area as a whole, not just one property.

Where applicable every property should have a system of fire breaks in place. The breaks must be on the boundary of the property unless there is an exemption granted by the Minister or an agreement with the adjoining landowner that the firebreak be located somewhere else within an FPA. Firebreaks must be located strategically to control the spread of wildfires, but mainly serve as an access road from which to fight a fire. A sensible firebreak width is not wider than 10m and must not be burnt during times when there is a high fire risk. It is often preferable to simply have a "tracer belt" of 2/3m to allow quick access and an opportunity to use a "backburn". Owners should ensure that firebreaks are positioned and prepared in such a way as to cause the least disturbance to soil and biodiversity. The owner should transplant protected plants within a fire break if possible or position the firebreak to avoid protected plants.

Specific points relevant to fire management are:

- Frequency: The interval between fires should be determined by the growth rate of natural existing plants and depending on the area's rainfall.
- Season: Generally, a winter or early spring burn is recommended for sour grass regions and summer or early autumn for Fynbos regions.
- Intensity: Intensity is influenced by the fuel load, fuel moisture, relative humidity and wind speed. The intensity can be manipulated by selecting conditions, point of ignition relative to slope and wind that will lead to the desired type of fire.
- Where a proportion of a area is burned it is vital to maintain a mosaic of different vegetation ages within a property (a variety of approved burning practices and veld ages is the best way to maintain species diversity).
- Inform property neighbours and local municipality fire officers of your intention to burn at least two weeks prior to the event.
- Ensure fire fighting equipment is maintained and in good working order before the start of each fire season.
- Keep accurate records of fire, using a map of veld age as a basis. Note the date and time of ignition, weather conditions, etc.
- Do not leave an extinguished fire unguarded for at least two days after a burn.
- Annuals are vulnerable to grazing pressure by domestic stock in the first 2 years after a fire.

For more information refer to:
Department of Water affairs 'Resource materials on National Veld and Forest Fire Act No 101 of 1998' www.dwa.gov.za/forestry/fireawareness

2.1.5 Veld and forage is managed to ensure a sustainable production of vegetation, livestock and wildlife

The legislation governing the use of veld and forage is contained in Section 6 of CARA (GN R1048 GG 10029 of 25 May 1984 as amended by GN R2687 of 6 December 1985) and requires that every land user protect the veld on the farm unit against destruction and deterioration by whatever means necessary:

- alternative grazing and rest periods should be used.
- use of different types of animals.
- restriction on the number of units on the veld.
- use of soil conservation works to allow for grazing and resting periods, protection of the veld against excessive soil loss as a result of rain and wind, and for collection of sediments from run-off water.
- reduction in numbers of animals if the veld shows signs of deterioration or the withdrawal of grazing camps until there has been sufficient recovery of the veld.

Regulation 10 requires each extension office of the Department of Agriculture to have a topocadastral map that indicates the grazing capacity of the veld, expressed as a specified number of hectares per large stock unit. Since grazing capacity will vary depending on soil type, aspect and climate the extension officer may decide that the grazing capacity of the veld on a farm unit differs appreciably from that specified on the topocadastral map. In this case, another grazing capacity may be applied and the land owner notified in terms of Regulation 17.

2.1.5.1 Grazing Habits and Veld Management[15]

Sufficient feed is the most important single factor to increase and stabilize animal production. Natural grazing is the cheapest source of animal feed. The correct and sensible use of grazing is essential where producers wish to farm with Angoras extensively. In South Africa there is already considerable deterioration in natural grazing. It has been calculated that the vegetal cover in the Karoo region has dropped by 15-20 percent during the period 1961 – 73. By comparing recent satellite photographs with existing plant growth charts, it has been established that the Karoo vegetation has extended considerably into the grassveld region.

Three factors determine the composition and condition of veld, namely climate, soil and the grazing animal, or rather grazing management. According to research results, it would appear that the type of vegetation i.e. whether it is mainly grassveld, bushveld or shrub country, is determined primarily by the climate and is controlled thereby. The kind of soil and topographical unit (e.g. ridge, flat, water-course) determine the climax species, or potential climax species, that will grow under specific climatic conditions. The climax vegetation of any area is the highest stage in the succession and the most complex vegetation that the soil and the climate of that area can support. Long-term grazing management determines and influences the quality, species composition, condition and productivity of the vegetation within the limitations set by the climate and the soil. Vegetation is not static, but is continually subject to change, because it is altered by and is in balance with the aforementioned environmental conditions such as soil, climate and treatments, which are all factors that can change from time to time. The phenomenon of continuous change in the vegetation is known as succession when it represents an improvement of the vegetation.

When grazing is destroyed by malpractices, such as under- and overstocking and insufficient rest, the vegetation becomes more sparce and undesirable, and less suitable vegetation increases. A tremendous chain reaction is launched during this deterioration.

As the vegetation becomes more sparce, the micro-climate becomes more unfavourable. The micro-climate is the climate pertaining from ground level to a height of 1,2 meters. The soil will then be increasingly subjected to the detrimental effects of the sun and wind causing increased evaporation. The structure of the soil will deteriorate, which leads to a decrease in soil fertility and an increased rate of erosion. The veld and animal production deteriorate, become unstable and result in a rise in farming costs.

The desirable form of change is when the grazing can be improved from the pioneer stage, through the different intermediate stages, up to the climax stage and the maintenance of this stage. The climax stage is the ultimate one in veld improvement. During this stage, the soil and vegetation are better protected against the injurious effects of the sun and wind, soil fertility is higher, rainfall is utilized more effectively and the micro-climate is favourable. Veld and animal production increase and are more stable and farming costs are lower.

With regard to the condition of the veld, the goal should be to obtain the maximum vegetal cover with the greatest percentage of climax plants in relation to the potential allowed by management and climatological factors. In other words, the quantity, quality and palatability of the veld must be increased to the highest possible level. In order to accomplish this, the following general considerations apply.

2.1.5.1.1 Grazing habits of stock

The various kinds of stock exhibit different grazing and eating habits in respect of the various plant species, seasons and vegetation strata. Each kind of animal has, potentially, a specific effect on the vegetal cover.

Owing to the goat's particular pattern of veld utilization, the chances to succeed in the conservation, utilization and development of the veld are greater with the Angora goat than with any other type of small stock. In addition, goats fit in very well with mixed stock farming. Goats utilize steep slopes, ridges and hilly country exceedingly well and primarily eat shrubs (browsers).

Where sufficient palatable trees and shrubs are available, goats will mainly concentrate on them. Research findings in the Valley bushveld of the Eastern Cape have shown that approximately 70 percent of the diet of the Angora consists of shrubs. On experimental plots where the well-known spekboom shrub *(Portulacaria afra)* forms 25 percent of the vegetation, it has provided 34 percent of the Angora's diet.

The goat is very much inclined to consume plants from the top downwards, while sheep actually follows a reverse pattern. Its utilization level is vertically spread over a much higher stratum than that of sheep or cattle. This stratum is mainly between 10 to 160 cm above ground level.

In the traditional Angora farming areas, trees and shrubs usually form a very important component of the vegetation. Karoo-bushveld and grassveld, however, are also present to a greater or lesser degree.

Although Angoras obtain the greater part of their feed from shrubs and trees in the bushveld, they can manage just as well on Karoo-veld, grassveld, lucerne lands, cultivated pastures and drought-resistant fodder crops. Similar to other small stock, the Angora will consume the vegetation which, at a specific moment, is most attractive and provides the best for its needs. However, they utilize a decidedly wider spectrum of vegetation than sheep do.

While Angora goats can change their grazing pattern, and consume more small bushes and grass when material from trees and shrubs becomes scarce, they perform better where the latter source is adequately available. Trees and shrubs usually contain adequate amounts of protein to meet the protein requirements for production and reproduction. In comparison with the grazing of sheep, the grazing of Angora goats causes less damage to the tender ground level vegetation, which includes germinating growth, young plants and crowns. This is mainly due to the fact that the goats are able to utilize a higher stratum of vegetation. According to feed intake studies, it appears that the Angora goat has the lowest total feed intake of the most common small stock breeds.

Trees and shrubs are sensitive to over-grazing and the majority of species of these vegetation components are difficult to increase because of slow growth. The Mimosa *(Acacia Karoo)* and the Kriebos species *(Lycium spp*) are among the few exceptions as far as a relatively rapid growth rate is concerned.

It is, therefore, clear that the availability of tree and shrub veld should, to a large extent, determine the number of Angora goats on a farm. Over-grazing by Angora goats causes degeneration of bush and shrub veld, without necessarily harming the ground level vegetation to the same extent, and thereby creates a false impression of the veld condition. Degeneration of the bush and shrub veld will be detrimental to the mohair industry.

Fig. 2. Examples of a) intact and b) degraded Sundays Spekboom Thicket. Intact thicket shows a canopy of trees (top right) surrounded by woody shrubs such as Portulacaria afra. Degraded thicket is sparse and park-like, or a pseudo-savanna, and is dominated by Papea capensis.

Reproduced with permission from Lechmere-Oertel et al., 2005.

Research has proved that Karoo-veld grazed continuously for ten years by Angora goats showed no deterioration, but instead the amount of perennials doubled. With sheep, under comparable conditions, palatable Karoo-bushes decreased by about half and a considerable increase in pioneer grasses took place. This shows that Angora goats had a far less injurious influence on the vegetation at ground level. By reason of its ability to extend and intensify its feed selection to a very high degree, the Angora goat can utilize veld more intensively and completely over a longer period than sheep can. Farmers must guard against this characteristic being misused to the disadvantage of the veld. In other words, overstocking with its extremely damaging results must be avoided.

The Angora goat is sometimes used to open up thick tree and shrub veld (bushveld) by crash-grazing for long periods. Although immediate advantage can be gained by such a practice, it is often the starting point for the gradual collapse of the bushveld. However, thick bush can indeed be opened up effectively without allowing the bushveld to deteriorate further, provided the correct veld management practices are applied.

The potential soil disturbance, or soil trampling factor, of the Angora goat is between 20 and 30 percent higher than that of the Merino sheep. This indicates that Angora goats will tramp out veld more than sheep, which emphasizes the importance of a correct stocking rate, especially where the danger of soil erosion exists, such as along river banks, on slopes, or where inter space grazing can take place (dense bush, or noorsveld). In addition to the above-mentioned, the following factors will also affect the stock numbers.

2.1.5.2 Stocking rate

A specific area of land, depending on the vegetation and climatical conditions, can only provide for the nutritional needs of a certain number of animals. If too many animals are kept on the specific area of land it will lead to deterioration of the veld and lower production per animal. If too small a number of animals is kept the vegetation may become overgrown and woody, which is also detrimental to both the veld and animal production. It is necessary that the number of animals on the veld (stocking rate) and the grazing capacity should be as equal as possible. The term stocking rate reflects the productivity of an area of vegetation in terms of the area of land required to maintain a specific number of animals over an extended period without deterioration of vegetation, or soil, under a given system of management. It is expressed as area animal unit per year, e.g. 20 ha/SSU/yr. A small stock unit is is equal to 1.36 dry Angora ewe.

Certain factors will determine the number of animals that can be supported by a specific area of land. These factors include, among others, breed, age distribution, physiological state of the animals (dry, pregnant, lactating) and composition of the flock.

As the grazing capacity for an area is usually expressed in terms of small stock unit (i.e. a dry Merino ewe) it will be necessary to calculate the equivalent number of the other breeds. For this purpose a comprehensive list of animal unit equivalents has been compiled.

In this list a large stock unit is defined as the equivalent of a head of cattle with a mass of 450 kg which gains 500 g/day in mass on a grass pasture with a mean DE % of 55. Using the conversion factor of six small stock per large stock unit one can use this list to calculate the number of animals of different types that equal the set grazing capacity.

With a view to optimal utilization, producers must study and observe their veld regularly in order to adjust the stocking rate within the acceptable guidelines. In this respect, experts should also be consulted regularly.

2.1.5.3 Veld production

Numerous variable factors between farms and areas prevent the application of one ideal veld management practice. However, general guidelines are given, which, with certain necessary adaptations for each area, or farm, form the basis of sound veld management.

Primarily, the farmer must be well acquainted with aspects such as the growth rhythm of the different veld components, that is when they bud, grow, flower and form seed. At the beginning of the growing season the growth cycle of a plant commences with budding and sprouting. This new growth, especially in grasses, is started with the assistance of reserves stored in the leave and stem bases, crown and roots. Although Karoo-bushes are not necessarily dependent on these reserves to start annual growth cycles, they may well be necessary after prolonged droughts, or severe grazing.

After the commencement of the growth cycle, plants grow vegetatively until the reproductive phase, i.e. when flowering and seed formation occur. Although the reproductive phase usually coincides with the period when growth activity is at a maximum, it may commence much earlier.

There is a rest phase before the plant begins regrowth at the start of the following growing season.

Relative growth activity of plants in the Angora goat farming areas illustrates that Karoo-bushes, in contrast to grasses, show two definite growth periods, namely, in spring from about September to November and in the autumn from February to May.

During midsummer Karoo-bushes grow relatively slowly, apparently as a result of high temperatures. Although growth activity of these buses is reduced considerably during the winter,

it does not drop as low as that of the summer grasses. Karoo-bushes thus have the ability of growing throughout the year if it rains, but they react best to late summer and autumn rains and less favourably to spring rains.

Shrubs and trees show a long growth cycle with a gradual increase in growth activity from August to the end of March, and a decrease as winter approaches, but do not drop markedly during winter. Spekboom *(Portulacaria afra)* is a prominent shrub in certain areas of the Angora goat territory. The lowest point in growth rate is reached during August after which the growing activity increases and remains relatively constant until May, whereafter it levels off.

The summer grasses grow actively during the summer but are dormant during the winter as a result of low temperatures. Subclimax grasses, including Bewertjie grass *(Eragrostis obtusa)* and Knietjies grass *(Eragrostis lehmanniana)* show a slightly different growth cycle in comparison with climax grasses such as Red grass *(Themeda triandra)*, Finger grass *(Digitaria spp)* and Buffalo grass *(Panicum spp)*.

The highest growth activity of the sub climax grasses is also during February and March, but there is a slight drop in growth activity in January, in all probability due to high temperatures. The growth activity of these grasses reaches a much lower level during the winter months than that of the climax grasses.

Ephemerals and annual plants, including annual pioneer grasses such as some of the *Aristida spp*., complete their life cycle within a very short time. These plants are opportunistic by nature and grow actively any time during the year when moisture is available. There is a large variety of annual vegetation with varying climatic requirements.

There are always annual plants that can react to rain at any time during the year and, as a result of their short life cycle, can obtain advantage from any rest period of a month, or longer, when ground moisture is available.

The removal of young growth of established plants by grazing when plants are sprouting at the beginning of a growth cycle, or after a drought, results mainly in physiological damage to plant systems. This damage includes mainly the disruption and weakening of vital processes and especially exhaustion and weakening of the root system. Physiological damage to plants can also take place with grazing during the termination of their growth cycles when replenishment of root reserves takes place, which is essential for rapid and vigourous regrowth at the start of a new cycle. These growth phases, and the months during which physiological damage may occur, are usually within the period when the growth curve begins to rise and/or decline.

Grazing, especially during the active growth phase of the plant, causes vegetative damage, resulting in the destruction of plant material. In itself moderate vegetative damage is not very disadvantageous, but it can lead to weakened reproduction (flower and seed formation) and, in severe cases, can cause total absence of the reproduction phase and serious physiological damage.

