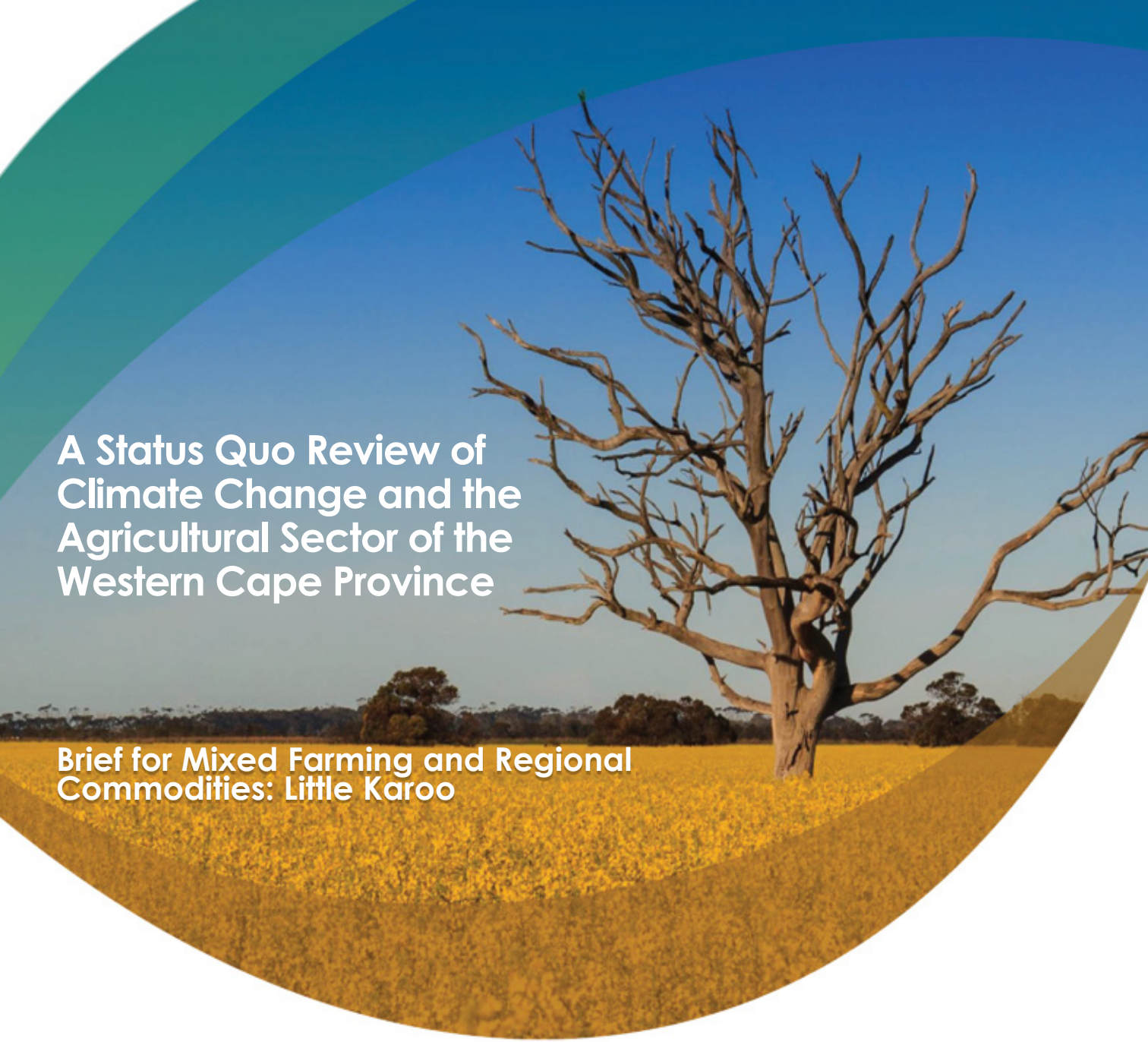


A Status Quo Review of Climate Change and the Agricultural Sector of the Western Cape Province

Brief for Mixed Farming and Regional Commodities: Little Karoo

SMART Agri

ACDI African Climate & Development Initiative

Western Cape Government

The SmartAgri project

Smart Agriculture for Climate Resilience (SmartAgri), a two-year project by the Western Cape Department of Agriculture and the Western Cape Department of Environmental Affairs & Development Planning, was launched in August 2014. SmartAgri responds to the need for a practical and relevant climate change response plan specifically for the agricultural sector of the Western Cape Province. By March 2016, the University of Cape Town's African Climate and Development Initiative (ACDI) and a consortium will deliver a Framework and Implementation Plan which will guide and support the creation of greater resilience to climate change for farmers and agri-businesses across the province. The project will provide real and practical information and support, and inspire farmers in a manner which optimizes their decision making and ensures sustainability at a local level.

