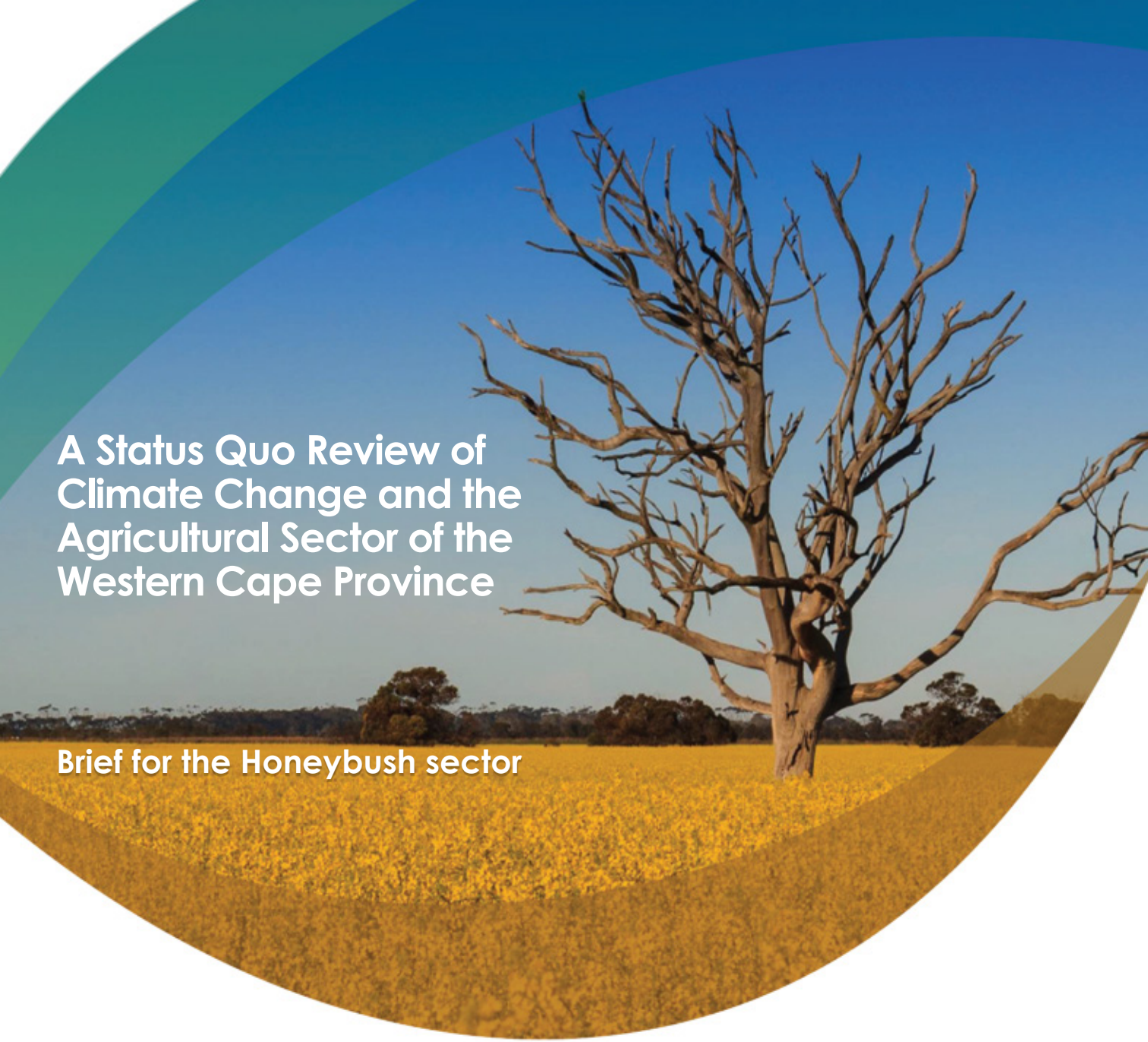

A Status Quo Review of Climate Change and the Agricultural Sector of the Western Cape Province

Brief for the Honeybush sector

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 honeybush sector. 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 honeybush production region

As a result of global climatic changes, the Western Cape faces a warmer future. This poses serious threats to agricultural commodities in the province, including honeybush. 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 crop 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 fertilisation 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 at specific times in the seasonal cycle. In addition, local conditions such as production potential and microclimate influence the extent of the threat.