Grazing during the reproductive phase can have a serious effect on the vegetation if it is done injudiciously. During this stage the animals will concentrate on the reproductive material, i.e. buds, flowers and seeds. Over-utilization of the reproductive material will lead to a shortage of seed for regeneration eventually leading to a decrease (in individuals) of the species in the community.

During the dormant periods (e.g. seasonal dry spells and winter) the greater majority of plants are vegetatively inactive, or dormant. Exceptions are some types of Karoo- bushes, shrubs and winter grasses, which are usually fairly active during the first half of winter. Grazing during the resting stages may damage, or destroy, already formed renewal buds and growing points so that, with the advent of the renewal growth stage, they show weak re-growth, or poor sprouting.

The fact that a plant appears to be dormant, or dead, is not positive proof that physiological activity in the plant has ceased. Over-grazing, or trampling, of such plants can have a very injurious effect on them. Ephemerals and annuals, like Steek grass *(Aristida spp.)* are subject mainly to vegetative damage, or destruction. In these types of plants physiological damage plays a less important role. In mixed veld the Karoo-bush component, especially, is favoured by late winter, spring and autumn rains, whereas summer rains promote mainly grasses. Rains from late winter, through summer until autumn benefit the shrubs. The Karoo-bush, shrub and grass components may thus be promoted, or retarded, separately, depending merely on the seasonal rainfall and general climatic conditions. It happens sometimes that the seasonal rainfall favours Karoo-bushes and shrubs for some years and then changes to favour grasses.

From the foregoing it is clear that:

(i) Perennial plants are damaged by management systems that exposes the plant to grazing for too long, with too low stocking densities and inadequate (too short) recovery periods and poor reading of the veld.
(ii) If continuous grazing is practiced, all growth stages of all edible plants will be adversely affected.
(iii) Grazing, combined with adequate time, sun and rain recovery is good for plants that have evolved with grazing animals for million of years.

Angora goats are mainly shrub browsers and they are usually kept in shrub veld, or in veld that has a reasonable amount of shrub component. Trees and shrubs are slow growers and the grazing systems must make provision for long rest periods in such veld, especially in damaged shrub veld.

Spekboom is a dominant shrub growing in certain areas of the natural Angora goat country. It is a most useful shrub plant but is highly vulnerable and can be over-grazed very easily. Spekboom veld that has been ruined, recovers with difficulty.

Research revealed that the Angora goat's free choice diet consists of approximately 34 percent spekboom, 33 percent other shrubs and 33 percent grass. (Karoo-bushes were not present on the experimental terrain).

Spekboom recovers slowly after defoliation. When spekboom is 50 percent defoliated it takes about 275 days before it produces the same mass of dry material as before defoliation. If defoliation is reduced to about 30 percent, it still takes 211 days to recover. The drier it is, the slower the recovery will be. Severe defoliation must be avoided, and farmers must rather concentrate on more and lighter periods of defoliation per year for this type of veld.

The leaf production of spekboom is stimulated by defoliation. A fifty percent defoliation results in noticeably more leaves per stem being produced, which is not the case with no defoliation and 100 percent defoliation. Because of the deep and extended root systems of shrubs, the plants are relatively resistant to grazing pressure up to a certain stage. This critical stage may only be reached after a number of years, but once this breaking point is reached, it deteriorates with a severe drop in production. There is proof that shrubs should only be moderately defoliated to increase production.

As far as rest periods for spekboom veld are concerned, it appears that an autumn to autumn rest period stimulates leaf and stem production more significantly than either a summer to summer, spring to spring or winter to winter rest period. Results also indicate that winter grazing harms the leaf and shoot production more noticeably than grazing during the other seasons. Grazing of spekboom throughout the winter is, therefore, extremely harmful.

To protect, promote and utilize the various veld components under normal and practical farming conditions, it is essential that every component be rested adequately, so that each critical phase of its growth cycle has the opportunity for complete development.

This promotion and protection, which is beneficial both to the grazing animal and the vegetation, can be best exercised by the application of rotational grazing.

It is apparent that fundamental aspects of veld management, grazing habits and the taste preferences of the various breeds of livestock, as well as plant cycles in relation to rainfall and temperature, should be carefully considered when designing an appropriate grazing system for a specific farm. When the relationship between these factors is studied, it becomes clear into which natural seasons a grazing year can be divided and which system should be applied.

Considering the wide variation of all factors involved in veld management, farm planning and suitable veld management systems for a specific locality can only be devised in consultation with experts on veld management. It is imperative that all efforts be aimed at optimal utilization and efficient conservation of the natural resources to secure the future of the Angora goat industry.

The section on Grazing Habits and Veld Management is a direct copy (with inputs and changes by Dr Peter Ardington, 2011) from Angora Goats and Mohair in South Africa (Van der Westhuysen JM, Wentel D, Grobler MC (2004c revised edition)

2.1.5.4 Veld intensification/ alternative fodder crops

Veld intensification refers to the fertilization of existing rangelands, or veld reinforcement by planting sods/seeds, usually with fertilization. In cases where the potential of some vegetation resources are limited alternative fodder crops can be established if rainfall allows[2, 23]. Rangeland and cultivated pastures can play a complementary role but need to be carefully managed as die-back, e.g. due to insufficient rainfall, of a cultivated pasture may encourage recruitment of weedy species. Drought tolerant crops should be established in areas prone to seasonal, annual and long-term droughts. If veld intensification is practised, refer elsewhere[14] for more details on management.

Most artificial pastures[6] suitable for sheep production can be used for Angora goats. It is therefore more important to select types of pastures suited to the specific area to provide the best fodder flow program. A few examples of pastures which have proved successful are lucerne, cereals, ryegrass and ryegrass clover mixtures etc. In order to ensure an effective animal fodder flow program, consultation with an expert is advised.

The following should be kept in mind when managing pastures in the summer rainfall region.

- After the grazing of lands enough leaf and stem growth should be left to maximize photosynthesis.
- The resting time should be sufficient so that nutrient reserves extracted from plants can be re-established.
- Pastures should be devided into at least six camps to best make use of pastures by grazing.

2.1.5.5 Veld monitoring

Vegetation surveys for monitoring change in veld condition should be conducted in strategic places on a property[2,14]. Detailed records must be kept of any management activity or environmental perturbation so that when sites are resurveyed, any change to the condition or type of vegetation can be traced back to the management applied and/or the environmental conditions experienced. Structured visual estimates are recommended in assessing the condition of the vegetation. This involves the identification of plant communities that are likely to have different production potentials, palatability and sensitivities to degradation. Records should also be kept of grazed days per camp and kg animals per flock.

2.1.6 Plant diseases are prevented and controlled

The Agricultural Pests Act 36 of 1993 provides for the control and prevention of plant diseases, which may require a farmer to destroy crops to prevent the spread of the disease. Farmers are also required to notify the local department of agriculture if flying locusts arrive and/or deposit eggs, or if breeding swarms of red-billed queleas are present (section 5). Where chemicals are used for pest and disease control, those with the least impact on human health and the environment should be selected. In particular, chemicals that contaminate ground and surface water should be avoided. Manufacturers' specifications must be strictly adhered to. Only chemicals that have been registered for the control of a particular weed, pest or disease may be used.

A useful website for farmers in SA (www.pestsandcrops.com), contains useful information on pest identification, life cycles, damage and control. Organised farming sectors should establish a list of approved chemicals that their sector members may use.

2.1.7 Acquisition and use of agricultural remedies and fertilisers is controlled

Agrochemicals include all herbicides, fungicides, insecticides, nematicides, biocides, and plant growth regulators used in agriculture. Many of these compounds have the potential to be harmful not only to man, but to the environment if not used responsibly.

Legislation controls the manufacture, registration, importation, packaging, labelling, storage, transport, disposal, handling and application of agrochemicals. The principal pieces of legislation are the Fertiliser, Farm Feeds, Agricultural Remedies and Stock

Remedies Act 36 of 1947 and the Hazardous Substances Act 15 of 1973. It is the responsibility of every farmer who uses any form of agrochemical to be familiar with the precautions necessary to ensure that a product is safely stored and applied, and that chemical residues and containers are disposed of correctly.

2.1.7.1 Prohibited chemicals

Farmers are restricted in certain areas or prohibited, in terms of the Fertilisers, Farm Feeds and Agricultural Stock Remedies Act 36 of 1947 from acquiring and using a range of agricultural remedies. A list of banned and restricted substances can be consulted. (Source: DAFF website - ww.daff.gov.za)

2.1.7.2 Chemical storage

The buildings or storerooms where agrochemicals are kept need to be of sound construction, well ventilated and secure, and have adequate warning signs posted. Highly Toxic Group 1 poisons, in terms of the Hazardous Substances Act, need to be secured in a separate, locked storage area. No agrochemical may be stored near food or animal feed and the building or storeroom must not be accessible to unauthorised people. Normal safety requirements must be available e.g. water and washing facilities, fire fighting equipment and any other special requirements specified on the product label. The storage area must be easily drained and a sealed sump constructed where spillage can be collected.

2.1.7.3 Application of fertiliser and agrochemicals

To ensure the correct type and quantities of fertiliser, soil samples should be taken at regular intervals. Calibration of fertiliser equipment, placement of fertiliser application all affect crop performance and farmers should pay special attention to their management as over-fertilisation can lead to an impact on the soil and lead to acidification and nutrient imbalance.

Agrochemicals must be applied under these conditions and in the manner specified on the product label. These would typically include the concentration or application rate, the target crop, correct time (crop stage) and under the correct weather and soil conditions. After application, washing of equipment must be done in a manner that avoids contamination of soil and water.
Records should be kept of:
- Inventory
- Use

2.1.7.4 Disposal of containers and unused chemicals

The disposal of product containers must be carried out in a responsible manner. The containers of highly toxic Group 1 poisons must be returned to the supplier for safe disposal. Other containers may be disposed of on the farm, but must be perforated and rendered unusable after draining and triple rinsing. All disposal pits should be away from human habitation, preferably in a heavy clay soil and positioned in such a manner that leachate from the pit would not contaminate water sources.

2.1.8 The use of genetically modified organisms is strictly controlled

Genetically modified organisms (GMOs) have evoked safety and ethical concerns around risks to human health and biodiversity, with the Convention on Biological Diversity (1992) providing in Article 19(3) that each contracting party to the Convention (South Africa being a contracting party) shall, as far as possible and as appropriate:

"establish or maintain means to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from bio-technology which are likely to have adverse environmental impacts that could affect the conservation and sustainable use of biological diversity, taking into account the risks to human health".

In South Africa, this requirement of the CBD has been addressed in the Genetically Modified Organisms Act 15 of 1997, which came into effect on 1 December 1999.

2.2 Critical ecosystem goods, services and ecological processes are maintained

Ecosystem goods include directly usable aspects of the environment such as wood for fuel, wildflowers for sale and ecotourism. Ecosystem services are critical and life-supporting but are often less known to us and conserving an ecosystem may only yield benefits after some years, or may even benefit property distant from one's own and so constitute a 'public good'. In time, producers may be compensated for these public goods

2.2.1 Critical ecosystem services and processes are identified and plans for their maintenance and protection are included in the land use or management plan.

2.2.1.1 Hydrological

Functional wetlands and riparian areas, provided they are functional as water sponges and will reduce flood damage, provide a process for the filtration and deposition of suspended sediments, and capture nutrients. Farmers should:
- Identify and delineate wetlands and riparian areas [using the DWA Guideline Document: A Practical field guide procedure for identification and delineation of wetlands and riparian areas, (www.dwa.gov.za)] include these details on the land use plan. Degraded wetland and riparian areas should receive priority for rehabilitation but will require an EIA in terms of NEMA.
- Not use water from wetlands (DWA).
- Remove crops from wetlands over a period of time. Such removal may have a positive impact on the provision of water.

Vegetation corridors, a conservation priority

Continuous natural habitats or vegetation corridors on farms or at the landscape level allow for many **ecosystem processes** (e.g. fire, water and animal movement) and services (e.g. water purification, veld maintenance, pollination)

Talk to your neighbours about forming corridors across farm boundaries, e.g. along rivers.

Get help from conservation authorities and ecologists

Focus on areas of conservation significance (e.g. wetlands and areas including uplands and lowlands)

2.2.1.2 Physical (Fire)

Many aspects of fire management benefit both the production and conserved areas. There are several objectives for using fire in biodiversity and veld management[2, 20]:

- to promote biodiversity in fire dependent systems (Fynbos, grasslands, savannah)
- to maintain the flower picking industry through appropriate regeneration (Fynbos)
- to remove unpalatable grasses and control bush in sour mixed bushveld (savannah)
- to reduce fuel load
- to burn off unpalatable growth that remains from the previous season and which if left unburnt, will result in a moribund grassland, especially in sour veld where top growth is not all removed by grazing
- to increase crude protein in grasslands
- to stimulate growth at the end of the dry season
- to control the encroachment of "undesirable" plants (both woody and forbs) – this is usually only successful in a limited number of applications, usually where grazing pressure is very light
- prevent damage to fire-sensitive forest areas by burning fire-breaks adjacent to forests

In grasslands:

- Burn every two to three years in grazed grasslands
- Burn annually in ungrazed grassland, annual fires can also be used (e.g. to reduce fire hazard, block winter burns as a fire protection mechanism, etc.) If bush control is required, a less frequent fire regime, which allows for the accumulation of sufficient fuel to have an impact on the bush, should be applied. Head fires (with the wind) are more effective against bush encroachment than a back burn (against the wind), but can pose increased risks for the farmer and the neighbours. There are practical ways of resolving this, such as starting with a back-burn and then initiating a head fire that will burn towards the back-burn.

In the Fynbos:

- Burn every 8 to 20 years depending on the objectives of the land owner
- The higher the grazing pressure, the less the fuel load and the less effective is the fire.

2.2.1.3 Biological

Both plants and animals provide important ecosystem services:

- Plant roots and the herbaceous layer stabilize soils and reduce erosion[20]. In addition, trees and woody shrubs with deep tap roots maintain water tables at levels that prevents concentration of salts in the upper soil layers[21].
- Many plants (agricultural and indigenous) depend on insects, birds and mammals for pollination, and thus seed set. These pollinating agents in turn rely on the presence of natural habitats distributed in the landscape. In addition, the presence of natural habitats provides for the seed dispersal of natural vegetation. Examples of what is required to conserve and sustainably manage pollinators with agro-ecosystems are[31]:
- conserve and restore habitat
- use mixed farming systems
- establish nectar corridors for migratory pollinators
- encouraging integrated pest management
- discourage misuse of agro-chemicals

2.2.2 Invasive alien plants posing threats to biodiversity and ecosystem services are controlled

Invasive alien species have a significant negative impact on the environment by causing direct habitat destruction, increasing the risk and intensity of wildfires, and reducing surface and sub surface water. Landowners are under legal obligation to control alien plants occurring on their properties.

2.2.2.1 Identification of alien species

Table 3 of CARA (the Conservation of Agricultural Resources Act) lists all declared weeds and invader plants. Alien plants are divided into 3 categories based on their risk as an invader:

- Category 1. These plants must be removed and controlled by all land users. They may no longer be planted or propagated and all trade in these species is prohibited.
- Category 2. These plants pose a threat to the environment but nevertheless have commercial value. These species are only allowed to occur in demarcated areas and a land user must obtain a water use licence as these plants consume large quantities of water. No land user may allow Category 2 plants to occur within 30m of the 1:50 year floodline of a water resource (river, stream, spring, lake, dam or wetland, unless authorised in terms of the National Water Act 36 of 1998).
- Category 3. Existing plants do not have to be removed but no new plantings may occur and the plants may not be sold. However, if they occur within 30m of the 1:50 year flood-line of a river, stream, lake, spring, dam or wetland, then they must be removed.