This brief was prepared for the mixed farming sector and regional commodities in the Little Karoo region. It summarises the findings of the Status Quo Review of Climate Change and Agriculture in the Western Cape Province. This study covers current climate risks and impacts across the sector and how risks and potential benefits are expected to shift under a changing climate. It also considers how climate risks and impacts can be reduced and managed. This is approached in the context of provincial economic and social development goals, and careful use of scarce and valuable natural resources.

Contents

Climate change in the Little Karoo

As a result of global climatic changes, the Western Cape faces a warmer future. This poses serious threats to agricultural commodities in the province, both livestock and crops. Changes in annual rainfall as well as changes to the spatial distribution, seasonal cycles and extremes in rainfall are also likely, even if the extent and direction of these changes are still uncertain. The SmartAgri project is focusing on the planning and preparation needed in the agricultural sector in order to deal with this threat over the next 10–40 years.

Agricultural production is closely linked to climate and weather. These linkages are sometimes straightforward, for example seasonal total rainfall influencing wheat yield. More commonly they involve far more specific influences such as dry spell duration during the germination phase, or rainfall during the harvesting period. Higher temperatures are often tolerated as long as rainfall is sufficient. However, temperature sensitivities can be much more complex, for example the reduction in fertility brought about by a heat wave, both in crops and livestock. Thus, a discussion of the impacts of climate change on agricultural production requires focused attention to specific threats to specific crops and animals and at specific times in the seasonal cycle. In addition, local conditions such as production potential and microclimate influence the extent of the threat.

The Little Karoo is characterised by all-year rainfall with peaks in spring and autumn. Annual rainfall is low in the valley but higher on the mountains which bound the zone to the north (Swartberg) and south (Langeberg-Outeniqua). Summers are hot and winter nights are cold. This distinct climate, the soils and mountains gives rise to a particular agricultural production potential. The area is suited to extensive rainfed and irrigated pastures for beef and dairy cattle, ostriches (a key commodity), sheep and goats, winter grains, and a range of irrigated crops including grapes and other Mediterranean fruits, nuts and vegetables. The western part of the Little Karoo falls into the Tankwa-Van Wyksdorp agro-climatic zone and is very dry with erratic rainfall and greater summer-winter temperature extremes. Eastwards from Van Wyksdorp to Uniondale and beyond to the Langkloof range, rainfall is spread more evenly through the year. The southern slopes of the Swartberg mountain range enjoy somewhat higher rainfall and provide good runoff for irrigation.

The SmartAgri project is assessing two agro-climatic zones in the region, based on Relatively Homogeneous Farming Areas: Tankwa - Van Wyksdorp (this brief focuses on the south-eastern part) and Little-Karoo (Figure 1).