The climate of the Overberg and Southern Cape areas, where honeybush is grown, is diverse. This gives rise, together with the ocean influence, soils and mountains, to a rich mosaic of agricultural production potential. Relative to other regions of the province the Overberg and Southern Cape enjoys a relatively mild climate with cooler temperatures than elsewhere. Rainfall transitions from mainly winter rainfall in the western Overberg to all-year rainfall between Groot Brak and Plettenberg Bay. The area around Mossel Bay – Herbertsdale is drier and warmer with more erratic rainfall. The southern slopes of the Langeberg and Outeniqua mountain ranges enjoy relatively high rainfall and are cooler. However, across the region, rainfall extremes are common and the region suffers from dry spells and floods.

The SmartAgri project is assessing five agro-climatic zones in this area covering most of the honeybush production, based on Relatively Homogeneous Farming Areas: Rûens-west, Rûens-east, Mossel Bay-Herbertsdale, Groot Brak-Plett, and Bo-Langkloof-Outeniqua (Figure 1).

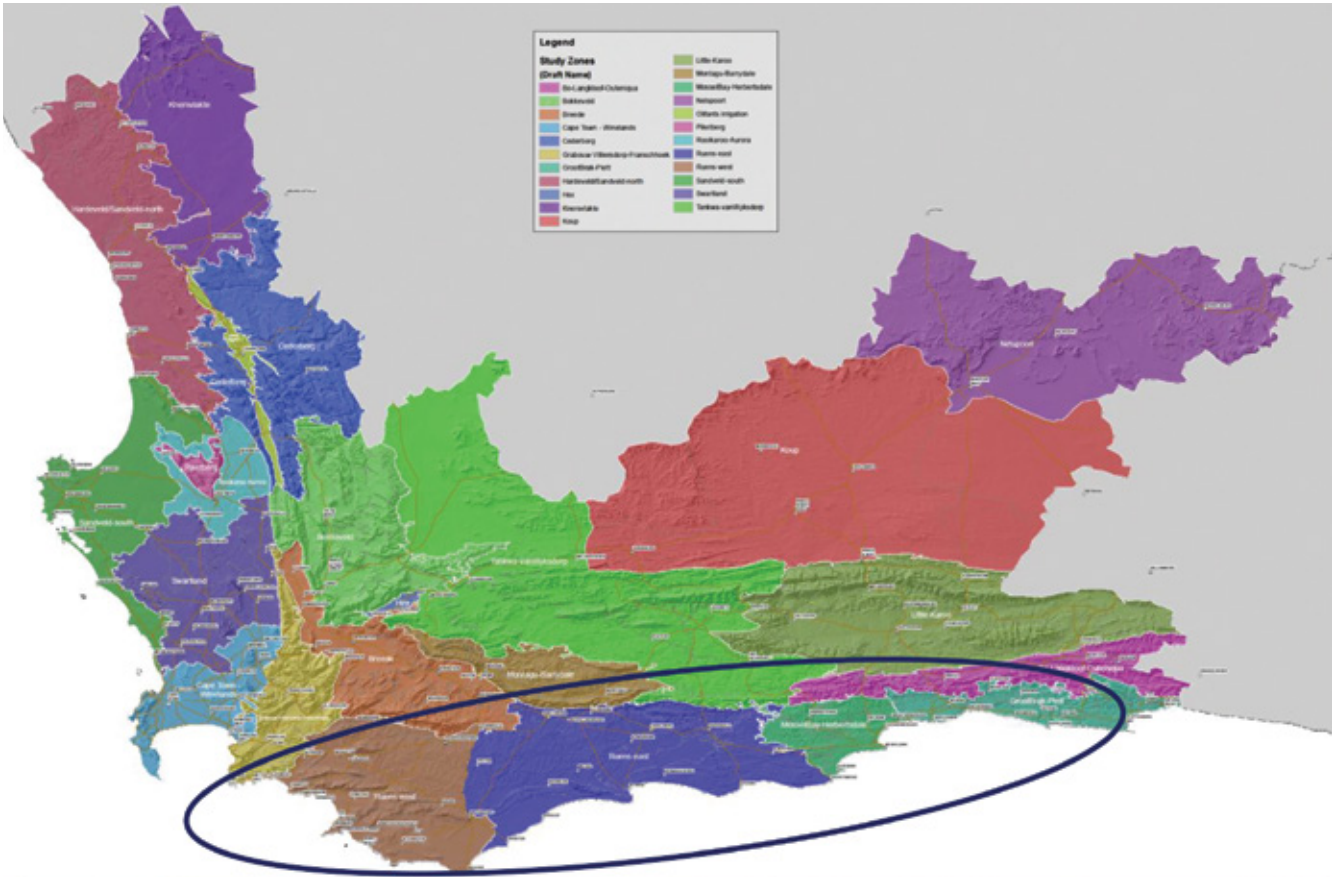

Figure 1. Map of the Western Cape Province showing the 23 agro-climatic zones used in the SmartAgri project, and the Overberg-Southern Cape honeybush production region (circle).

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. However, some of the models indicate a higher probability of overall wetting in the eastern Overberg and Southern Cape, with possible wetting in the mid-summer months. An important change in the climate system involves the shifting of the rain-bringing frontal storm tracks further south during winter. 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, and a higher frequency of intense rainfall events in spring and summer, 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), particularly in mid- to late summer, with a decrease in annual rain days (two days fewer per decade), particularly in autumn, in the Southern Cape. This trend is also perceived by the farming community according to information given during stakeholder workshops. It may indicate a progressively later start to the rainfall season in this area. As yet there are no detectable trends in total annual rainfall in the Overberg and Southern Cape.

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 Indian Ocean. 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 coastal Southern Cape likely tending towards the lower part of this range. Both maximum and minimum temperatures will increase leading to increased heat stress for crops.

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. Between 2003 and 2008 six significant costly flooding events occurred in the Overberg and Southern Cape as a result of cut-off low weather systems. Catchments such as the Duiwenhoks River have suffered repeated damage with losses to agriculture. An increase in extreme rainfall events is likely in the core of the winter season which could increase the risk of flooding. During the serious drought of January 2009 - January 2011, farmers and workers in the Southern Cape suffered large losses. The sector remains vulnerable to disasters such as this.

Heat waves are expected to become more frequent. Figure 2 shows the monthly count of days exceeding 32 °C for Riversdale, as well as projected changes in the same statistic for mid-century. This shows that under climate change such occurrences will increase significantly.