2.2.2.2 General clearing principles

The following principles apply:[4]

- As a minimum, the plan should include a map showing the alien density and indicating dominant alien species in each area.
- Alien control programs are long-term management projects and a clearing plan, which includes follow up actions for rehabilitation of the cleared area, is essential. This will save time, money and significant effort.
- Different species require different clearing methods such as manual, chemical or biological methods or a combination of these. For example fire is a useful tool for pines, but should not be used on the Acacia species as fire stimulates alien seed germination.
- Start clearing the lighter infested area first (with young/ immature, less dense trees) to prevent the build up of seed banks. Starting with less dense areas will also require fewer resources and have greater impact in the long term. In the case of alien species confined to rivers, it is ideal to start in the headwaters and then move downstream, thereby removing the source of re-infestation. Dense mature stands ideally should be left for last, as they probably won't increase in density or pose a greater threat than they are at the moment.
- Collective management and planning with neighbours allows for more cost effective clearing and maintenance considering aliens seeds are easily dispersed across boundaries by wind or water courses.
- Biological control is cost-effective and very safe compared with the expense and risks associated with herbicide use, and can be successfully integrated in other management practises.
- Consider the role of fire in alien clearing operations. Fire with the appropriate management is a cost effective clearing method, but untimely and uncontrolled fires easily and often defeat the purpose of mechanical and bio-control clearing. Follow up after fire with manual seedling removal is essential, or in extreme cases where there is little other vegetation, herbicide spraying could be considered.
- All clearing actions should be monitored and documented to keep track of which areas are due for follow-up clearing.
- Follow-up clearing is often underestimated and farmers should plan for years of follow-up.

Know your aliens!

Category 1
e.g. Mauritius thorn, pom-pom weed, ink-berry, triffid weed, Chinese camphor tree, lantana, oleander, various prickly pear species, hakea species, American bramble, sesbania, bugweed.

Category 2
e.g. Black wattle, blackwood, silver wattle, eucalyptus, pine, poplar, castor-oil plant,weeping willow.

Category 3
e.g. loquat, jacaranda, various species of privets, syringa, firethorns, cassia, tipu tree.



2.2.2.3 Alien grasses

Alien grasses are among the worst invaders in lowland ecosystems adjacent to farms, but are often the most difficult to detect and control. Alien grasses also change the fuel load of the veld causing more frequent and hotter fires, which can be detrimental to biodiversity.

To avoid alien grass invasion:
- Avoid dispersal of seed on animals (Mohair).
- Keep livestock that have grazed in areas infested by alien grasses while these species are seeding between August and November, from moving to areas that have not been invaded.
- Frequent fires favour alien grass invasion, therefore apply good fire prevention practices to natural areas (see 2.1.4)

To control alien grasses:
- Do not burn as research has shown that fire stimulates germination and growth of alien grasses.
- Preferably do not hand-clear as soil disturbance promotes alien grass growth.
- Applying a pre-emergent, systemic herbicide has been found to be the most effective control method such as Snapshot, Gallant Super, Fusilade while Mamba and Round-up can be used for controlling Kikuyu.
- If small areas are affected, black plastic covering the grass will heat-destroy grass and seed.

2.2.2.4 The negative impacts of authorised listed or scheduled activities are minimised

Various activities, e.g. cultivation, earthmoving, land re-zoning and animal confinement, have a negative effect on the environment and are regulated by the Environment Conservation Act (ECA) 73 of 1989 (sections 21, 22 and 26) and the National Environmental Management Act (NEMA) 107 of 1998 (section 24). The former Act was replaced by NEMA on 1 July 2006, but farmers who have had authorisation under ECA still need to comply with the conditions set out in the Record of Decision. Farmers need to ensure that any of their farming activities that fell into the ECA activities between March 1998 and July 2006, or post July 2006, are authorised or exempt (section 28A of NEMA).

Activities that would affect farmers under the ECA include:
- the cultivation or any other use of virgin ground (on or after 10 May 2002). Virgin ground means land which has at no time during the preceding 10 years been cultivated.
- the construction or upgrading of dams, levees and weirs on or after 2 March 1998
- the change of land-use from agricultural or undetermined use to any other land-use on or after 1 April 1998; or
- the change of land-use from agricultural or zoned undetermined use or an equivalent zoning, to any other land-use on or after 10 May 2002
- the change of land-use from grazing to any other form of agricultural use (on or after 1 April 1998)

Activities that would affect a farmer under the NEMA (as from 1 July 2006) are, *inter alia:*
- construction of facilities or infrastructure, including associated structure/infrastructure for the concentration of animals for the purposes of commercial production in densities that exceed
  - eight square meters per goat and more than 1000 Angora goats per facility per year;
  - agri-industrial purposes, outside areas with an existing land-use zoning for industrial purposes, that cover an area of 1000m^2 or more
  - any purpose in the one in ten year flood-line of a river or stream or within 32 metres from the bank of a river or stream where the flood-line is unknown (including canals, channels, bridges, dams and weirs)
  - off-stream storage of water, including dams and reservoirs with a capacity of 50000m^3 or more
- dredging, excavation, infilling, removal or moving of soil, sand or rock exceeding 5m^3 from a river, tidal lagoon, tidal river, lake, in-stream dam, floodplain or wetland
- transformation or removal of indigenous vegetation of 3 hectares or more or of any size where the transformation or removal would occur within a critically endangered ecosystem listed in terms of Section 52 of the NEM: Biodiversity Act 10 of 2004
- subdivisions of portions of land 9 hectares or larger into portions of 5 hectares or less.

2.2.2.5 Significant pollution and degradation of the environment is prevented, contained, minimised or remedied

Farmers are required by law (NEMA section 28) to prevent or minimize pollution or degradation of the environment (mainly soil and water).

Soil and water pollution can be avoided by the application of best management activities at the following sites on a farm:
- Organic fertiliser stockpiles
  - should not be placed near natural water sources or near groundwater where water can be contaminated.

- should be protected from wind dispersal and the breeding of insects and pests (there should be no standing water at the stockpile).

- Farm workshops
  - Wash-bay facilities should be provided for cleaning tractors and equipment, and all run-off should be directed into a protected sump to minimise contamination of ground water or water courses.
  - Old engine oil should be emptied into containers and recycled.
  - All equipment and power supply points should comply with relevant health and safety requirements.
- *Farm land*
  - Servicing of vehicles in-field should not occur anywhere near a waterway or water course; oil and diesel should be drained into containers and removed, together with discarded spares.

2.2.2.6 Waste is reduced, re-used, recycled, recovered and safely disposed

Mohair producers (farmers) may dispose of waste generated as a result of normal household activities in a waste disposal site (pit) on their land. The National Environmental Management: Waste Act 59 of 2008 requires that any person that stores waste (such as a waste pit on a farm) must ensure that adequate measures are taken to prevent leakage; that waste cannot be blown away and nuisances such as odour, visual impacts and breeding of vectors do not arise. The following applies:

- Compile a waste management plan, where waste is reduced where possible and seen as a resource that can be re-used
- or recycled.
- Do a risk analysis – use should be advised by a soil and
- leaf analysis.
- Refuse management must comply with legal prescriptions and may not pollute the environment (particularly wetlands and water sources) or create a health hazard.
- Educate farm workers and their families on waste management and recycling.
- Prevent fertiliser runoff to adjacent natural areas, and especially wetlands and rivers. This runoff favours the spread of alien plants and actively poisons many indigenous plant species and aquatic animals. Department of Water Affairs has issued target water quality guidelines, which address impacts on water quality and measures pollutants in final water body. (visit their website for these guidelines – www.dwa.gov.za).
- Empty containers should be triple-rinsed and rendered unserviceable (puncture or cut up).
- Combustible containers may not be burned on the farm as this is an illegal practice.

NEMA

The removal of indigenous vegetation from areas **≥3** ha requires basic evaluation.

This surface has been increased to **20 ha** with a top limit of **100 ha**, after which a complete EIA is required.

2.3 Biodiversity assets and threatened ecosystems are conserved

2.3.1 Threatened and protected species as defined in legislation are protected

The National Forest Act (NFA) 84 of 1998 and the National Environmental Management: Biodiversity Act (NEM:BA) 10 of 2004, and more informally, the Stewardship Programme under the SA National Biodiversity Institute (SANBI) regulate protection or plants and animals.

Landowners are encouraged to join a Stewardship Programme and/or determine whether any threatened or protected species occur on their farms through consultation with other farmers and local conservation services. A management plan for conserving these species can be drawn up using a format such as the Draft Sustainable Resource Farm Management Plan Guidelines developed by Cape Nature and Flower Valley Conservation Trust under the Agulhas Biodiversity Initiative (www.flowervalley.org.za).

Regarding legislation, no person may cut, disturb, damage or destroy any protected tree (certain indigenous trees and all trees in forests) except under licence or as an exemption (NFA). Conducting a restricted activity (e.g. hunting) involving listed threatened of protected species requires a permit (NEM:BA).

2.3.2 Ethical and non-lethal control of damage causing animals is practised

Angora goats are attacked by predators, making the human-wildlife conflict topic highly contentious.

The intension of this guide is to make regular changes as new information becomes available. The National Environmental Management: Biodiversity Act (NEM:BA) defines poisoning, trapping and hunting of animals as restricted activities and prohibits the hunting of damage causing animals (DCA) with dog packs. Hunting of listed (i.e. threatened) species by means of poison, traps, snares, dogs and various types of firearms is

Biodiversity

Biodiversity or biological diversity is the variability among living organisms from all sources, including, among others, terrestrial, marine, and other aquatic ecosystems, and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems.

Definition adopted by United Nations Convention on Biological Diversity 1992

prohibited unless that animal has been specifically classed as a DCA by authorities, after which a permit for these activities may be given. **However, sustainable farming encourages the use of deterrents as a first line of defence against damage causing animals.** It promotes animal welfare and a more environmentally-friendly approach to predator management. Poisoning and trapping cause the death of many non-target, harmless 'by-catch' species such as birds, porcupines, aardvarks, mongooses, buck and domestic pets that must be avoided. Deterrents should include using a combination of livestock guarding animals (e.g. Anatolian shepherd dogs, donkeys and alpacas), livestock protection collars, fencing, noises, lights, smells and shepherding techniques.

The random killing of predators to protect livestock does not provide a long-term solution as the ecological imbalance that results from the removal of one species may impact on the population of undesirable species. A balanced approach by improving the natural basis of prey; a good knowledge of the predator population on farms (especially of the dominant territorial animals); the protection of livestock in partnership with neighbouring farms; and the taking part in a coordinated predator conflict and management initiative will in time result in a reduction of stock losses. (Van Deventer J. pers comm. 2008)

2.3.2.1 A predator management plan is in place

Taking the above in consideration it is important to understand that producers are responsible to protect their livestock against predation.

In the absence of local data, the following plan is based on expert knowledge (Viljoen, pers comm. 2009). The successful management of damage causing predators requires the development of a natural habitat plan where the producer recognizes the prevalence of different predator and prey species and takes note of their numbers and behaviour.

A typical integrated predator management plan would include:

- a map of watering points, lairs and territories.
- details on breeding seasons.
- records of production information, losses and costs of deterrent methods and reactive control measures, records of species, sex, age and stomach contents of predators hunted.
- Contact details of nature conservation officials regarding management of large predators.
- Make preferential use of non-lethal control methods.[5, 14, 23]
  - Bell collars and scent collars. These collars are inexpensive, low maintenance, very easy to fit, readily available and developed by farmers for local conditions. However, if used too frequently, they may become an attractant 'dinner bell' indicating the flock whereabouts rather than being deterrent working on the principle of xenophobia, the fear of new things.
  - Cell phone "Veldwagter" collars. This technology employs a transmitter with motion sensing ability. This enables a farmer to respond to the threat from a predator or stock thief. Their use is unfortunately limited to areas with cellular phone reception.
  - Fencing. This is a long-term solution for smaller premises but is expensive. Predators often dig under mesh fences, so it is important to secure the base of the mesh, or even to attach a base mesh at 90 degrees to the fence, i.e. flat on the ground, to prevent predators from digging underneath. Adequate and effective overhangs or electrification can be considered if there are species present that climb over fences.
  - Frightening devices. These may include lights and noises, such as FM radios and VHF radio alarm systems, used to frighten and confuse predators at night. As with bell and scent collars, if frightening devices are used frequently, predators will become accustomed to the noises and ignore them. Frightening devices can be used in camps for short periods of time.
  - Guardian animals
    - There is a renewed interest in more **effective, traditional ways of guarding livestock**, e.g. Anatolian shepherd dogs, alpacas and donkeys.
    - The use of *Anatolian shepherd dogs* is effective when they are correctly selected, trained and used according to guidelines. Genetics plays a major role in a particular dog's effectiveness. Conditioning consists largely of placing puppies in the environment where they will spend the rest of their lives. They should bond and spend their time as one of the flock.
    - Some livestock owners have found *donkeys* to make excellent guard animals. A single donkey, usually a female gets introduced to the herd and undergoes a natural bonding phase. Males seldom work because they can be too aggressive. A donkey will, after bonding, protect sheep against canine predators as if they were its own. Donkeys are thought not to cover as much area as dogs.
    - *Alpacas* can also be used as guard animals. Research indicates that the effectiveness of Alpacas stems from their curious and fearless nature.
  - King Collars and 'Dead Stop Collars'. The King Collar is a wide, adjustable PVC collar that is fitted to the neck of each member of the flock and adjusted once or twice a season. They make it difficult, if not impossible for a jackal to kill by a throat bite. The Dead Stop Collar is a more robust mesh wire collar than the King Collar and protects the flock against attacks by caracal, which have a strong jaw and skull structure and may bite through King collars. Other control methods are required when sheep are caught from behind.
- Scent marking where predators have been deterred by territorial marking using urine, which can be collected before the lambing season and sprayed onto fence posts and gates.

When lethal methods are considered, care should be taken that these are legal according to the various provincial regulations; are

Ordinary dogs as deterrents

Well trained dogs accompanied by their handler can effectively be used as deterrents against predators. By marking territories such animals can even be seen as dominant predators guarding their own territories. Where this is practiced care must be taken that sufficient control is administered and that the operator is qualified.

Care should be taken that dogs themselves are not responsible for stock loss, i.e. dogs should be enclosed in the evening and early morning when they might hunt stock.

always be executed by competent professional people[5]; are quick and humane to limit suffering; and are cost effective relative to the livestock losses experienced.

2.3.3 Threatened ecosystems are protected.

The National Biodiversity Framework (NBF) required in terms of the Biodiversity Act was recently (October 2009) gazetted by the Department of Environmental Affairs (DEA). The NBF is based on the National Biodiversity Strategy and Action Plan (NBSAP) The framework has identified 33 priority actions to guide the work of the biodiversity sector for the next five years and provides targets for these priority actions.

Now that there is officially a national ecosystem protection system, there is excellent opportunity to conserve biodiversity through partnerships between the landowners of both private and communal land, conservation authorities and government. Farmers are encouraged to know the conservation status of their area using the free online Biodiversity GIS facility of SANBI (http://bgis.sanbi.org, Register on the website beforehand) and the framework offered by DEAT. Consult the Eastern Cape Biodiversity Conservation Plan (ECBCP 2007, http://bgis.sanbi.org/ See Map, Register on the website beforehand).