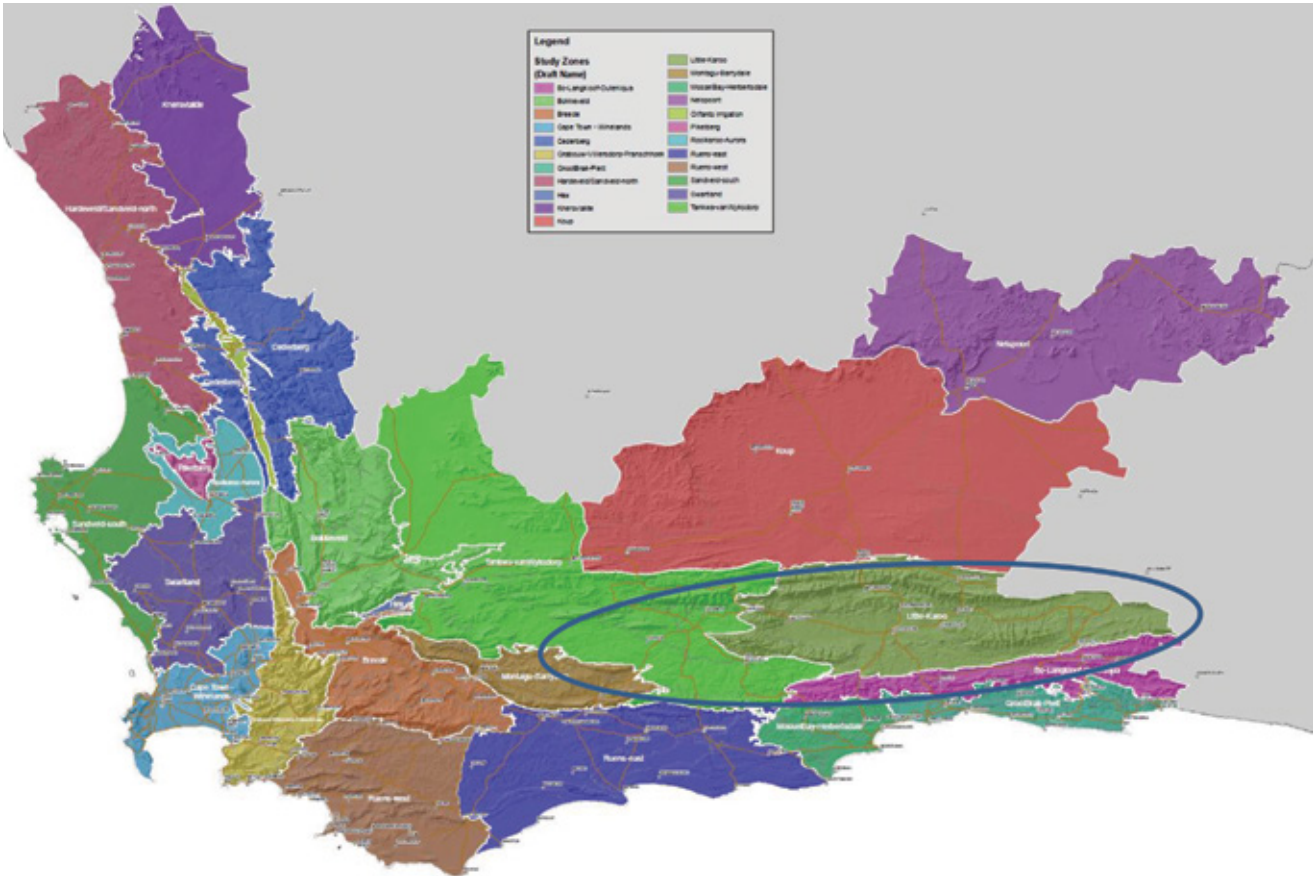


Figure 1. Map of the Western Cape Province showing the 23 agro-climatic zones used in the SmartAgri project, and the Little Karoo region (circle).

How will the climate of these zones change into the future? Climate modelling studies show with a high degree of certainty (i.e. almost all the models agree) that the western parts of the province will experience continued warming and reductions in winter rainfall by mid-century and thereafter. Some models indicate the possibility of wetting in the eastern part of the province. Summer thunderstorms are likely to become more intense in the interior regions transitioning towards summer rainfall. However, the influence of the mountains and ocean will lead to more complex results at local level, particularly for rainfall. In the short term, these influences could lead to increased rainfall on the windward mountain slopes, for example. Future changes in total annual rainfall will depend strongly on the strength of various system responses to the changing global climate. Since the science is not yet able to provide absolute certainty, both increased and decreased rainfall should be considered by farming communities, particularly in the east of the province.

Already, the weather data shows that warming has occurred (on average approximately 1.0 °C over the last 50 years), primarily in mid- to late summer, with a decrease in annual rain days, particularly in autumn, and an increase in rain days apparent in early summer. It may indicate a progressively later start and end to the seasons. As yet there are no detectable trends in total rainfall in the Little Karoo.

Future increased temperatures are almost a certainty. The greatest increases are likely to be inland and the lowest increases along the coast indicating a moderating effect from the oceans. Expected increases in mean annual temperature across the province for mid-century are in the range of 1.5 °C to 3 °C, with the Little Karoo likely tending towards the middle part of this range. Both maximum and minimum temperatures will increase.