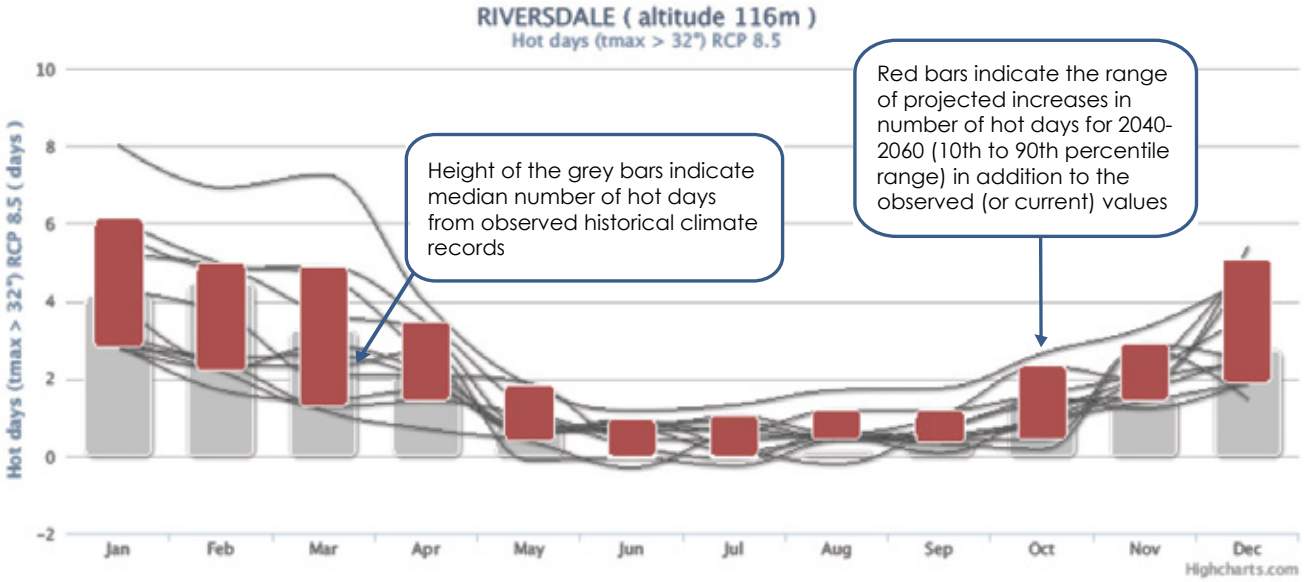

Figure 2. Observed (grey) and projected possible range of increase (red) number of hot days (> 32°C) per month for Riversdale. Projections are for the 2040 – 2060 period and based on 11 different climate models.

Cooler areas in the east, such as Uniondale, and parts of the Langkloof and Baviaanskloof, will likely be somewhat buffered to warmer conditions, but possibly exposed to more heavy rainfall events. The warmer production areas of the Overberg and Hessequa can suffer from heat and wind but it is uncertain what the future holds. Hessequa (Mossel Bay-Herbertsdale area) lies in a climatic transition area between winter and year-round rainfall. 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 west and east. The low water storage capacity across the region renders it vulnerable to periods of low rainfall. On the western sandy coastal plains (e.g. Agulhas Plain) reductions in rainfall would have high impacts on dryland honeybush cultivation.

Climate change risks and impacts on honeybush production

The likely climate-related risk factors in the area include higher temperatures, more frequent and longer dry spells, reduced seasonal rainfall, higher frequency of heavy rainfall and flooding, more frequent summer rainfall, and an increase in hot wet days during the growth period.

Honeybush species are indigenous leguminous shrubs which belong to the genus *Cyclopia*. Honeybush tea is a young, small but growing industry in the province. It is both cultivated and harvested in the wild. The species used occur in the coastal belt from the West Coast to Port Elizabeth, primarily within 50 km of the ocean but extending into the interior as far as Prince Albert and the Bokkeveld. Out of 23 species occurring naturally, six are used commercially, with a centre of activity in the Groot Brak-Plett and Bo-Langkloof-Outeniqua regions.

The physical requirements of suitable habitat (in decreasing order of importance) are soil type, rainfall, aspect, elevation above sea level, and temperature. Research into honeybush is in its infancy and no work has been done to assess the possible impacts of climate change. The fact that soil type is so important could limit the potential of honeybush to migrate to, or be cultivated in climatically suitable areas in future. However, the milder climatic changes projected for the coastal regions and for the Southern Cape could confer resilience on this crop.

Since honeybush only requires irrigation during the early establishment stage and supplementary to rainfall in older plants, and has a low water requirement compared to other crops, any negative impacts of climate change on water resources are not likely to be felt as acutely as for other horticultural irrigated crops. In addition, the natural predator-prey associations for the indigenous honeybush species dramatically reduce the need for chemical interventions for pests and diseases. In fact, honeybush can be regarded as an organically grown crop although certification remains too expensive for most farmers. This hardy crop and the large undeveloped market for it could drive more rapid growth of the industry in a future warmer climate.