Examples of existing stewardship programmes are The Biodiversity Stewardship Programme (C.A.P.E and CapeNature, contact 021 866 8000, http://www.capenature.org.za/projects.htm) and Biodiversity Stewardship South Africa (contact Endangered Wildlife Trust, https://www.ewt.org.za) which provide a hierarchy of increasing support (alien clearing, land management advice) in the following way:

1. Conservation Areas – Conservation Areas are flexible options with no defined period of commitment (includes conservancies).
2. Biodiversity Agreements – Biodiversity Agreements are negotiated legal agreements between the conservation agency and a landowner for conserving biodiversity in the medium term.
3. Contract Nature Reserves – Contract Nature Reserves are legally recognized contracts or servitudes on private land to protect biodiversity in the long term.

It is only the Nature Reserves that attract compulsory zero based rates in terms of the Local Government Municipal Property Rates Act.

Stewardship practises, some of which have already been mentioned as part of conserving the agricultural resources, are:

- inclusion of all transformed and untransformed (natural) land in a land use plan and mapped.
- invasive plant control, controlled burning, litter management, road construction and maintenance, fencing, poaching control, hunting, game counts, species check lists, etc, depending on the size of the operation.
- removal of crops in or near to wetlands.
- rehabilitation of degraded areas using a browse species like Spekboom (Portulacaria afra).

3. Animal Health and Well-being Principle

The following section draws on various references.[6, 7, 9, 11, 13, 14] In general, The Animal Health Act (Act 35 of 1984)was promulgated to promote animal health and to control animal diseases and to regulate the importation and exportation of animals.

3.1 Management practices

A large number of husbandry/management practices are required in any Angora goat farming enterprise and Mohair producers must accept the responsibility for the following. (Odendaal D. Pers comm. 2008).

- Provision of adequate nutrition for maintenance, growth and reproduction.
- Prevent pain, injury and disease by good animal health practices.
- Provide the environment for goats to express natural behaviour.
- Protection from fear and distress.
- Protection from predation.
- Protection when exposed to life threatening weather conditions.
- Controlled use of animal health remedies and prevention of exposure to unnecessary or illegally imposed toxins.

The responsibility of Angora Goat Farmers:

To responsibly protect their goats from any form of threat and to care for their overall well being.

A young goat killed by a predator

3.1.1 Facilities

3.1.1.1 Shelter

Goats tolerate cold weather well, as long as they are dry and out of the wind. They require shelter from the extremes of weather. This may be as simple as a shelterbelt tree plantation, or a windbreak. Where a building is used to supply shelter, it should be designed and maintained to provide clean, well-ventilated and sanitary conditions. Adequate ventilation should be provided when animals are housed indoors to reduce the risk of pneumonia and the chilling of kids. Goats should have access to a well-drained area for rest and rumination. Ruminants also need a good fill of feed to help them combat the cold. Goats also like to be in or near a shed during the night hours. Shorn goats, kids, pregnant goats and goats in a weaker condition are particularly sensitive to cold and exposure. The timely provision of high energy supplements will alleviate this problem.

3.1.1.2 Handling facilities

Goats are motivated by instinct and tempered with a very sharp memory. They are creatures of habit, and once familiar with a set of pens or handling procedures, will expect to be treated the same way each time. They should be handled quietly when penned. Excessive noise and rough handling upsets them. Goats exhibit a natural "flocking" behaviour; when one or two start to move, they all do. Well designed goat handling facilities, and the ease with which animals flow through them, have important implications for the welfare of goats. All races and enclosures must be free from sharp projections, corners and broken rails that may cause goats to injure themselves.

3.1.1.3 Shearing facilities

Shearing facilities should comprise of:

- Adequate overnight facilities with slatted floors
- Individual slatted catching pens
- Individual inspection pens
- A wooden shearing board
- Adequate lighting and fresh air
- Absence of a draft

3.2 Animal Husbandry Practices

3.2.1 Castration

Castration should preferably be done before 3 weeks of age. There are a number of techniques that can be used to castrate kids:

3.2.1.1 Surgical castration

A sharp knife or scalpel is used to remove the bottom one-third of the scrotal sac. The testicles are then withdrawn one at a time and removed by different methods:

- The chords are severed by repeated scraping movements with a sharp, sterilized knife. Scraping causes tearing of the blood vessels and promotes blood clotting.
- Emasculator. The use of an emasculator is advocated as the best and safest method if performed by a competent person. A tool, with a triple action: clamping, crushing and cutting, is used to remove the testicles. As the jaws are closed on the spermatic cord it is gripped by the clamping part. Blood loss is minimal as blood vessels are crushed immediately after they are being cut. It reduces trauma with minimal blood loss.

In order to limit bleeding, this operation should be performed in the early morning or late afternoon when it is comparatively cool. Kids should be confined in a pen or paddock prior to the operation so that they are rested. Bleeding from the open wounds can be reduced considerably by applying a five per cent solution of copper sulphate. The operation must be performed hygienically and the instruments and hands of the operator must be disinfected regularly. After the operation, wounds should be disinfected and the kids should be left quietly with their mothers. Kids should be allowed to slowly amble off with their mothers in order to limit their exposure to a very contaminated kraal environment.

According to research conducted in Great Britain, surgical castration is the most painful method of castration as surgically castrated lambs have higher amounts of cortisol in their bloodstream as compared to lambs castrated using other methods. Surgical castration also has the greatest potential for infection and fly infestation. Surgical castration should only be done before or after the fly season.

3.2.1.2 Banding

An elastrator band can be placed around the neck of the kid's scrotum. This technique consists of applying a small, stout, rubber ring around the scrotum, above the testes with the aid of a specially designed applicator. As the blood supply is cut off, the scrotum and testes become necrotic and drop off (slough) in due course. Tetanus vaccination of the ewes before kidding is required for colostral protection (passive immunity via colostrum) of the kids against tetanus. Castration by banding causes pain to the kids, but the pain seems relatively short-lived. Kids should be castrated at a young age, preferably between 1 and 7 days of age. Castration by use of a rubber ring without anaesthetic or pain management is considered acceptable only within the first weeks of life.

3.2.1.3 Burdizzo® (bloodless castrator clamp)

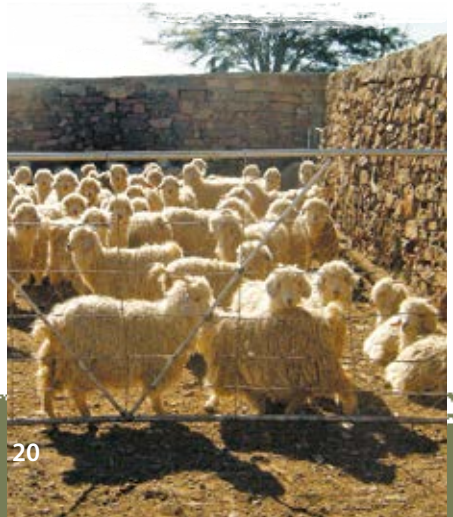
The Burdizzo emasculatome is a tool that is used to crush the spermatic cord, which crushes the blood vessels, thus depriving the testicles of blood supply and causing them to shrivel up and die. The Burdizzo does not break the skin. Each cord should be crushed separately. The cattle-size Burdizzo should not be used to castrate kids. An appropriate size for small stock is required to prevent damage of the skin and related complications.

Adult Angora goats should be castrated by using a Burdizzo® clamp to crush and rupture the spermatic cords. It is important to remember that the spermatic cords must be crushed one side at a time. After restraining the animal, grab the scrotum and manipulate one of the testicles downwards, away

Surgical Knife

Burdizzo®

Elastic Band Applicator



from the body, in the scrotal sac, and find the spermatic cord. Place the clamp over the spermatic cord one-third of the way down the scrotum. Clamp down and hold for 20-25 seconds. Release the clamp, reposition it over the spermatic cord one-half inch lower and repeat the same procedure. Perform the same steps on the other side to crush the other spermatic cord. Always check the position of the spermatic cord before and after each clamping to ensure no mistakes are made. The clamp lines of the two sides should never be directly opposite one another. With this method, the scrotal sac will not slough off, but will remain on the animal. The testicles will atrophy and disappear.

This method is the best to use during the fly season because it leaves no big open wound. Goats should be between four weeks to four months of age with eight to 12 weeks being ideal. Because of the difficulty in telling if the spermatic cords have been crushed, this method may be perceived as less reliable than other methods.

General

When castration is practiced it should best be done before or up to the age of six weeks (Larson and Bath pers comm. 2009). Though banded kids are most vulnerable, prior vaccination to afford immunity against tetanus is recommended for all castration methods. Where kids are not protected against tetanus via passive immunity, the tetanus anti-toxin should be used at the time of castration. Wounds should be inspected regularly, and when necessary treated for maggot infestation, or septic conditions. Castration of male goats over three months of age should be carried out with anaesthesia and pain management. Please consult with your veterinarian.

3.2.2 Hoof care

In areas where goats are kept on soft, sandy soil, their hooves tend to grow out too long. Hooves may become permanently deformed and the animal will be crippled. As it is difficult to cure an already deformed hoof, it is necessary to prevent deformity by regular trimming with a knife, or pruning (foot-rot) shears.

Hooves of goats that are kept in stables, or stalls with slatted floors can also become overgrown and should be trimmed regularly. Trimming of hooves is easier when animals have been on damp soil for a day or two. When trimming hooves, avoid stressful times like hot weather or late gestation.

3.2.3 Horn Trimming

The removal of horns from adult goats is unacceptable as a farm practice and should only be performed by a registered veterinarian under anaesthesia. The horns of rams and some kapater (castrated) goats may need to be cut back to avoid injury from an ingrown horn, injury to other goats and to allow free movement through handling races. The removal of the tip of the horn in adults is acceptable if done above the 'quick' where the tissue is devoid of nerves and blood vessels.

3.2.4 Kidding

Ewes should be allowed to kid with as little interference as possible. Kidding under grazing conditions should be supervised to ensure that ewes having difficulties when giving birth are given timely attention. When assistance is necessary it should be provided by a competent attendant using good standards of hygiene and accepted veterinary techniques. The flocks should be under adequate surveillance to ensure that other problems, such as pregnancy toxaemia and predation, are not occurring. If the risk of bad weather at kidding is high - access to shelter or a sheltered paddock is recommended.

3.2.5 Orphan kids

Where stray kids can be identified they should be given proper attention by reuniting them with their mothers, raising them as orphans or euthanazing them.

3.2.6 Shearing

Shearing should preferably be done by accredited shearers and it is imperative that shearers observe the industry quality standards as prescribed in the NWGA shearing manual. The shearing manual is standard issue to all trainees participating in a NWGA shearer training course. The manual is also available at the regional offices of the NWGA.

Shearing is stressful to goats, so:

- Undue handling of goats must be avoided.
- Care should be taken not to expose shorn goats to adverse weather conditions.
- Goats should be returned to food and water as soon as possible after shearing.
- Where circumstances indicate, shearing cuts should be treated with a disinfectant and a fly repellent wound oil to prevent infection.

3.2.7 Health precautions

Prevention of disease transmission is of utmost importance during shearing. The correct disinfection and sanitary procedures must be followed to prevent the spread of infectious diseases by shearing equipment and shearers within a flock or between flocks, so:

- Dead animals should not be skinned in a shearing shed.
- Sick animals should not be housed in a shearing shed.
- Skins and pelts should not be treated, dried or stored in a shearing shed.
- Before shearing commences the entire shearing shed should be cleaned and disinfected.
- After completion of shearing all Mohair should be classed, packed and removed from the shed and shearing equipment should be disinfected.
- Shearing equipment should be disinfected at regular intervals during shearing to stop the spread of disease.

NWGA Shearing Manual

The NWGA Shearing Manual is a complete guideline to best practice and producers are encouraged to obtain it from:

NWGA Shearer Training Division,
PO Box 4520, Bloemfontein, 9300.
Tel. 051 447 3023

- Shearers should change into a clean pair of trousers once they cut an abscess. When this happens the shearing area should also be disinfected.
- Care should be taken that young goats are shorn first in order to prevent disease transmission from older animals.

3.2.8 Identification of goats

Ear marking instruments should be sharp, with the cutting edges undamaged, so as to prevent tearing of the ear. The ear may be tattooed, tagged, notched or hole-punched. Electronic identification methods may also be used. According to the Animals Identification Act (Act no 6 of 2002) goats should be tattooed when they are 30 days old.

3.2.9 Euthanasia of goats

Effective and humane methods of euthanasia which cause a quick and painless death must be used when there are no other alternatives to either prolong life or to limit pain.
The humane destruction of animals should be performed by the following methods:

- Pre-stunning using a captive bolt pistol, then a cut to the throat with a sharp knife, of suitable blade length, ensuring that the trachea (windpipe), both carotid arteries and the spinal cord are cleanly severed.
- A clean shot to the head using a fire-arm.
- In case of emergency, a sharp knife, of suitable blade length, must be used to ensure that the trachea (windpipe), both carotid arteries and the spinal cord are cleanly severed.

3.2.10 Transport

The following key elements of importance should always be considered when handling goats.

3.2.10.1 Penning of goats

- Goats must always be penned separately from other animals.
- Goats should always be penned in different age groups.
- 0.56 m^2 of floor area must be provided per goat.
- There must be an adequate supply of water and food.

3.2.10.2 Handling

- Goats must be handled with patience and tolerance with due allowance for their natural behaviour.
- Goats may be caught above the heel or by the horn, depending on their ages.
- Goats should not be dragged by their legs.
- The South African Mohair industry does not condone the use of electric prodders.

3.2.10.3 Movement on the hoof

- Goats on the hoof shall be driven in a calm manner at a gait that is relaxed, natural to that animal, and not faster than the pace of the slowest animal.
- Goats may not be moved for a distance greater than 20 km on the hoof on the first day and more than 15 km on consecutive days.
- Goats shall be watered and fed immediately on reaching their night camp or final destination, with sufficient food of a quality and of a type compatible with the species.
- Contingency plans must be in place to move by vehicle any goat that becomes exhausted, lame or otherwise unable to keep up with the herd.

3.2.10.4 Vehicles used in transport

Vehicles must be licensed and roadworthy and a removal certificate must accompany stock.

- All such vehicles and trailers shall have:
  - A suitable non-slip floor.
  - Adequate ventilation and light whilst in motion as well as when stationary; no vehicle shall be totally enclosed.
  - Side-walls must be high enough to prevent a goat from escaping or falling out of the vehicle.
- The density of goats packed into any given space shall be such as to ensure their safety and comfort. The average recommended floor space per animal is 0.4 m^2.
- Different age groups should be kept apart and may require more or less floor space.

3.2.10.5 Watering and feeding prior to loading

Goats shall be provided with sufficient and suitable food and fresh water up to the commencement of the journey.

3.2.10.6 Loading and off-loading procedure

- Loading and off-loading of livestock into or out of a vehicle shall be accomplished as quietly and calmly as possible, with patience and tolerance and without undue harassment, terrifying of the animals, bruising, injury, suffering or undue stress.
- Animals shall be promptly off-loaded on arrival at the destination.