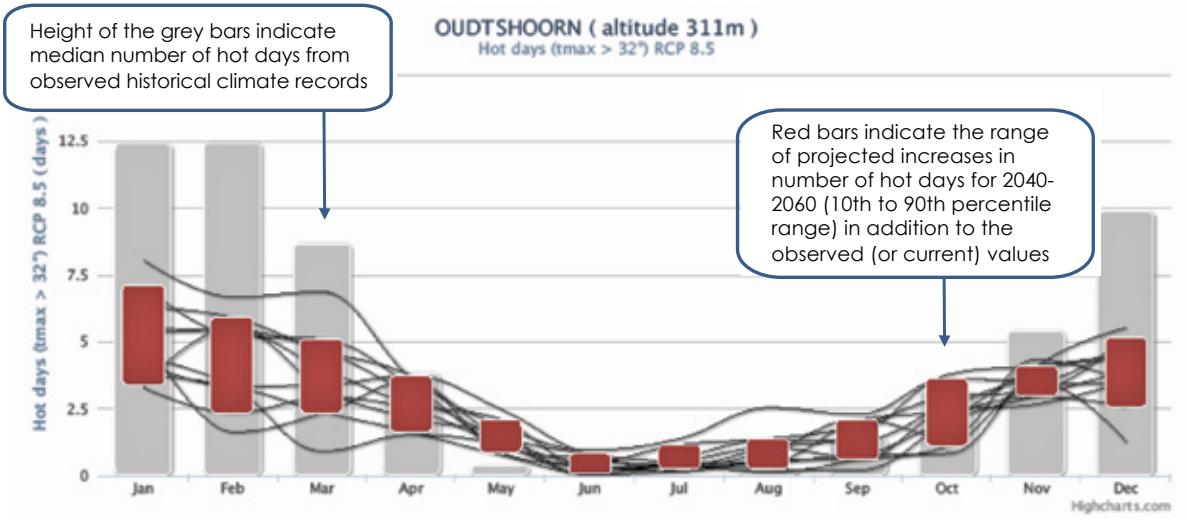


Figure 2. Observed (grey) and projected possible range of increase in (red) number of hot days (> 32°C) per month for Oudtshoorn. Projections are for the 2040 – 2060 period and based on 11 different climate models.

The Western Cape experiences regular flooding events, droughts and heat waves. These events have had significant impacts on farmers. Floods are the most common problem, causing most damage and costs for response and recovery. Many of the worst floods are caused by cut-off low weather systems. An increase in extreme rainfall events is likely which could increase the risk of flooding. This could have an impact on erosion, sedimentation of dams and flood damage, which are already threats in the area.

Heat waves are expected to become more frequent. Figure 2 shows the monthly count of days exceeding 32 °C for Oudtshoorn, as well as projected changes in the same statistic for mid-century. This shows that under current climate, very hot days are frequent in the summer and shoulder season months and that under climate change such occurrences will increase dramatically, possibly as much as doubling.

During the serious drought of January 2009 - January 2011 the region's farmers and workers suffered large losses. The sector remains vulnerable to disasters such as this, since drought relief funding for farmers is limited and there is a shortage of skilled expertise available for agricultural risk management.

The western part of the Little Karoo (west of Van Wyksdorp) lies in a climatic transition area between winter and year-round rainfall, with erratic and low rainfall, and it has only a moderate water storage capacity. There is a higher reliance on groundwater use here. This area is expected to be more responsive to either drying (negative) or wetting (positive) and shifting rainfall patterns (seasonality) than the areas to the east. The lower water storage capacity and heat stress renders it vulnerable to periods of low rainfall. The eastern part of the Little Karoo has a relatively large water storage capacity mainly in private farm dams and medium-sized government dams. It is nevertheless very vulnerable to low stream flows and dam levels and periods of drought.

Climate change risks and impacts on mixed farming and regional commodities

Farming in the Little Karoo is sensitive to higher temperatures and more intense heat waves, more frequent and longer dry spells, reduced seasonal rainfall, higher frequency of heavy rainfall and flooding, more frequent summer rainfall (including thunderstorms), and rising CO_2 levels.

Livestock

Extensive livestock production (cattle, sheep, goats and ostriches) will be primarily impacted by rangeland vegetation changes, changes in the distribution of pests and diseases and water availability. Climate change is expected to worsen the condition of already degraded and marginal rangelands through further loss of vegetation and erosion. Soil degradation affects some commercial grazing areas in the Little Karoo. Range management can either increase or decrease the negative impacts of climate change on rangelands. Subsistence, emerging and smallholder farming systems are expected to be at high risk due to the high dependency on rainfed natural pastures, and fewer capital resources and management technologies available to farmers.

Irrigated planted pastures will respond to warming and shifting rainfall patterns, and the availability of water will become a key factor. Irrigation requirements for pastures are set to increase under conditions of increased temperature. This poses a threat to livestock farms in the area (dairy and beef cattle, some ostriches) which rely on irrigated pastures and fodder production.

Livestock, especially dairy cattle which are common between Ladismith and Oudtshoorn, are sensitive to heat stress which will become more frequent in future. In dairy cattle this reduces milk production and fertility. Sheep and beef cattle could be at risk of reduced growth and reproduction performance, reduced meat yield and quality, reduced wool production and quality, and increased deaths and illnesses, due to heat and nutrition stress. These impacts are likely to be lower in sheep compared to cattle, and lowest in goats. However, mohair goats such as the Angora breed may experience greater thermal and nutritional stress. Increasing winter temperatures and fewer cold days could be beneficial to livestock farming in the colder areas.