Nevertheless, these are some key risks to honeybush production. In the drier production regions, more frequent dry spells and drought during the winter rainfall periods (when seeds are germinating and seedlings are establishing) could decrease yields. Shifting rainfall seasonality could impact on both cultivated and wild honeybush, particularly in the eastern distribution area with more erratic rainfall. Honeybush is highly sensitive to possible increases in heavy rainfall which would lead to more severe waterlogging on the heavier soils and increases in fungal soil-borne diseases.

The impacts on rural communities need to be considered. The well-being of agricultural workers is likely to be affected by increasing heat stress. Poor nutritional status and other health threats (stunting, obesity, HIV/AIDS) render rural workers less resilient to the demands of agricultural labour under stressful conditions. Nevertheless, the growth potential of honeybush in a changing climate could provide new livelihood opportunities for farmworkers and smallholder and emerging farmers. The potential market is currently estimated at four times the size of current sales. Enlarged or new processing facilities would also create jobs.

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 honeybush production regions. The summary indicates overall agricultural sensitivities and is not specified to honeybush production.

Name	Main water resource features	Main climatic features	Climate change temperature projections	Main commodities	Future agricultural potential
Rûens-west	Farm dams, occasional river, low storage capacity	More reliable dryland conditions than to the east, winter rainfall, warm dry summers	Low range warming	Wheat, barley, canola, honeybush Dairy, sheep, cattle	Remains high for rainfed crops but with increasing yield variability
Rûens-east	Farm dams, occasional river, low storage capacity	More variable rainfall than to the west, with recent droughts in Heidelberg-Albertinia area, mostly winter with some summer rainfall	Low range warming	Wheat, barley, canola, honeybush (biggest area) Sheep, cattle, dairy, pigs ostrich	Currently becoming marginal for rainfed crops but could improve given possible increases in rainfall
Bo-Langkloof-Outeniqua	Dams, insufficient storage capacity, use of ground-water	Rainfall throughout the year with spring and autumn peaks; recent floods, droughts and fires	Low to medium range warming	Pome fruit, hops, wheat, honeybush Cattle, sheep, goats	Increasingly marginal, constrained by water availability and extremes
Groot Brak-Plett	Rivers, low storage capacity	Rainfall throughout the year, relatively wet	Low range warming	Wheat, barley, vegetables, honeybush Dairy, cattle, egg layers	Possibly less productive but depends on rainfall shifts
Mossel Bay-Herberts-dale	Rivers, low storage capacity	Mostly winter rainfall, but occasional rain in summer, cool with onshore wind in summer	Low range warming	Wheat, barley, canola, berries, honeybush Dairy, ostrich, pigs, cattle, sheep	Transition area, productivity could improve with more irrigation capacity

[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 Overberg and Southern Cape, 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.

Land and soils

The Overberg and Southern Cape regions have limited areas of arable soil, with most soils being generally shallow, sandy or stony and nutrient poor. Arable land is intensively utilised for wheat and other field crops. Some areas are threatened by dense stands of invasive alien plants, especially on the Agulhas Plain and parts of the Gouritz region. Shifting agricultural land uses to other areas in response to climate change will not be easy but there remain opportunities for sensitive land development.

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. However, the probability for increasing rainfall shown by some climate models means that the future of this region could take on many forms, both positive and negative.

Crop irrigation accounts for a high proportion of water use (61%) in the Gouritz Water Management Area (WMA), although honeybush production accounts for a very small proportion. 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.

A recent study of the potential impacts of climate change on floods in South Africa showed a high level of variability over time and geographically. Of interest here is that one of the models shows a significant increase in the flooding risk in the Southern Cape region.

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. The coastal areas of the Overberg and Southern Cape have a high density and total area of important wetlands, many threatened by agriculture. Working for Wetlands is currently conducting wetland rehabilitation projects in the Duiwenhoks and Goukou River catchments.