3.2.10.7 Restraining livestock during transport

- Goats may not be kept in restraint for more than 4 h in any 24-h period.
- No wire or bailing twine shall be used for tying a goat's legs or feet.
- To avoid strangulation or neck-break, a slip knot may not be used where animals are secured to the vehicle by the horns or neck. The rope must be attached to the vehicle at the level of the goats 'knees', so that in the event of the goat falling, the possibility of serious injury or death is reduced. The rope should be long enough to allow a goat to lie comfortably in a natural position with the head in an upright position.

The Code of Practice for Handling and Transport of Animals may be visited at www.samic.co.za

3.2.11 Nutrition

Adequate nutrition for maintenance, growth and reproduction must be provided as a key element to Angora goat well being[6,11].

In case of a full-feeding or supplementary feeding system, diets should be formulated by a professional animal nutritionist to prevent metabolic disorders and accompanied unnecessary discomfort, pain and deaths. Goats should be excluded, as far as possible, from toxic plants and other substances suspected of being deleterious to their health. As a good practice, feed must be of good quality and free of moulds and poisonous plants and seeds. The use of animal by-products (e.g. bloodmeal, bonemeal, chicken litter) should not be allowed.

For more information the policy on animal feed could be visited (under Act 36 of 1947).

3.2.11.1 Water

Goats should have access to clean, palatable and adequate volumes of drinking water. Regular assessment should be made of the quality and quantity of water supply with attention to the special needs of lactating ewes and to goats in hot weather. Watering points should be of sufficient capacity and safe access must be provided. Mechanical equipment, controlling the delivery of water, (including windmills and boreholes) should be inspected regularly and frequently in hot weather and kept in good working order. The quality of water provided should be adequate to maintain health. Voluntary water consumption is 2 or 3 times dry matter consumption and it increases with high-protein and salt-containing diets. Drinking water, which contains potentially toxic levels of salts, or other harmful substances, should be monitored and managed to minimize harmful effects. Where sufficient good quality water to maintain health cannot be provided, goats should be moved to other areas where an adequate supply is available. As a guide, goats should not be deprived of water for more than 24 hours. This period should be reduced during late pregnancy, kidding and in the event of hot weather.

3.2.11.2 Drought

Drought is defined as a severe food and/or water shortage during prolonged periods of abnormally low rainfall. A drought is not a normal seasonal decline in the quantity and quality of food available.

Property strategies for drought management should be prepared well in advance and progressively implemented. Where drought feeding is indicated, it should be started before normal grazing feed runs out. For optimum results goats should be fed in different age and condition groups. Goats that are fed for survival should be observed carefully at feeding times. Weak animals may require separation for special treatment.

Goats should not be allowed to starve. Where minimal water and food requirements cannot be met supplemental feed should be given if it is economically viable. Grazing could be hired or the stock must be sent for slaughter to prevent suffering. Drought affected goats are highly susceptible to stress and require careful handling and treatment.

3.3 Health and Disease management strategy

In general:

- A Health Management Plan should be monitored by a veterinarian versed in the field of Animal Production and Disease Control.
- Sick, injured or diseased goats should be given prompt and appropriate treatment or must be humanely slaughtered.
- Preventative measures should be used for goat diseases that are common in a district.
- Remedies should be administered in strict accordance with the manufacturer's instructions and veterinary prescription medicine must be used as prescribed by the veterinarian.
- The label instructions must be followed strictly to ensure successful administration and to avoid risks to goats, workers, consumers and the environment.
- Individuals handling and applying medicines must be trained and able to demonstrate appropriate competence and knowledge of diseases.
- The use of hormonal growth promoters should be limited and is not allowed with organic farming systems.
- Medicines past their expiry date and used medicine containers must be disposed of in a manner agreed to with the attending veterinarian so that it will not result in subsequent mis-use.

3.3.1 Medicine Storage

- Medicines must be stored in accordance with the label instructions in a sound, secure, locked and well lit location, away from other materials, like feedstuff. The same applies for medicines that require refrigeration. Medicines should be stored in a cool, dark room, not kept on the windowsill in direct sunlight.
- Emergency information and facilities must be available to workers to deal with accidents e.g. eyewash, plenty of clean water.
- Medicines must be stored in their original containers.
- Records: An inventory must be kept of remedies and medicines and their use. This should be monitored by a veterinarian versed in the field of Animal Production and Disease Control. See Appendix 1 for a example of a medicine inventory.

3.3.2 The handling and use of vaccines[26]

3.3.2.1 What is a vaccine?

A vaccine is a preparation containing an infectious agent, which when administered to a goat will produce resistance to that specific agent. The goat is protected on subsequent exposure to the same organism. There are various types of vaccines:

Live vaccines

Live vaccines usually contain a live micro-organism which has been weakened (attenuated) in some way, or a naturally occurring avirulent strain. Most live vaccines are in a freeze-dried form. Freeze-dried vaccines are presented in the form of a compact, dry pellet, which must be mixed with sterile water before it can be injected. In this form the micro-organisms in the vaccine can be successfully stored provided the vaccine is kept in a refrigerator and is not exposed to direct sunlight.

Inactivated vaccines

There are 3 types of inactivated or non-living vaccines:

1. Killed vaccines: This is a vaccine made of micro-organisms that have been killed using chemicals or heat. Killed bacterial vaccines are sometimes referred to as bacterins.

2. Toxoids: These are vaccines made of bacterial toxins, which have been rendered non-toxic by chemical treatment.
3. Sub-unit vaccines: Sub-unit vaccines contain only certain parts or structures of a micro-organism.

Inactivated vaccines are usually less effective inducers of an immune response than live vaccines and so they have chemicals added to them which improve the immune reaction. These chemicals are called ADJUVANTS. The adjuvants may be mineral oils or potassium or aluminium salts. In some adjuvanted vaccines that have been standing for a while, a sediment may settle out to the bottom of the vaccine bottle. Vaccines containing adjuvants must be shaken well but gently before use to mix all the components.

3.3.2.2 How to use a vaccine

Directions for the use of a specific vaccine must always be followed carefully. As the directions for using a vaccine are changed from time to time vaccines should never be purchased without the package inserts which contain the directions for use. It is essential to read the package inserts with regard to the following important information:

1. Storage: The vaccine must be stored at the recommended temperature. With the exception of heartwater and frozen redwater vaccines, which are kept frozen on dry ice or in liquid nitrogen, all other vaccines should not be frozen. Freezing and thawing destroys certain components in vaccines and therefore a vaccine which has been accidentally frozen must be discarded. Fridges used for vaccine storage should be checked regularly for efficient functioning. Maximum-minimum thermometers or commercially available colour indicators can be used for this.
2. Dose: The dose recommended by the manufacturer has been determined by extensive and expensive research. Reducing the dose to save vaccine will result in little or no immunity developing, whereas exceeding the dose is wasteful and may result in toxic or allergic reactions.
3. Route: The route by which the vaccine is administered is very important and use of the wrong route of vaccination may cause problems. It is very important to follow the instructions of the manufacturer in this regard and to administer the product via the route and at the site as prescribed by them.
4. Age: The recommended age of vaccination is usually based on the age at which the animal is exposed to or becomes susceptible to that particular disease.
5. Season: Some diseases are seasonal and vaccination must be carried out before exposure and high risk period in order to be effective. Time must therefore be allowed for an immune response to develop. It must be borne in mind that for some diseases (for example blue tongue) a number of vaccinations must be given and sufficient time must be allowed for immunisation.

3.3.2.3 Precautions when using vaccines

1. Needle and syringe hygiene: Needles and syringes used for vaccination must be sterile. They can be sterilized by boiling in water for 30 minutes in a small pot or in an instrument sterilizer. Needles should be changed as often as is practically possible while vaccinating. During outbreaks of disease a single needle must be used for each animal. Using unsterilized needles and syringes can cause abscesses or generalized infections. Syringes must be set aside for administering *Brucella melitensis (Rev 1)* vaccine and only used for this purpose.
2. Exposure of vaccines to sunlight: The ultra-violet rays of the sun are damaging to all infectious agents and it is therefore essential that live vaccines are kept out of direct sunlight. All vaccines are degraded by heating and care must be taken to keep vaccines cool during transport and use in the field. A cool bag containing cool packs should be used for this purpose.
3. Mixing vaccines: Different vaccines should not be mixed in the same syringe unless the manufacturer states that this can be done. Vaccines must also not be mixed in syringes with any other injectable preparations (vitamins, antibiotics, dewormers, etc) as chemicals contained in the latter may damage the vaccine components.

4. Vaccinating during outbreaks: Vaccinating during outbreaks is fraught with problems and should be avoided by implementing a well-planned preventive vaccination program. Apart from the fact that animals may already be incubating disease when they are vaccinated, immunity takes time to develop and animals may sometimes be affected before they can develop immunity. Another consideration is that diseases can be transmitted from animals incubating disease to healthy stock by inoculation needles. Needle transmission can occur with the following diseases: lumpy skin disease, Rift Valley fever, anthrax, quarter evil. It is essential to use a separate needle for each animal during outbreaks of these diseases. A further problem of vaccinating during outbreaks is that many other farmers have also not vaccinated and this results in vaccine shortages!
5. Vaccines potentially harmful to humans: Live vaccines of zoonotic diseases could cause serious disease in humans if they are exposed via accidental injection or splattering into the eyes. This includes *Brucella melitensis* (Rev 1) which can cause Malta fever in humans. Care should be taken when these vaccines are used and precautionary measures should be in place. If an exposure incident occurs, immediate action should include rinsing of the eyes with clean water and medical attention.

3.3.3 Injecting goats

3.3.3.1 General - hygiene

- When giving injections always get veterinary advice to make sure the products are appropriate and you know the correct procedure.
- Follow the manufacturer's instructions to the letter for storage and use of the product.
- Make sure you take care to dispose of old syringes, needles and packaging in a safe place. Needles are especially dangerous and should go into a special "sharps" rubbish container.
- Various pathogenic bacteria are present on the surface of the skin and these may produce infection if injected with the medication. Therefore, when time allows or for valuable animals, or if the environment is very dirty, take every care to clean and disinfect the skin before injecting.
- Tincture of iodine is satisfactory and is better than methylated spirits which though commonly used, is not effective as
- a disinfectant.
- A fresh swab of disinfectant should be used for each animal.
- On large farms, the above comments may be hopelessly impractical. For example, if you have to vaccinate 500 ewes, you will not have time to disinfect the skin of each goat.
- You may simply proceed down the race injecting each goat in a clean part of the neck, taking care to keep your hands clean (and washing them if they become dirty), and replacing the needle after each race.
- The injection gun, including all parts coming in contact with the drug or the product to be injected, should be placed in a large container such as a pressure cooker or saucepan and thoroughly boiled with with the lid on.
- Bringing to the boil will kill all normal bacteria and boiling for 30 minutes will ensure the destruction of most bacterial spores.

A subcutaneous injection behind the elbow

A subcutanious injection in the neck region

Intramuscular injection in the rump

Intramuscular injection in the hind leg

- After boiling, the saucepan or container should be tipped sideways with the lid on so that the water drains out.
- With all the water out, the syringe and the plunger may be picked up by external parts only and carefully fitted together without touching any part, which will make contact with the animal or the vaccine. Wash and dry your hands before picking up and assembling the injection equipment.
- Generally, use the smallest needle that is suitable, i.e. the needle with the narrowest bore, such as a 19-gauge needle. In tough-skinned animals a stouter needle may be necessary, e.g. a 16-gauge.

3.3.3.2 Subcutaneous injection (SQ - under the skin)

- This is the easiest and quickest form of injection, and it is used for many vaccines and drugs that are non-irritant and are readily absorbed.
- With stock held in a race to give a subcutaneous injection, pull up a handful of skin to make a "tent" and slide the needle into the base of the tent under the skin and press the plunger.
- Check when doing this to make sure the jet from the syringe is not coming out the other side of the tent because you've pushed the needle too far through.
- The loose skin on the side of the neck or behind the elbow is a good location for SQ injections.
- A 1-inch needle of 18-20 gauge diameter should be used.
- With irritant materials as some vaccines can be, a reaction may result producing a lump. This may blemish the carcase when the animal is killed and dressed. In such cases, make the injection at the top and to one side of the neck. Any lump that occurs here can be trimmed off when the carcase is dressed.

3.3.3.3 Intramuscular injection (IM - into the muscle)

- Many drugs have to be injected deep into the muscles to give more rapid absorption and may lead to less irritation.
- Angora goats usually do not have thick muscles and care should be taken when giving intramuscular injections.
- Possible intramuscular injection sites are the muscles of the neck and big muscle mass of a hindquarter. Care should be taken to avoid the nerves and blood vessels that run alongside these muscles.
- It is important that the injection is not put into subcutaneous fat and actually hits muscle.
- A shorter needle than for sheep should preferably be used, especially in kids; 1 or less inches in length and 18-20 gauge in diameter is recommended for IM injections.
- Just before pressing the syringe plunger; withdraw it a little and if the needle has inadvertently gone into a blood vessel, blood will show in the hub of the needle. If this happens the needle must be moved to a new site so that the injection is intramuscular and not intravenous.

3.3.3.4 Intravenous injection (into the vein)

Avoid giving intravenous injections (into the vein) and leave them to your veterinarian, as finding a vein and injecting into to it can be tricky, especially on a goat with long hair.

3.3.3.5 Intra-mammary injection (into the udder)

- In goat, antibiotics for mastitis are normally given intramuscularly but you may need to give an Intra-mammary injection to get antibiotics into the udder via the teat canal.
- These are really "infusions" using the long neck on the tube rather than a needle to deliver the treatment.
- Remember the teat sphincter muscle that opens into the teat canal are very delicate structures and the teat is a very sensitive part of the goat so work gently and with care.
- A goat's teat canal is much smaller and more delicate than that of a cow.
- After the full tube has been emptied into the teat, it's no longer recommended to hold the teat end and massage the product up into the udder.
- It is also important to clean the end of the teat with methylated spirits before you insert the tube. Use cotton wool swabs and keep using them until they show no more dirt from the teat end. This may take quite a few rubs. If you don't clean the teat end all you'll do is to push dirt and bugs into the teat and cause more problems.

3.3.3.6 Filling a syringe

- If you have to draw liquid from a new bottle of product into a syringe, it's often hard to suck out because there is no air in the new bottle or container.
- All you need do is to draw into the syringe the amount of air that will be replaced by the injection, and inject this air into the bottle through the rubber cap.
- This will put enough air into the bottle and allow you to fill
- the syringe.
- You may have to do this every now and again if you find it hard to fill the syringe.
- Or you can put another needle in the cap of the container to act as an air entry while you are drawing product out.
- Try to keep everything as clean as possible and free from contamination.

3.3.4 Important bacterial and viral diseases

The following diseases do not cover the whole spectrum and a veterinarian must be consulted when there are suspect cases. Producers should know which diseases are prevalent in their respective areas and manage Angora flocks accordingly.

3.3.4.1 Enzootic abortion

The organism which causes enzootic abortions in ewes is called *Chlamydophila abortus*. *Chlamydophila* is the most common cause of abortion in ewes. It is transmitted from aborting goats to other susceptible females. Ewe kids are usually the most susceptible

on farms where the organism is present. *Chlamydophila* causes abortion during the last month of pregnancy and may also result in the birth of kids that die shortly after birth.

The organism may also cause pneumonia in young kids, but the *Chlamydophila* species that causes abortion is not associated with conjunctivitis or arthritis. *Chlamydophila* abortions can usually be stopped or reduced by treating the entire flock with tetracycline. Various vaccines are available and care should be taken to follow the manufacturers recommendations when administering these. Ewes should be vaccinated at least 4 to 6 weeks before the breeding season.