Extensive ostrich production requires significant hectarage of land. This is mainly marginal semi-arid land where the environment is very sensitive to disruptions of any form. It is in these areas where the impact of climate change is likely to be felt. Where stocking rates are inappropriately high, ostriches can lead to rapid rangeland deterioration, often exacerbated by poor management of water resources.

The ostrich is one of the most heat tolerant farmed animals but excessively high temperatures will likely affect productivity particularly in the survival and growth of younger birds. Fertility is also adversely affected by high ambient temperatures.

In intensive ostrich production the feed is grown on-farm with some supplementary feed being bought. The effect of climate change is therefore via the crops grown to feed the birds. The ability to provide affordable forage and feed to the ostrich industry will remain one of the biggest challenges of the industry. Climate change will likely affect lucerne production. Depending on the performance of the export market ostriches may be pushed more and more into the marginal areas of the province where they will compete with small ruminants and cattle.

Crops

The Little Karoo has some of the warmest wine grape production areas in the country. Warming will likely cause the vines to alter their phonological patterns i.e. the timing of various developmental stages such as flowering, véraison and harvest. Climate change is expected to cause changes in the quality characteristics of the various cultivars and wine styles. When temperatures rise above a varietally specific heat threshold, the ability to ripen balanced fruit and produce existing styles of wine from them will become compromised. Increases in the frequency of extreme hot days (>35 °C) in the growing season could affect wine grape production, but the impacts can be managed to some extent through vineyard canopy and water management practices. However, irrigation demand will increase. During the last phase of grape development and the harvest, dry weather is required – any increases in rainfall in January to March would cause problems. It is possible that, relative to current conditions, climate change could reduce the suitability for wine grape production in parts of the Little Karoo, with a contraction of the production regions to cooler zones with sufficient irrigation water.

Stone fruit do well in the Little Karoo since they thrive in warm to hot and drier climates and have a low to medium winter chill requirement. Climate risks to stone fruit include some risks common to all fruit production, such as reduced availability of water (both from rainfall and irrigation), reduced winter chilling, and shifts in phenology (earlier flowering). Disruptive weather events such as frost, hail, strong wind and heatwaves have serious negative impacts on stone fruit. Since flowering occurs during early spring in many cultivars, a specific risk relates to late winter and early spring weather, including cold rainy and/or windy conditions or frost during the pollination and early growth period. Rainy conditions during the harvest period increase the risk of fungal disease. Extended water-logging and flooding are highly detrimental to stone fruit orchards since they easily lead to diseases such as root rot. On the other hand, climate drying could open up new areas to stone fruit production linked to reduced risks of fungal attack.

Olive production thrives under cool winters and hot summers and is widely found in the Little Karoo. The species has a broad climatic tolerance. Summer temperatures are important for the growth of fruit-bearing foliage. Most olive growing regions of the world have average maximum daily temperatures above 30 °C in the hottest month of summer, but the trees are resilient to afternoon temperatures as high as 45 °C. Although olives are relatively drought tolerant, they do require adequate moisture for commercial production, and commercial orchards are all irrigated. The olive tree is one of the few fruit bearing trees that will survive and still bear quite well with poor quality saline (salty) water. Climate warming could affect the infestation levels of pests and diseases.

Nevertheless, it seems unlikely that warming will negatively affect olive production in the region and may even favour the crop, but negative impacts could occur through changes in the availability of irrigation water.

The Little Karoo is one of the main areas for onion production as well as vegetable seed production. Onion seed is mainly produced in regions with reliable warm, dry summers with low atmospheric humidity to reduce the risk of diseases. Warm, clear weather also promotes optimal insect pollination activity on flowering crops, but heat stress reduces pollination success. The optimum temperature for onion growth is 18 - 22 °C. Higher temperatures (25 - 27 °C) speed up bulbing, and bolting (flowering) is triggered by low temperatures (8 - 13 °C). Onions are highly prone to fungal diseases caused by high humidity. The potential risks and impacts of climate change on onion and vegetable seed production in the Little Karoo and elsewhere have not been studied.

Mixed farming

Mixed crop-livestock farming systems are practiced by some commercial farmers, particularly where fodder is grown under irrigation for own animal consumption. Mixed farming can provide considerable resilience to climate and market fluctuations. For smallholder farmers, there is little mixed farming involving cropping and livestock in the Little Karoo. Most of these farmers keep livestock with very little or no crop farming, since they find growing crops too risky in those marginal environments. The effects of climate change on these farmers are determined by the impacts on their livestock, which renders them vulnerable.