Invasive alien plants and wildfires are expected to become more problematic under climate change, especially in the foothills of the mountain ranges where honeybush is harvested in the wild and cultivated. Research shows that under climate change trees will grow more strongly, including alien invasive species. This will potentially allow them to become dominant in some areas, an outcome which seems likely for the Overberg and Southern Cape.

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.

Cultivated and wild-harvested fynbos plant species such as honeybush are likely to come under pressure as the climate changes, possibly via smaller populations and habitat fragmentation in the marginal areas. There could be a loss of genetic resources for climate-adapted cultivated fynbos crops, as well as changes in pest and disease complexes. This could affect honeybush production.

A climate resilient sector

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 Overberg and Southern Cape, flexible adaptation options are available for honeybush farmers which could provide some resilience to moderate warming. 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. Farming practices will focus increasingly on conserving soil moisture, for example maintaining a continuous organic soil cover.

Specific adaptation options for honeybush have not been researched. However, research on the responses of the fynbos biome and its species to climate change, and adaptation options from a biodiversity perspective, could provide some answers for the honeybush industry. Honeybush will likely experience range shifts in suitable production areas, with warmer and drier areas contracting and new areas becoming suitable which are currently too cool or wet. Responses will depend primarily on rainfall trends which are still very uncertain.

The gene bank provided by the fynbos flora is a critical resource for horticultural breeders. For example, it can provide clues for pest-and disease-resistance and climatic tolerance, particularly pertinent in the face of climate change. From this point of view, conservation of the genetic pool in the wild honeybush species has significant benefits for agriculture.

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.

For the honeybush industry, mitigation options can be found mainly in reducing the use of diesel (although this is not high), other ways of increasing energy efficiency, particularly at the processing facilities which have high energy requirements, and the installation of wind or solar energy generation capacity. In some areas biomass could be used as an energy source at the processing facility.

Key actions which farmers can implement

What are key actions farmers in the Overberg and Southern Cape region 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. Do not overharvest the wild honeybush populations. These populations will have to adapt naturally to changing climatic conditions which requires a healthy age distribution and strong gene pool. Reduce wild harvesting under drought conditions and following fire damage to give the populations the best chance of recovery. Use a variety of suitable local species – genetic diversity provides greater resilience.

2. Best practice management of soil resources. The benefits of a Conservation Agriculture - type approach for honeybush farming should be considered and put into practice. Land use decisions for marginal soils and those in areas with low and erratic rainfall should be carefully made. The importance of biological diversity within soils needs to be better understood. The water-holding capacity but also the drainage of soils must be improved through suitable farming practices including best practice soil preparation.

3. Improved management of water resources to optimise water use efficiency, reduce water losses in the system, and preserve and restore good water quality. Monitor soil moisture levels and depletion rates carefully and irrigate optimally according to best practice – only when it is really necessary to supplement rainfall. Aim to maintain an organic soil cover at all times, and remove water-thirsty alien invasive plants in the vicinity of fields. Catchments and wetlands require conservation and good management – maintain the necessary buffer of unfarmed and undisturbed land between riverbanks / wetlands and the cultivated lands.

4. 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), greater attention to firebreak management, and accessing the best available weather forecasts for decision making purposes. In the future, the development of early warning systems relating to pests and diseases will be critical.

5. The energy crisis and climate change are both driving the need for **increased efficiencies of energy use** and the **greater use of renewable energy on-farm**. Farmers who need energy for irrigation pumping and on-site processing are particularly vulnerable. 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. Take an active part in **skills development and on-farm research** relevant to farming honeybush in this region under conditions of climate change. Technologies which can help to confer resilience must become available and affordable to all. Support efforts to conserve the genetic resources and develop them horticulturally in order to supply the industry with resilient plant material. Help to position this crop as a growth proposition given its natural climate resilience.

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.

All farms in the Overberg and Southern Cape 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. 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

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Brief for Peri-urban Food Gardens and Food Security