3.3.4.2 Rift Valley Fever

Rift valley disease is a viral disease of sub-Saharan Africa. The virus attacks the liver and causes symptoms ranging from fevers and listlessness to hemorrhage and abortion rates approaching 100% in pregnant goats. It is transmitted by mosquitoes. There is no specific therapy for infected animals.

Vaccination of animals against RVF is used to prevent disease in endemic areas.

Vaccination

Different vaccines are available.
Live vaccine (for cattle, goats and sheep)
This is a vaccine that must be administered annually. The vaccine cannot be used in pregnant animals and kids of vaccinated dams should be vaccinated after 6 months of age.

Inactivated vaccine (for cattle)
This vaccine is an inactivated vaccine developed for cattle. This vaccine can safely be given to pregnant ewes during an outbreak, but the immunity lasts, at most, for one year.

Points to note

1. Vaccination against RVF is strongly recommended as a routine, because vaccination during outbreaks is a problem.
2. Severe losses are suffered during an outbreak.
3. RVF is a zoönosis.

3.3.4.3 Bluetongue

Bluetongue is a an midge–transmitted, viral disease that can affect goats. A bluetongue virus infection causes inflammation, swelling, and haemorrhage of the mucous membranes of the mouth, nose and tongue. Inflammation and soreness of the feet also are associated with bluetongue. In goats, the tongue and mucous membranes of the mouth become swollen, hemorrhagic, and may look red or dirty blue in colour, thus giving the disease its name. Bluetongue viruses are spread from animal to animal by biting midges. Animals cannot directly get the disease from other animals. With vacinations, care must be taken that the manufacturers recommendations be followed exactly. The three fractions of this vaccination must be administered three weeks apart and rams should not be vaccinated within 60 days of mating as the accompanied feverish reaction may inhibit fertility.

3.3.4.4 Pasteurella (Mannheimia haemolytica)

Goats of all ages are affected and the disease usually causes different forms of pneumonia ("bontlong" and "harslagsiekte") and *Pasteurella* bacteria are also one of the causes of mastitis (blue udder)[27]. *Pasteurella* infections are frequently accompanied by infections by parainfluenza virus, mycoplasma organisms and diseases such as chlamydophila and "jaagsiekte" as well as stress conditions such as drought and cold. In order to obtain the best results with the vaccine these conditions should also be combated.
There are a great variety of *Pasteurella* bacterial strains and only the most important strains are included in the vaccine. Consequently the vaccine will be ineffective in certain instances. If problems are encountered, a veterinarian should be consulted. Special vaccines for specific strains, that are not included in the standard vaccine, are obtainable from Onderstepoort Biological Products.

3.3.4.5 Orf (Vuilbek)

Orf is caused by a poxvirus named Paravaccinia[27]. Young kids are more susceptible and therefore show more severe clinical signs than adult animals. The virus is transmitted from infected to susceptible goats by direct contact or indirect through wounds. The affected areas are typically the lips, ears, feet, reproductive organs, flanks and upper legs. The wart-like lesions may become secondary bacterially infected and can give rise to complications such as mastitis or septicaemia. Animals never show a fever because the virus remains localised in the lesions. The vaccine is called Onderstepoort Orf Suspension.

3.3.4.6. Abscesses (Corynebacterium)

There are various causes of abscesses in goats but the bacterium *Corynebacterium pseudotuberculosis (previously known as Corynebacterium ovis)* is the most common[27]. Infection results in abscess formation in the lymph nodes which when cut or rupture, discharge pus containing the bacteria into the immediate surroundings. When the abscesses spread internally, affected ewes slowly lose weight and eventually become emaciated. The disease is controlled by culling visibly infected animals and practicing good hygiene at shearing time. There is a vaccine licensed for goats.

3.3.4.7 Blue Udder

Blue udder is an acute mastitis in goats which occurs soon after kidding[27], It is most often caused by serotypes of *Mannheimia haemolytica, Corynebacterium* or by *Staphylococcus aureus*. It is most common in young ewes. These causative bacteria are carried by normal healthy goats.

The name of the disease refers to the affected udder becoming hardened, the function of the udder impaired with the ewe becoming economically non-viable.

3.3.4.8 Heartwater (Ehrlichia ruminantium)

Heartwater is an infectious rickettsial disease transmitted by infected bont ticks[27]. The tick prefers moist areas and is found widespread (traditionally only in the eastern half of South Africa). Affected animals have a fever, are listless and lag behind. As the disease progressed breathing becomes more laboured and animals may push their heads up against firm objects. Affected animals eventually lie on their side with the head pulled backwards and the legs extended. They are sensitive to light. More information can be obtained from www.obpvaccines.co.za

3.3.4.9 Clostridial Diseases

The various Clostridia bacteria are found in the soil, where they can survive for a very long time[24, 27]. Most Clostridial organisms can also occur quite naturally in the gut of healthy animals. Goats can be infected with various Clostridial diseases, i.e. black leg, botulism, malignant oedema, red water disease, enterotoxemias (several types), and tetanus, but the most common disease are enterotoxemia types C and D and tetanus.

Enterotoxemia type C (hemorrhagic enteritis, bloody scours)
Enterotoxemia type C is caused by *Clostridium perfringens* type C and affects kids during their first few weeks of life, causing a bloody infection of the small intestine. It is often related to indigestion and predisposed by a sudden change in feed such as beginning creep feeding or sudden increase in milk supply. Treatment (antitoxin injected under the skin) is usually unrewarding. Vaccination of pregnant ewes 30 days before lambing is recommended as prevention.

Enterotoxemia type D (pulpy kidney, *Clostridium perfringens* type D)
Overeating disease is one of the most common goat diseases in the world. It is caused by *Clostridium perfringens* type D and most commonly strikes the largest, fastest growing kids in the flock. It is caused by a sudden change in feed that causes the organism, which is already present in the kid's gut, to proliferate causing a toxic reaction. It is most commonly observed in kids that are consuming high concentrate rations, but it can also occur when kids are nursing heavy milking dams. It usually affects kids over one month of age. Treatment (antitoxin injected under the skin) is usually unrewarding. Vaccination of pregnant ewes 30 days before kidding is recommended as prevention.

Tetanus (lock jaw, *Clostridium tetani*)
Tetanus is caused by *Clostridium tetani*, a soil inhabitant that is a prolific spore producer. This disease is usually related to docking and castrating by elastrator bands, though any wound can harbour the tetanus organism. Signs of tetanus occur from about four days to three weeks or longer after infection is established in a wound. The animal may have a stiff gait, "lockjaw" can develop and the third eyelid may protrude across the eye. The animal will usually go down with all four legs held out straight and stiff and the head drawn back.

Treatment consists of the tetanus anti-serum and antibiotics. It is usually unrewarding. Tetanus can be prevented by vaccinating pregnant ewes 30 days before kidding. If pregnant ewes were not vaccinated for tetanus, the tetanus anti-toxin can be administered to kids at the time of docking and/or castrating. The tetanus anti-toxin provides immediate short-term immunity and can be used at the time of docking and castrating to prevent disease outbreaks.

Lamb dysentery (*Clostridum perfringens* type B)
Clostridum perfringens type B causes lamb dysentery. It usually affects strong kids under the age of 2 weeks. Symptoms include sudden death, listlessness, recumbency, abdominal pain, and a fetid diarrhoea that may be blood-tinged. On post-mortem, intestines show severe inflammation, ulcers, and necrosis. The mortality rate approaches 100 percent.

Malignant Edema
Malignant edema is caused by the bacterium *Clostridium septicum, Clostridium chauvoeii and Clostridium novoeii*. This is a form of quarter evil which affects the uterus of ewes shortly after lambing. There are 10 in 1 vacinations available.

3.3.5 Internal Parasite Control

Although there are numerous internal parasites of grazing livestock, nematodes (roundworms) are the principal internal parasites that plague grazing ruminants. Other common internal parasites of ruminants are protozoa (coccidia), trematodes (flukes) and cestodes (tapeworms).

Coccidia Epidemiology and Control
Coccidia live in the mucosa of the small intestine, and under favorable conditions can multiply very rapidly. A rapid asexual development may occur prior to the release of large numbers of oocysts (commonly called eggs) in the feces. This rapid development, combined with a heavy level of infection means that the quantity of oocysts in the feces is not indicative of the severity of the disease. It is predominantly a problem of young, growing animals because their immune system has not developed the ability to combat heavy infections, and regularly occurs as early as 3 – 4 weeks of age. These infections most commonly occur when animals are closely confined, particularly under conditions of poor sanitation and ventilation. They are less common in grazing animals, although they can occur in warm, moist conditions.

Coccidia transmission occurs from oral ingestion of the oocysts. Coccidia thrive in warm, moist environments, which also favor pneumonia, so these two diseases often parallel each other. Outbreaks on pasture are sometimes associated with seasonal rainfall. Factors, which increase animal stress, such as shipping or weaning, can be associated with outbreaks. From a management point of view, stress reduction and sanitation are essential coccidia control practices. Proper sanitation, which reduces faecal contamination and reduces moisture buildup, can reduce coccidia infection rate and disease outbreak. Administration of anticoccidial drugs can significantly reduce coccidiosis.

Nematode Pasture Epidemiology and Control
The gastrointestinal nematodes of ruminants all have a simple direct life cycle. In a direct cycle infective larvae are picked up from the pasture by the host. The larvae develop into egg laying adult nematodes. With some minor exceptions, the eggs are shed in the feces, embryonate, hatch into larvae on the pasture, some of which are consumed, continuing the cycle. A key point of the direct life cycle is that the nematodes do not multiply in the host. Multiplication is due to the quantity of eggs passed in the feces. Ultimately, the worm burden in the animal is directly related to the density of infective larvae on pasture. The actual density of infective larvae on pasture is related to the stocking density or animals, the effectiveness of the dosing program, and the environment.

Control Strategies
Today's major challenge for goat producers is to provide a parasite safe environment for their goats while minimizing the development of anthelmintic resistance. Achieving these goals requires an understanding of the parasites, selection of the right goats, and incorporating the right management practices. Strategies to prevent or delay the development of anthelmintic resistance fall into three groups: management strategies, grazing strategies and anthelmintic strategies.

Management Strategies
Controlling hypobiotic larvae
Nematodes over winter either on pasture or in the host. Those that over winter in the host stop their development (hypobiosis) when they are picked up from pasture in autumn. The most pathogenic nematodes of small ruminants, particularly *Haemonchus contortus*, over winter principally in the host. Thus one of the most important times to dose animals is during the over wintering period. (Note that immature larvae do not shed eggs, so faecal analysis would likely give low values).

Immunity to parasitic infections
Genetics affect an animal's ability to resist infection, as well as withstand infection. Resistance is defined as the animal's ability to resist infection. It is measured by faecal egg counts (FEC) and is 20 to 30 percent heritable. Resilience is defined as the animal's ability to withstand infection. It is measured by blood haematocrit or packed cell volume (PCV). It is less heritable than resistance.

It is important to manage both resistance and resilience in a herd. Since only a small number of animals shed the majority of worm eggs, ideally, these animals should be identified and removed from the herd. They are often those with clinical signs such as anaemia, emaciation.

Nutrition status
Sheep and goats on a higher plane of nutrition and/or with a higher body condition score are better able to withstand parasite challenges. Nutrition in early pregnancy increase fat stores and has been shown to increase the immune response to parasites. Ewes receiving increased protein levels during late gestation are better able to mount an immune response to parasites. Since worms need grass to develop, sheep and goats raised in confinement have fewer parasite (stomach worm) problems and those put in confinement are less likely to get re-infected.

Grazing Strategies and Pasture Systems
Clean or safe pasture systems
The use of clean or safe pastures will help to control parasite problems. Care must however be taken that worms in "refugia" which have not been exposed to drug treatment are present in free-living stages on pasture and worms in untreated animals. To increase refugia, it is suggested that a portion of the flock is not to be dewormed. This principle is viewed to slow down anthelmintic resistance. A pasture grazed by cattle and/or horses is also considered safe, since sheep/goats and cattle/horses do not share the same parasites.

Pasture rotation systems
Rotational grazing generally does not help to control internal parasites unless pasture rest periods are long enough (> 70 days).

One other comment on safe pastures would be related to browse utilization. Often it is noted that goats browsing don't seem to have problems with parasites. Since infective larvae are generally associated with the moisture on the lower parts of the forage, animals consuming browse or woody plants would not pick up as many parasites. In some systems this may be viewed as a type of safe pasture.

There are some forages that may have anti-parasitic effects. These include Birdsfoot Trefoil, Chicory and other forages containing condensed tannins.

Alternate animal species
The nematodes of sheep and goats are similar, but the nematodes of other animals differ significantly. Pastures that were not grazed by sheep or goats in the previous year will be safe or clean for grazing. A small number of producers raise two or more different types of animals in enough quantity that they can alternate from year to year which animals graze which pastures. If horses or cattle graze a pasture one year, then the following year that pasture would be considered safe for small ruminants. Goats and sheep have very similar nematode parasites, so alternating between them is not effective.

Anthelmintic Management Strategies
Reduce the use of anthelmintics
Anthelmintic use should be restricted to 2 or 3 times per year. Regular monthly (or more frequent) dosing, as practiced on some farms, cannot be recommended.

In any herd, there is a large variation in animals in their ability to tolerate parasite loads. The emphasis on dosing is shifting towards less frequent dosing and treating only those animals that need to be dosed (targeted selective treatment). There are a number of ways that producers could decide which animals are less parasite tolerant (need treatment). These would include faecal analysis of individuals, clinical evaluation of anemia (FAMACHA eyelid system) or general animal condition (large operations). Basically any of these systems would identify a portion of the herd as being more susceptible to parasites or specifically to *Haemonchus contortus*.

There are several important concepts here. One is that the idea is to treat less frequently and less animals. These systems are not being used to decide when the whole herd should be treated, rather just the individuals. Another is that tolerance is a genetic trait, so that animals identified as less tolerant should be culled. This will slowly improve the average herd tolerance to parasites. Finally to some degree these systems emphasize selection on the basis of tolerance to *Haemonchus contortus*, the most pathological sheep and goat nematode. This is why veterinary parasitologists are encouraging producers to be trained in using faecal analysis and FAMACHA systems. One runs the risk of not properly analyzing faecal egg counts or eyelid anemia, so it is advised to regularly consult with your small stock veterinarian. In addition, while *Haemonchus contortus* is the major parasite problem, other nematodes can also be devastating. These other nematodes will not cause severe anemia or as high faecal counts.

Use the full dose of an anthelmintic
Use of a sub-therapeutic dose of anthelmintic may permit survival of some worms showing partial resistance to that drug. When these

partially resistant worms interbreed they may produce offspring that are more resistant to the anthelmintic. Use of reduced doses mostly results from underestimating the weight of the animals. All animals should be weighed prior to treatment and a recommended dose (or higher) should be used. As it is often not feasible to weigh all animals, weigh a few heavier ones and dose all according to these heavier weights.