The impacts on rural communities need to be considered. Adverse impacts on the sector and its extensive value chain, and the employment it offers could heighten levels of poverty, drive urbanisation, and increase food insecurity. The well-being of agricultural workers is likely to be affected by increasing heat stress, diseases associated with floods and poor water quality, and physical danger associated with storms, floods and fires. Poor nutritional status and other health threats (stunting, obesity, HIV/AIDS) prevalent in the region render rural workers less resilient to the demands of labour under stressful conditions.

The following table summarises key sensitivities for each agro-climatic zone:

Table 1. Summary table of climate change sensitivities for each agro-climatic zone in the Little Karoo.

Name	Main water resource features	Main climatic features	Climate change temperature projections[1]	Main commodities	Socio-economic features	Future agricultural potential[2]
Little-Karoo	Farm dams, few seasonal rivers, large storage capacity	Hot summers, cold winter minimum temperature	Medium to high range warming	Wheat, vegetables, wine grapes, stone fruit, olives Dairy, ostriches, sheep, cattle, goats, pigs	Unemployment and poverty	Remains moderately high as longs as dams fill up
Tankwa-van Wyksdorp	Medium storage capacity, use of groundwater	Very hot and very dry; cold winter minimum temperature	Medium to high range warming	Wheat, stone fruit, wine grapes Sheep, goats, pigs, cattle, game, ostrich, dairy	Very low population density	Slowly declining productivity, constrained by heat and water availability

[1] Due to model uncertainties both decreasing and increasing rainfall scenarios should be considered
[2] For the medium term future 2040-2060

Natural resource use and management

Many of the impacts of climate change on agriculture show strong linkages with the ecological system and the natural resources which provide the means for farming. In the Little Karoo, the most important factors and threats to consider are water supply and demand by numerous competing users, fire risk, invasive alien plant infestations, and biodiversity loss. All are expected to become worse under climate change.

Water resources

Water resources are already stressed with low level of assurance for agricultural use. Climate change is likely to increase this stress through increasing evapotranspiration, more variable rainfall and increasing crop demand.

Crop irrigation accounts for a high proportion of water use (61%) in the Gouritz Water Management Area. For this component of production, water storage capacity and maintenance of infrastructure are essential. The protection and management of high-yielding catchments and flow-regulating wetlands and river banks upstream of farmlands is critical for the optimisation of water flows serving agriculture. Options to increase water supply, such as water conservation and demand management through improved irrigation efficiencies, will also need to be developed.

Compared to the highly developed and integrated water supply system for the greater Cape Town area which provides a reasonable degree of resilience to potential climate change impacts for this main demand centre, the less well-integrated water supply systems of the Little Karoo will likely be more vulnerable to climate change impacts.

The Oudtshoorn area is highly water stressed due to the over-allocation of water. The irrigation sector (notably the Stompdrift-Kamannassie region) has expressed concern regarding their water resource situation. The assurance of supply to farmers in the area is very low. Opinion has been expressed by the farmers that building new dams will allow for infrequent floods to be captured rather than losing the water downstream. However, the erratic nature of rainfall and related sporadic runoff is unlikely to allow such dams to routinely fill, further adding to the unit cost of water from new dams. New dams will therefore not necessarily increase assurance of supply. Drought management planning by local authorities is critical.

Opportunities for water conservation and demand management, such as canal refurbishment and lining, have also been investigated. It would be very expensive to refurbish the conveyance canals forming part of the Government Water Supply Scheme but this would substantially reduce water loss. However, the question of cost and who will pay for this work to state owned infrastructure is a challenge.

Biodiversity and ecosystems

Healthy ecosystems connected to working landscapes are the foundation for clean air and water, fertile soil and food production. They provide an immensely valuable role in buffering agriculture from the worst effects of climate variability and climate change, provide opportunities for adaptation, and provide sinks for the absorption of carbon dioxide.

The region contains ecosystems with exceptional biodiversity, some of which is under threat from extensive land transformation. Other threats to ecosystems within or surrounding farmlands include destruction of riverbanks and wetlands, which act as flow regulators and drought buffers. Invasive alien plants and wildfires are expected to become more problematic under climate change, particularly on farms close to the mountains. High fire risk conditions are projected to increase by between 40 % and 300 % from the western to the eastern parts of the province with rising risks to crops, livestock and farming infrastructure. Future shifts in agricultural climatic potential could come up against restrictions on land conversion imposed by conservation requirements.