Alternate the type of anthelmintic used
Anthelmintic groups should be alternated on an annual or longer basis. Alternating anthelmintics at every dosing is not recommended. This more frequent change may enhance the chances of developing resistance to both types of anthelmintics. Resistance can be measured by the faecal egg count reduction test (FECRT) 14 days after drenching

Efficacy in Goats
Goat metabolism is physiologically different from cattle and sheep. Generally, it takes higher dose of anthelmintics to reach the same pharmacological dose in goats. This is important because most anthelmintics are not labeled for use in goats (or maybe mislabeled at lower than desired doses). It should be noted that these higher dose recommendations are not always based on actual controlled tests in goats, but the controlled tests that are available are consistent with a general increase. Another problem using field experience to determine recommend dosing levels for goats is that anthelmintic resistance has reduced the efficacy of many products, which could account for a need for higher doses. The general rule of thumb is that goats need twice the anthelmintic dosage (concentration on a body weight basis) as sheep or cattle. One exception to this rule is levamisole where an actual controlled study indicates that 1.5 times the sheep dose is efficacious in goats (or about 12 mg per kg body weight).

Faecal Analysis
Doing faecal analysis is great as a part of an overall management program, but they are of limited value in determining when to dose. Many producers are under the opinion that faecal analysis is a good indication of when you should dose your animals. This isn't entirely accurate. As we see it, there are three real values to faecal analysis: first they tell you how infected your pastures are. Note that I said pastures (not animals). This is great in a management program where you monitor faecal egg counts for pasture loads. The main thing that a faecal tells you is how contaminated your pastures are with parasite larvae (or more specifically how bad they were three weeks earlier). If you're doing faecal analysis at regular intervals, then you can use this knowledge to design management strategies that keep pasture worm burden manageable. This is the real goal of parasite control.

Second, faecal analysis can be used as part of a culling program. If you run faecal analysis on your breeding herd, you can select for animals that are more tolerant to parasites. The idea would be to cull animals that have high faecal egg counts. The higher the percentage that you cull, the more rapid your selection will progress.

Third, faecal analysis can be used as part of a drug test program to see if the anthelmintic works. Basically, if an anthelmintic works, faecal egg counts should drop to zero and not return for at least a couple weeks. The actual test is called a faecal egg count reduction test.

3.3.6 External parasites

3.3.6.1 Ticks

A wide variety of ticks are found in areas where goats are kept. These include the blue tick, Pantropic blue tick, bont tick, bont-legged tick (large, small and grey species), brown tick and Karoo paralysis tick. Apart from being blood suckers, ticks are also responsible for transmitting specific infections (heartwater) and non-specific infections (abcesses), tick bite wounds, skin damage and toxicosis such as tick paralysis.

3.3.6.2 Flies

Only the nasal fly and the stable fly are of significance. The larvae of the former cause severe irritation of the mucous membrane of the nasal passages and sinuses and excessive nasal discharges. Adult stable flies are voracious bloodsuckers, especially on the ears and lower extremities.

3.3.6.3 Midges and mosquitoes

Females of both midges and mosquitoes are active bloodsuckers. By this process certain midges transmit the bluetongue virus, while mosquitoes are the vectors of Rift Valley Fever and Wesselsbron disease.

3.3.6.4 Lice

The blue body louse and two species of sucking lice are important in Angora goats. These lice cause severe irritation of the skin and will cause the animal to scratch itself, rub against objects, or to bite its fleece. This in turn leads to weakening, matting and discoloration of the fleece. Heavy infestations may stunt growth, or even cause death in kids.

Monitor all goats for lice infestation – Lice are most prevalent in wintertime. When infected, dip all goats, including kids with a registered product. When dipping is not possible, treat all goats, including kids with two treatments of a registered pour-on. It is a good practice to notify your neighbours.

3.3.6.5 Mites

Various types of mites may be found either in the ears, the face or lower joints of the legs. Mites cause severe irritation and damage to the skin, resulting in scratching, rubbing and biting by the affected animal. The skin becomes thickened and inflamed, the hair is lost and crusts are formed on the surface. Loss of appetite, emaciation and death may result.

3.3.6.6 Treatment and control of external parasites

Treatment and control of ticks, lice and mites are effected by regular plunge dipping, or belly dipping in case of paralysis ticks. A wide range of dips are available and should be used strictly according to the accompanying instructions, especially with regard to preparing the initial concentration and subsequent constant replenishment. The control of flies, midges and mosquitoes away from the host animal is almost impossible. Control in any way is not at all practically possible in some cases, while in other instances control is effected by elimination of breeding places, or treatment of such places in order to kill off the immature stages.

3.3.7 Dipping

Animals should be dipped at least once, shortly after shearing. Newly shorn animals require less dip, and dipping is also more effective at this stage. Dip animals preferably two to six weeks after shearing, as the Mohair is then long enough to retain dip.

Angora goats should be handled carefully because they are more nervous than sheep and tend to panic. The animals should be separated into various age groups to prevent the larger animals from injuring the smaller ones. Each goat should be lowered into

the dip gently, hindquarters first, and should not be turned on its back. The head should remain above the water for a while to allow for normal breathing, and then be submerged twice with a dipping stick, again allowing time for breathing between dipping. Hereafter the goat proceeds to the draining pen. Goats should not be driven for long distances immediately after dipping. In hot weather it is best to keep the animals in kraals until it becomes cooler. Dipping should, as far as possible, be done in early morning on a mild, sunny day. This will allow the animals to dry properly.

Where tortoise-shell ticks ('bont'-legged ticks) are most active, belly baths are recommended during October and December, whereas belly baths for Karoo paralysis ticks are normally done from March to August. In heartwater areas, dipping at ten to fourteen day intervals may be necessary.

3.3.8 Pesticides

Chemicals in the form of residual pesticides on greasy Mohair are a threat to the environment and the image of the South African Mohair industry.

3.3.8.1 Chemical groups (Russel IM, Nunn CR 2006)

There are four main types of chemicals available to control mites, lice and blowflies in South Africa.
These are:

- Organophosphates (OP)
- Insect growth regulators (IGR)
- Macrocyclic lactones (ivermectins)
- Synthetic pyrethroids (SP)

See factsheet 1 for a list of parasiticides that is safe for the use on Angora Goats in South Africa.

3.3.8.2 Know the risks (Russel IM, Nunn CR 2006)

The different chemical groups have various degrees of relative risk relating to operator health, pest resistance and Mohair residues. Understanding these risks will help when deciding what, if any, chemical to use. Organophosphates (e.g. diazinon etc) pose the greatest risk to human health. Due to the high incidence of lice resistance to chemical groups, the advice from chemical suppliers and veterinary authorities must be sought.

3.3.8.3 What you can do

The key to reducing reliance on chemicals is to use an integrated parasite management (IPM) approach to control ectoparasites. However, if you need to use chemicals, select those with minimal risk. The two main IPM elements are:

- Management options (e.g. reduce susceptibility to a risk of lice and mite introduction).
- Selective use of chemicals (e.g. only treat when required).

3.3.8.4 Ectoparasiticide withdrawal periods

Drug residues in Mohair should be minimized by accepting the following measures: Mohair South Africa recommends the avoidance of full body treatment during the last three (3) months before shearing. Special care should be taken when applying products with Organophosphates as active ingredients such as Diazinon and Chlorofenvinphos and Synthetic Pyrethroids such as Cypermethrin. High levels of residues may pay a real marketing risk to the South African clip. See Factsheet 1 for a list of parasiticides that is save for the use on Angora Goats in South Africa.
Specific withdrawal periods must be fully complied with[15]. (Bath G. pers comm. 2009, Saayman D. pers comm. 2015)

SANS 10205:2005

Angora Goat farmers are encouraged to visit the following website for a complete Checklist on the storage, handling and disposal of pesticides on farms:
www.rpmasa.org.za/stansa2_10.html

3.3.8.5 Testing for chemical residue

Dipping / Washing of Angora Goats before shearing
The OEKO-TEX® Standard 100 is a worldwide consistent, independent testing and certification system for raw, semi-finished, and finished textile products. The export of Mohair to Europe is regulated by strict residue criteria set by OEKO-TEX®.
Mohair producers have, for some time now, been made aware of the guidelines set by the Mohair industry for the use of dips and pour-on products in the control of ectoparasites (lice and ticks).
Testing has now also highlighted that washes used by some producers to clean the mohair prior to shearing leaves unacceptable residues as determined by OEKO-TEX®.
What are the residues detected in these washes?
Endocrine disrupting compounds (EDCs) namely alkylphenols and their alkylphenol exthoxylates.
What are EDCs?
EDCs are chemicals which may have an adverse effect on human and animals by disrupting the endocrine system.
What is endocrine disruption?
The endocrine system is the system of glands, organs and tissues that secrete hormones into the bloodstream. Hormones are chemical messengers that are critical to many body processes, including growth, development, metabolism, and sexual differentiation.
Some chemicals can block normal hormonal function in animals and humans. This process is called endocrine disruption.
On the basis of its comprehensive and strict regulation of substances, the OEKO-TEX® standards feedback along with residue trials has resulted in the Mohair industry setting guidelines for the cleaning of mohair.

- The ONLY recommended wash for Angora goats (other than clean water) are products TESTED FREE of EDCs.

These guidelines may change in future as determined by the OEKO-TEX® standards and as further information obtained from residue trials becomes available.

3.3.8.6 Herbicide withholding periods

The minimum number of days between the last application of herbicides and grazing or harvesting of pastures must be observed according to the registration of a product.

3.3.8.7 Handling of chemicals

Chemicals need to be handled, stored and used in a responsible manner as prescribed by the occupational health and safety legislation and the latest regulations supporting this legislation[18].

The following guidelines concerning farm chemicals are of importance in Angora goat farming systems.
Chemical Stores and management:

- The store should be located above the 50-year flood line
- Only authorized and trained personnel shall have access to keys and the store
- Persons responsible for managing pesticide store (literate farmer/ farm worker) must be trained in pesticide handling & understand implications of incorrect handling

- Only plant protection and/or animal health products are allowed in the store – no feedstuffs
- Shelves must be non-absorbent, impervious and chemically resistant to products – wooden shelves covered with thick plastic is recommended
- Large containers should not be stored directly on cement floor – place on wooden pallets covered with thick plastic or on plastic pallets
- Products in solid, powder or granular form must be stored above liquid formulations (less damage during accidental leakage)
- All products must be stored in original containers with
- labels intact
- The responsible person shall ensure that oldest stock is used first (label date of manufacture or mark container with date of delivery in waterproof ink
- Keep records away from storage area. A copy can also be kept in store

3.3.9 Biosecurity[27]

Biosecurity is the management of all potential biological hazards to production that could be introduced into a flock from an external or internal source. The objective of biosecurity is the control, prevention or eradication of a potential hazard.

3.3.9.1 External threats

External threats include invertebrates, infectious agents, unwanted genes and plants. The hazards are introduced by farm animals, predators and vectors as well as human activity. Topography, wind and waterways may contribute to the route of access that hazards may follow to gain entrance to a flock.

3.3.9.1.1 Internal parasites

New species and strains may be introduced if adequate biosecurity measures are not in place.

3.3.9.1.2 External parasites

Some external parasites are endemic to most small ruminant farms but certain parasites that may be responsible for serious losses, can be eradicated and flocks can be maintained free of these parasites. Maintenance of adequate fencing and buffer zones are essential to the control of parasites. Eradicating parasites on animals that are introduced to the farm will form an essential part of quarantine measures.

3.3.9.1.3 Infectious diseases

Infectious diseases are the main focus of biosecurity practices. Infectious diseases can be endemic but are often introduced by farm animals that gain entrance to the farm.

Diseases with a short incubation period

These diseases can usually be detected soon after arrival and can usually be controlled by placing new introductions in a quarantine facility for two to three weeks.

Table 1. Selected infectious disease with short incubation periods (Coetzer & Tustin, 2004).

Disease	Incubation period
Anthrax	1 to 14 days
Blue Tongue	7 days (Experimentally 2 to 15 days)
Pasteurella pneumonia and septicaemia	Under 7 days
Footrot	3 to 4 days
Ophthalmia (Moraxella)	3 days to 3 weeks
Ophthalmia (Chlamydophila)	3 days to 3 weeks
Necrotic Balanoposthitis	5 to 6 days
Rabies	2 to 4 weeks (up to 17 weeks)
Heartwater	7 to 35 days (average 14 days)
Orf	2 to 6 days
Tetanus	3 days to 3 weeks

Diseases with a long incubation period

These diseases may not be detected at the time of purchase or introduction of new animals to a flock and a vendor declaration that goats are free from diseases should be requested from the seller. Some of these diseases are presented in Table 2.

Table 2. Infectious diseases with long incubation periods (Coetzer & Tustin, 2004).

Disease	Incubation period
Casous lymphadenitis (Corynebacterium pseudotuberculosis)	25 to 140 days
Ovine Progressive Pneumonia (Maedi-Visna	Symptoms in 2 to 4 year old animals
Jaagsiekte	5 to 6 months
Scrapie	2.5 to 3.5 years
Footrot	May be dormant but become active in a later season
Scab (Angora goats will not contract the disease, but can be passive carriers of the mites)	May be dormant but become active in a later season
Johne's Disease	Animals older than 2 years
Rabies	2 to 4 weeks (up to 17 weeks)
Actinobacillus seminis epididymitis in young rams	Transplacental infection from carrier ewe to offspring becomes active from 12 weeks old to puberty

Diseases that cause abortion

Diseases that cause abortion may only be seen clinically during pregnancy. It is therefore important to test for these diseases if possible at purchase or introduction on the farm. Ewes and rams that may introduce these diseases should be kept in separate flocks until the end of the lambing season to make it possible to detect and control these diseases effectively. Selected diseases that cause abortion are listed in Table 3.

Table 3. Incubation period of selected infectious diseases that cause abortion (Coetzer & Tustin, 2004).

Disease	Incubation period
Toxoplasma gondii abortion	7 – 14 days
Q Fever	Months. Becomes active in late pregnancy. Sheds for 8 to 60 days after parturition
Brucella ovis	Months. Becomes active in late pregnancy. Rarely seen
Rift Valley Fever	1 to 3 days
Enzootic abortion (Chlamydophila)	Months. Becomes active in late pregnancy. Sheds for 8 to 60 days after parturition
Wesselsbron Disease	1 to 3 days in neonates. 5 days before abortion occurs.

Insect-transmitted diseases

Measures to prevent insect transmitted diseases are seldom successful as most insects travel large distances, especially downwind. The most common insect transmitted diseases such as Bluetongue, Rift Valley Fever and Wesselsbron Disease can be prevented by vaccination.

Tick-borne disease

Although ticks can walk onto farms, they are mostly introduced on hosts. Domestic animals can be dipped prior to introduction but feral species may pose a problem. A disease that is currently creating problems through the introduction of ticks by game animals is Heartwater. The tick vector, Amblyomma hebraum (bont tick), is found on warthogs, bushpigs and kudu that are migrating northwards into the interior of the Eastern Cape Province. Fencing to keep the feral species out of farms is currently the only possible control measure.

Transmission by contact

Owing to the flock behaviour of goats many diseases have adapted to transmission by contact. It is therefore important from a biosecurity perspective to prevent contact of new introductions or unplanned introductions with the resident flock. If contact happened by accident the potentially affected flock should be treated as if diseases had been transmitted during the contact.

3.3.9.1.4 Unwanted plants

The Spiny Cockle Bur or *Xanthium spinosum* (Boetebos) is a well-known plant that produces seeds that can attach to mohair.

Jointed prickly pear or *Opuntia aurantiaca* (Jointed Cactus or Litjieskaktus) (Henderson & Anderson, 1966) is a common contaminant of mohair and could cause severe matting especially between the back legs of small goats, leading to restricted movement and cause financial losses if contaminated hair is presented for sale. Many species of thistle, grasses and other weeds can be introduced onto a farm attached to livestock.

Animals that are introduced or re-introduced to a farm should be de-contaminated in a quarantine facility and the seeds and plant material carefully destroyed. Prosopis seeds may be present up to 11 days after ingestion (Hoon et al., 1995). Faeces should therefore be managed in such a way that seeds are rendered harmless or that emerging seedlings can be eradicated.

3.3.9.2 Prevention of external and internal biosecurity hazards

3.3.9.2.1 Quarantine

The implementation of quarantine procedures is the single most effective way of preventing the introduction of biological hazards into a flock. The construction of a suitable quarantine station should be one of the first activities of any flock manager to ensure that all animals introduced into the system are managed in such a way that the lowest possible threat to the flock's health is presented by new introductions.

Quarantine station

Physical terrain. The quarantine station should be positioned in such a way that animals can be off-loaded into the quarantine facility without any possibility of coming into contact with the resident flock. The quarantine facility should be adequately fenced and positioned far enough from existing camps, pens or human activity to prevent the spread of hazards.

Run-off water should not contaminate downstream farming activities. If no other terrain is available, the run-off water should be channelled into a dam that is inside the quarantine area. Quarantine facilities should ideally be sited downstream from the rest of the farm.

Insects can pose a serious problem in carrying infective material from a quarantine facility. Quarantine facilities should ideally be situated downwind from the rest of the farm. Quarantine areas should always have their own handling facilities such as races, footbaths and dips. At least 100 m clearance around animals in quarantine should be allowed to avoid aerosol transmission (Hofmeyr, 2010).

Quarantine procedure

Before purchasing any animals, request a vendor declaration and get a signed commitment that Angora goats can be returned if found to be infected with slow incubation period diseases.

Before departing from source (if possible)

1. Dip all animals.
2. Conduct a Famacha flock examination.
3. Collect a faecal sample from at least 10 animals.
4. Vaccinate the animals as required against at least the following diseases if more than 7 days remain before movement to their destination:
   - Enterotoxaemia
   - Pasteurella.

After arrival

1. Perform a physical examination.
2. Tag each group with a distinct colour code and record origin and destination.
3. Clip feet that need attention.
4. Footbath animals with Zinc sulphate plus small amount of soap.
5. Dip and inject for external parasites (for example: amitraz plus endectocide).
6. Collect faeces for faecal egg counts.
7. Conduct a Famacha flock examination.
8. Respond to faecal examination results.
9. Drench if necessary.
10. Test the response to drenching after 10 days and act accordingly. (Alternative procedure: Buy susceptible Haemonchus larvae and drench introductions with low levels to stimulate their immunity.)
11. Collect blood for serology (discuss with flock health veterinarian – for example: Jaagsiekte, Brucellosis).
12. Respond to serology results: (If any positive of Jaagsiekte or Brucella)
13. Keep animals in quarantine for at least the incubation period of short incubation infectious diseases (21 days) or sufficient time for vaccinations to take effect.
14. Observe animals daily. Take temperature and record if possible.
15. After release from quarantine facility keep rams separate until genital soundness examination and first mating if possible.
16. Keep pregnant ewes separate until after lambing. Keep ewes separate until after first mating. Pizzle Disease becomes apparent only at mating time.

Planned contact with other animals

Group breeding, veld ram projects, shows, sales and shared rams pose a very serious risk to biosecurity of a flock (Van Wyk et al, 1991). All animals that are re-introduced to a flock should be treated as if that animal was purchased from an unknown source. Flock managers that take part in these activities should insist on strict biosecurity at these activities and possibly compulsory treatment and testing at admission and again before returning to the flock.

Farm fences

Because of the possible transmission of sheep scab, red lice and other parasites across fences, flock managers are constructing a second fence or additional strands that could keep animals from coming into contact with the perimeter fence. A single electrified strand at a low level on the inside of the perimeter fence which was intended to prevent jackals from crawling through the fence has had the added benefit of preventing sheep from rubbing against the perimeter fence with obvious biosecurity benefits.

Fences should receive top priority as biosecurity measures. Unwanted stray animals roaming onto the farm could introduce a number of diseases with possible serious financial implications. Gates are often left open by people that visit by foot and flock managers could consider providing stilus for people to climb over the fence without having to open a gate. Unplanned visits are however not encouraged because of security risks and even for biosecurity reasons. Footrot is one example of a disease that could be spread by people.

Shearing teams and other operators, visitors and vehicles

Hired labour, service teams such as shearers and vehicles could be the vehicle for introducing serious disease outbreaks in flocks. Flock managers should provide their own protective clothing for these operators and also provide showering and laundry facilities for decontamination before flocks are handled. Shears and other instruments should be disinfected although it is probably advisable that flock managers supply their own. These measures should even be applied between different subunits or flocks on the same farm. An example of an outbreak of post shearing Quarter Evil was experienced where 200 pregnant ewes (out of a flock of 2000) died after a team of shearers arrived on a farm from a previous farm where they had slaughtered and consumed a cow that had died of Quarter Evil. Flock managers regularly report that Caseous Lymphadenitis was introduced by shearing teams.

Waterways

Flash floods can wash infective materials onto neighboring farms. Faeces that have washed up on river banks or end up in marshy areas may introduce parasite eggs that could lead to parasite outbreaks. As an example: Lucerne bales, contaminated with Redwater carrying ticks, were washed downstream during the floods of 1976. This lead to cattle losses along the banks of the Orange River in the Karoo where Redwater does not occur. Waterways that could introduce infective material should be fenced off to restrict access by animals if possible. Camps that pose a risk could also be avoided during seasons that pose the greatest threat.

Livestock sources

Flock managers should only buy animals from farms with good biosecurity and general health management. Flock managers should examine animals well before purchase or get a veterinarian to assist them. Buyers should insist on veterinary health certificates.

3.3.9.2.2. Do a strategic environmental scan to assess risk

Farmers and their advisors should include a strategic environmental scan in their management process. The strategic environment should be scanned for political, economical, social, technological, legal and ecological issues that could impact on biosecurity (PESTLE Scan). The recent outbreak of Rift Valley Fever (RVF) in South Africa provides a good example. News reports of outbreaks in countries to the north of South Africa started appearing about two years before the 2010 outbreak. The outbreak was preceded by at least 3 to 4 months of high rainfall in the areas that could have provided a link to the areas where RVF had occurred. Cases of RVF were seen in the northern provinces of South Africa the year before.

4. Social Principle

Angora goat farming and Mohair production is an economic activity which does not take place in a social/ethical vacuum and as such must be compliant with acceptable social and ethical norms and standards.[14,16]

The social principle is: The rights and well-being of employees and the local community are upheld and promoted, and product hygiene practices are in place.

The farm business must be socially sustainable and must show a commitment to a safe and enjoyable workplace for partners, employees and family members. The purpose of the Labour Relations Act 66 of 1995 is to ensure fair labour practices as contained in the Bill of Rights of the Constitution of the Republic of South Africa.

General Administration Regulations i.e. written particulars of employment, keeping records, payment of remuneration etc. must be followed.

4.1 Human rights

All employers should respect the following core labour rights of the International Labour Organisation:

- No forced labour
- No child labour
- Freedom of association and the effective recognition of the right to organise and bargain collectively.
- No discrimination

4.2 Basic Conditions of Employment Act 75 of 1999

All employees, South African or foreign, are entitled to certain conditions of employment:

- Arranged working time and hours.
- Leave including annual leave, sick leave and maternity leave.
- Rights on termination on employment including notice and severance pay.
- The provision of certain particulars of employment such as a pay slip and certificate of service.
- Minimum age of employment.
- A decent wage should be paid to all farm employees.
- No children under 15 must be employed on farms. Children between the ages of 15 and 18 must only be employed in work that does not place at risk their well being, education, physical or mental health, or spiritual, moral or social development.
- The terms and conditions of seasonal employees, employees on fixed term contracts and other forms of a typical employment should be appropriately regulated and they should receive benefits proportionate to those received by permanent employees.



4.3 Labour relations

Employee conflict on farms should be minimised by ensuring that it is well-managed by the involved parties. Both employees and employers should ensure that their actions are lawful and procedural. All farms should have an accessible and appropriate grievance and disciplinary procedure in place.

4.4 Skills development

The skills of all farm employees need to be enhanced so as to improve productivity and employability in the Mohair farming industry. It is recommended that SAQA registered qualifications and mentorship programs be encouraged.

A Brilliant Webpage

Producers are encouraged to visit the webpage of the Department of Labour (www.labour.gov.za) for legislation and information on annual leave and basic guidelines on labour Law practices, forms and examples.

4.5 Occupational health and safety

The following applies:

- The working environment on farms should be safe and
- healthy. This includes protection against occupational diseases and accidents.
- Farm employees should be made aware of the contingency procedures relevant to their enterprise in the event of emergencies which pose a threat to human health, food safety or livestock health and welfare. These contingency procedures must cover the event of failure of the food and water supply
- Mohair growers should do an assessment of the risks that exist on their farms and develop a plan to minimise such risks including the adoption of preventative measures.
- Employees must have access to basic first aid and medical treatment to be administered by a trained employee.
- Employees are entitled to compensation in the event of an occupational injury or disease. To ensure this, farm employers must register with the Compensation Fund and pay their assessments.

4.6 Social security and benefits

The following applies:

- Employees are entitled to unemployment insurance if they become unemployed. To ensure this, farm employers must register with the Unemployment Insurance Fund and pay their contributions together with those of their employees.
- Employers should endeavour to ensure that farm employees have access to pension or provident funds, medical aid, funeral or death benefits.
- Employers whose employees live on the farm should ensure that housing and sanitation meets acceptable standards.

4.7 Security of Tenure

No. 62, 1997 Extention of Security of Tenure Act, 1997.

- Employees (Labour tenants) and their family members are:
- Allowed to occupy and use land they were occupying or using on or before 2 June 1995.
- Employers must ensure that should there be a need to terminate the above right it is done within the provisions of this Act.
- Labour tenants may only be evicted in terms of a court order under this Act.
- The rights of labour tenants that, subject to the provisions of this Act, want to acquire land, must be respected.

4.8 Productivity

Productivity improvement is the result of many factors including increased skill, greater job satisfaction, more appropriate use of technology, etc. and it is the responsibility of both employer and employee. Both should identify the factors that can lead to improved productivity at the workplace.

4.9 HIV/AIDS

Testing of employees to establish their HIV status is prohibited in terms of the Employment Equity Act. Employers should ensure that all those living on farms should have access to a prevention programme including awareness rising, condoms and counselling.

4.10 Contract Labour

Suitable housing should be provided for contract workers, e.g. shearers. This includes:

- Sleeping facilities
- Ablution facilities
- Where food is not provided, adequate enclosed cooking facilities must be available.

Working hours

It is recommended that contract workers like shearers have an 8-h, 5-day working week with days divided into 4x2 h working shifts. Less working hours and days will result in a loss of productivity and income for shearers.

4.11 Shearing team facilities

Guidelines

- Access to running water.
- Housing unit with cement surface.
- Well ventilated house away from the shearing shed.
- Availability of beds or bunk beds.
- Access to toilet facilities.
- Provision to shearers to heat up water.
- Garbage bins at the house and shearing shed.

Rights of Contract labour

The same rules of permanent workers apply to contract workers except for restrictions placed by the labour law.

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IDR 2016-2017	Trade Name	Active Ingredient	Company	Application	Ticks	Scab Mite	Itch Mite	Mange Mites	Lice	Keds	Blow Fly	Screw Worms	Nuisance Flies	Biting Flies	Midges
Dips															
	Extinosad	**Spinosad 25g/l**	**Elanco**	**Dip**					x	x	x				
	Expel Plus Jetting fluid	**Ivermec 3%, Novaluron 2%**	**Afrivet**	**Dip, Spray**		x			x		x				
	Expel Jetting fluid	**Ivermectin 3%**	**Afrivet**	**Dip, Spray**					x		x				
	Fleececare	**Diflubenzuron 25%**	**MSD**	**Dip**				x	x		x				
	Supatraz 25%	**Amitraz 25%**	**Cipla**	**Dip**	x	x		x	x						
	Taktic TR	**Amitraz 23.75%**	**MSD**	**Dip**	x	x		x	x						
	Triatix 125	**Amitraz 12.5%**	**Afrivet**	**Dip**	x	x	x	x	x						
	Triatix 250	**Amitraz 25%**	**Afrivet**	**Dip**	x	x	x	x	x						
	Triatix 500 TR	**Amitraz 50%**	**Afrivet**	**Dip**	x	x	x	x	x						
	Taktic Cattle Spray	**Amitraz 12.5%**	**MSD**	**Dip**	x	x	x	x	x	x					
Off Lisc	Amidip Max	Amitraz 25%	Virbac	Dip	x			x	x						
Off Lisc	Amigard	Amitraz 12.5%	Zoetis	Dip	x			x	x						
Off Lisc	Milbitraz LS	Amitraz 23.75%	Bayer	Dip	x			x	x						
Off Lisc	Milbitraz Spray Dip on	Amitraz 125g/l	Bayer	Dip	x			x	x						
Off Lisc	Taktic wetable powder	Amitraz 23.85%	MSD	Dip	x			x	x						
Off Lisc	Taktic LS Cattle	Amitraz 23.75%	MSD	Dip	x			x	x						
Off Lisc	Triatix 500 LS Cattle	Amitraz 50%	Afrivet	Dip	x			x	x						
Pour on															
	Zapp Pour-on	**Triflumuron 2.5%**	**Bayer**	**Pour on**					x		x				
Off Lisc	Triatix 2% Pig pour on	Amitraz 2%	Afrivet	Pour on				x	x						
Off Lisc	Triatix Cattle pour on	Amitraz 2%	Afrivet	Pour on	x										
Off Lisc	Supatraz Cattle Pour	Amitraz 2%	Cipla	Pour on	x										
Off Lisc	Veltrazin pour-on	Cyromazine 10%	Novartis	Pour on							x				
Off Lisc	Acatak pour-on	Fluazuron	Novartis	Pour on	Blue										
Off Lisc	Noromectin pour on	Ivermectin 0.5%	Norbrook	Pour on	Blue			x	x						
Off Lisc	Avotan pour-on	Abamectin 5mg/ml	MSD	Pour on	Blue										
Off Lisc	Eliminate	Abamectin 0.5%	Virbac	Pour on				x	x						
Off Lisc	Cydectin pour on	Moxidectin 0.5%	Zoetis	Pour on	Blue			x	x						

Appendix 1: Example of a medical inventory

DATE				PRODUCT INFORMATION			USAGE				DATE		
Product name	Purchased	Expiry	Used	Lot no.	Company	Quantity bought	Quantity used	Left over (balance)	Total Goats	Herd name (number)	Treatment	End of with-holding period	Signature of person responsible

Appendix 2: Example of an animal register

HERD		DESCRIPTION						EWES						KIDS						RAMS / WETHERS
Date	Camp name / nr	Amount	Treatment, Activities ect.	Cost	Remarks/Status/Age	Follow-up Date	Date	Brought over	Dead	Caught	Shortage	Found	Transferred	Brought over	Dead	Caught	Shortage	Found	Transferred	

CERTIFIED
SUSTAINABLE MOHAIR

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SA Sybokhaarkwekersvereniging

MOHAIR
SOUTH AFRICA

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Choice
Serving Nature's Bounty

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This document has been aligned with industry relevant standards, several certification systems (organic; EU; Global GAP) as well as the generic Living Farms Reference (a Green Choice project produced for WWF and Conservation South Africa) and has been developed in a multi-stakeholder process.