A climate resilient sector in the Little Karoo

Responding to climate-related risks involves decision-making in a changing but uncertain world. The agricultural sector of the Western Cape is adapting by responding to the demands posed by current climate variability and extremes in the context of other equally challenging socio-economic drivers and pressures. Irrespective of production system, location or resource status, if producers and their value chain have access to a wider choice of appropriate options, they are able to innovate and improve their practices tailored to their own situation and needs.

In the agricultural sector, technology plays an important part in productive potential and ability to adapt. It includes physical infrastructure, machinery and equipment (hardware), knowledge and skills (software), the capacity to organise and use all of these (orgware), as well as the biological technology with which farmers produce.

For farmers in the Little Karoo, flexible adaptation options are available for all farming systems and commodities which, combined with the fertilising effects of rising atmospheric CO_2 , could provide sufficient resilience to warming of up to ~+2 °C. Additionally, planning for droughts and floods is essential.

The critical element in this region for both crops and livestock is security of water for agricultural use and an increase in water sources to account for rising demand in future. In the case of irrigated agriculture, threats can arise through malfunctioning water storage infrastructure and irrigation systems, as well as increasing competition from other water users such as growing settlements, particularly in times of drought. Farming practices will focus increasingly on conserving soil moisture.

For livestock farmers, choice of breed is the primary adaptation already being used. A range of breeds/species are available which are more heat and drought tolerant, and more resistant to diseases and parasites. Provision of alternative supplements can reduce the effects of heat stress. In low rainfall areas or during periods of low rainfall, farmers are making use of bought–in commercial dietary supplements (e.g., poultry litter, urea blocks/licks) and conserved forages (silage, hay, foggage, crop residues). There are also prospects for using novel feeds from various sources such as horticultural crop residues, insects and worms to provide alternative sources of energy and protein. Other options include stock and grazing management, reseeding pastures with improved grasses and legumes to cope with drought and long dry spells, and improving water management. In addition, animal health monitoring and management can be stepped up.

Crop farming can become climate resilient through the effective choice of drought- and heat-tolerant species and cultivars, and those which are resistant to pests and diseases. Other approaches include Integrated Pest and Disease Management and technologies which reduce heat stress such as shade netting. Most importantly, further gains in irrigation efficiencies will be needed through improved irrigation systems as well as better monitoring and scheduling.

In all cases marketing and processing options should be re-evaluated on a continuous basis in order to optimise the opportunities presented by local shifts in production and shifting global markets.

Energy use and reducing greenhouse gas emissions from agriculture

The generation of electricity and the use of liquid fossil fuels such as diesel leads to greenhouse gas emissions which cause climate change, but energy is an essential input in agricultural production and processing. In the Western Cape the sector is responsible for 2% of energy use and 5% of greenhouse gas emissions. Estimates suggest that the livestock sub-sector is accountable for approximately 16% of provincial agricultural emissions (highest contribution from cattle), grains and field crops for 28% (highest contribution from wheat), fruit and wine for 55% (highest contributions from pome fruit and wine grapes) and other commodities for 1%.

The economic competitiveness of the agricultural sector must be maintained and increased. One component of this is to ensure international acceptability of agricultural products from the province by minimising the environmental impact of their production and complying with agreed standards for energy use and emissions. Farmers are already measuring their ‘carbon footprint’ and implementing measures to reduce it. This can be done either by reducing energy consumption and switching to renewable (non-fossil) energy sources such as wind or solar, or by absorbing carbon through land-based farming methods.

There are six principal options in the Western Cape:

- Restoration of grasslands,
- reducing land degradation,
- conservation agriculture,
- improving energy efficiency at a farm and packhouse level,
- production of bioethanol,
- production of electricity through anaerobic biogas digestion using organic waste such as cattle manure.

Apart from conservation agriculture which is already widely adopted in the Western Cape, the other options are still in their infancy. Both the implementation of anaerobic biogas digestion and bioethanol provide a means of processing waste streams from the agricultural sector in a way that generates energy, leads to a net reduction in greenhouse gas emissions, and reduces potential water and soil pollution. A number of the other options also provide combined benefits for emissions reductions and adaptation.

Key actions which farmers can implement

What are key actions farmers in the Little Karoo can take to be able to respond effectively to existing climate risks and projected climatic changes? The following priorities were highlighted by the status quo assessment and by regional farmers attending the stakeholder workshop:

1. Implement best practice grazing management and protection of soils against erosion. The overgrazing in some parts of the Little Karoo by ostriches and goats must be halted and the land rehabilitated in order to restore its productive potential. All farmers should implement soil erosion measures and sustainable grazing management practices. Land use decisions for marginal lands should be made carefully. The importance of biological diversity and organic carbon within soils needs to be better understood, and farming practices implemented which increase the water holding capacity of the soils.

2. Improved management of water resources and maintenance of on-farm water infrastructure to optimise water use efficiency, reduce water losses in the system, and preserve and restore good water quality. Maintain an organic soil cover at all times, and remove water-thirsty alien invasive plants. Water infrastructure must be well maintained to prevent losses and crises in times of drought. Catchments and wetlands require conservation and good management – maintain the necessary buffer of unfarmed and undisturbed land between riverbanks / wetlands and the cultivated lands. Do not overextract groundwater.

3. Continue or get involved in the **clearing of alien invasive plants**, especially in the catchment areas of the mountains and foothills and along river courses. These include black wattle, hakea, "satansbos", blue gums and invasive reeds in rivers and dams. Considerable volumes of water begin to flow again when dense stands of the plants have been removed. It is also important to follow up on the clearing.

4. Look after the honeybees which perform a critical service to farming in this region. Current disease pressures on hives and insufficient forage sources could become worse under the additional stress of climate change. Farmer can actively provide honeybees with additional sources of forage and do everything in their power to help contain the current disease problem.

5. The energy crisis and climate change are both driving the need for **increased efficiencies of energy use** (particularly for irrigation pumping) and the **greater use of renewable energy** on-farm. Farmers who need energy for the following activities and equipment are particularly vulnerable: irrigation, dairy operations, cooling and cold stores, driers for fruit and onions, ostrich incubators, packhouses and wineries. The use of variable speed pumps and strategic irrigation scheduling can reduce pumping costs (and water use) significantly. Farmers can install photovoltaic systems on the roofs of farm buildings (e.g. sheds, packhouses), or attached to water pumps, to increase reliability of supply, bring down costs, and simultaneously reduce the carbon footprint of the farm operations.

6. Natural hazards and pest and disease outbreaks pose a high risk in some parts of the region and **pro-active risk management** should be practiced by farmers. These should include learning from established long-term experience of dealing with droughts, better holistic flood and drought planning by all role players (farmers and government in partnership), and excellent monitoring and rapid response to disease outbreaks. In the future, the development of early warning systems relating to pests and diseases will be critical.

Further information on all these responses and opportunities, and others, can be found on the GreenAgri information portal: **http://www.greenagri.org.za**

Conclusion and way forward

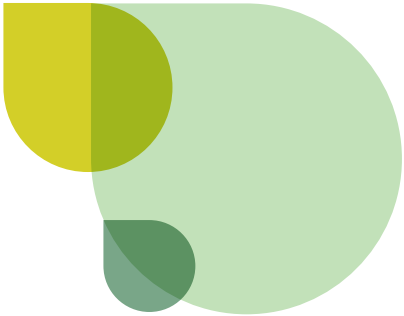
The Western Cape agriculture sector is faced with numerous difficulties and climate change will exert its influence in the context of multiple interacting drivers and pressure points. It can thus be regarded as a stress multiplier. Agriculture is highly dependent on effective risk management covering economic, environmental and social sustainability across the value chain.

All farms in the Little Karoo region can experience exposure to variable and extreme weather, but some are able to draw on resources and skills to 'bounce back' relatively unscathed, whereas others never fully recover and become morbid or fail. Economies of scale and diversification across commodities and agro-climatic zones renders larger farming groups with greater resources much more resilient than small, undiversified and resource-poor farming operations. A shift to more resilient crop types and farming systems (climate smart agriculture) can buffer agriculture against some aridification without negatively impacting profitability or jobs.

Nevertheless, there will be 'winners' and 'losers' and the sector together with government needs to identify the latter and jointly provide support. The SmartAgri project is currently developing the Climate Change Response Framework and Implementation Plan for the province, which will provide the mechanisms for such support. We warmly invite comment on the issues summarised in this brief, and the needs of farmers and other role players in responding to climate change.

Contact us:

To find out more or send comments or questions please visit **www.greenagri.org.za.**



Publications In This Series

Brief for the Grain and Livestock sector: Swartland and greater West Coast region

Brief for the Grain and Livestock sector: Rûens

Brief for Mixed Farming and Regional Commodities: Little Karoo

Brief for Dairy and other Regional Commodities: Southern Cape

Brief for the Livestock sector: Central Karoo

Brief for the Citrus sector

Brief for the Table Grape sector

Brief for the Deciduous Fruit sector

Brief for the Olive sector

Brief for the Wine sector

Brief for the Honeybush sector

Brief for the Rooibos sector

Brief for the Fynbos Cutflower sector

Brief for the Potato and Vegetable sectors

Brief for the Intensive Livestock sector

Brief for Peri-urban Food Gardens and Food Security