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REPORT

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Understanding climate risk to South Africa's agri-food system

A commodity value chain analysis of wheat

AUTHOR

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ABOUT THIS STUDY

WWF received funding from the British High Commission to establish a research programme exploring the complex relationship between food, water and energy systems from the perspective of a sustainable and secure future for the country. This paper is one of three commodity value chain analyses.

PAPERS IN THIS STUDY

1. *Commodity value chain analysis for wheat*: Stephanie J.E. Midgley
2. *Commodity value chain analysis for dairy*: Stephanie J.E. Midgley
3. *Commodity value chain analysis for apples*: Stephanie J.E. Midgley

ABOUT WWF

The World Wide Fund for Nature is one of the World's largest and most respected independent conservation organisations, with almost five million supporters and a global network active in over 100 countries. WWF's mission is to stop the degradation of the Earth's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

DISCLAIMER

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1. SUMMARY

Wheat production in South Africa and its value chain are focused on the domestic consumer. The value of the industry is high in terms of its contribution to food security and to the agricultural economy. Nevertheless, local consumption of wheat exceeds production and South Africa is a net importer of wheat. Wheat imports fluctuated between 2002 and 2012, but averaged 1.18 million tonnes per annum. The drop in the value of the rand leads to higher costs of imported wheat and affects the affordability of wheat-based products for poor consumers. Local producer prices for wheat are influenced by international market prices as wheat is an internationally tradable commodity product. The producer price is usually close to the import parity price. Wheat farmers in the Western Cape have the added cost of transporting their wheat to Randfontein in Gauteng – also bear the costs of the "transport differential". Profit margins are very tight and any additional stress such as that caused by climate variability and climate change is of great concern.

The wheat supply value chain consists of suppliers of farming inputs, producers, importers, silo operators, millers, bakeries, feed manufacturers, wheat-based goods manufacturers, transport operators, retailers and consumers. Significant changes in local production, which can include unfavourable climatic conditions, combined with international production variations, affect the entire value chain. Increased imports make up for local supply shortages and the impacts on the supply chain are transmitted mainly via price. Consumers have felt these impacts in the rising prices of staple wheat-based foods such as bread.

The rain-fed wheat production area has shifted in recent years from the summer rainfall regions to the winter rainfall region of the Western Cape. Falls in rain-fed production have been particularly severe in the Free State, partly due to increasingly lower and more erratic rainfall. Experts expect that, in the longer term, the area planted to wheat in the winter rainfall regions will decline by 40,000 hectares, and the wheat area in the summer rainfall regions will stabilise at the current lower level. Total national production is expected to stabilise at around 1.6 million tonnes, but rising demand will lead to price rises in the longer term. In South Africa, wheat imports will have to keep rising to feed the growing population and will exceed local production within the next 10 years. Local prices of wheat and wheat-based foods will be even more influenced by international prices and the currency exchange rate.

Climate variability has a strong impact on wheat production. Current production areas with high rainfall variability are considered marginal and planted only when a good rainfall season is expected. Other current climate risks include a late and/or inadequate start to the rainfall season in April–May–June, droughts, warm and rainy conditions during the harvest period, localised flooding, heat waves and strong winds.

Climate change in the dominant winter rainfall production region will bring about warming and shifts in seasonality and rainfall amounts, with both more and less rain being possible, according to various climate models. Changes which could cause the most damage to wheat farming include a progressively later start and end to the rainfall season, thus interfering with the harvest; less total seasonal rainfall; longer dry spells; cycles of drought and flood; and increasing heat stress. Significant climate change threats to grain production are likely to lie in changes to the distribution and intensity of pest species, the spread of diseases and the growth of weeds. Climate change is expected to result in a moderate decline in wheat yield in the winter rainfall region and a moderate increase in some parts of the summer rainfall region. Increased imports will make up for reduced national wheat production.

Farmers are already adapting to climate change by reducing drier or higher-risk areas planted to wheat, employing conservation agriculture production systems and using more climate-resilient cultivars.

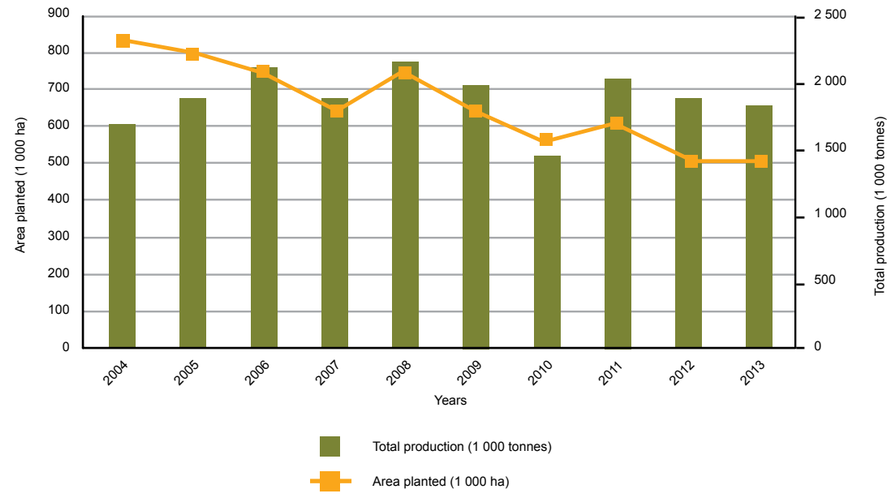
Impacts of climate change on the wheat supply chain will be felt in the transport sector responsible for distributing wheat between sources of supply and ports, and areas of demand. Good transport infrastructure and a cost-efficient transport system will be essential to keep the prices of staple wheat-based foods as low as possible.

Farmers are increasingly expected to absorb greater impacts of year-on-year and multi-year climate and yield variability. It will be unsustainable to expect farmers to continue carrying all the risk. The value chain institutions and government (through strategic policy development and support) will have to become better partners in order to spread the risk more equitably. Failure to do so could put the wheat industry at risk and necessitate heavy reliance on imports in future. Under the expectation of a continuing weakening of the exchange rate, this could cost the country and consumers dearly.

2. ROLE OF THE WHEAT VALUE CHAIN IN THE AGRICULTURAL ECONOMY

Wheat is South Africa's fifth largest product in terms of production (tonnage) and the second largest grain crop after maize. South Africa harvested almost 1.8 million tonnes of wheat on 477,000 hectares in 2014 (BFAP, 2015). From 2004 to 2013, the area planted to wheat declined (discussed later) but total production varied between 1.4 million and 2.2 million tonnes (Figure 1).

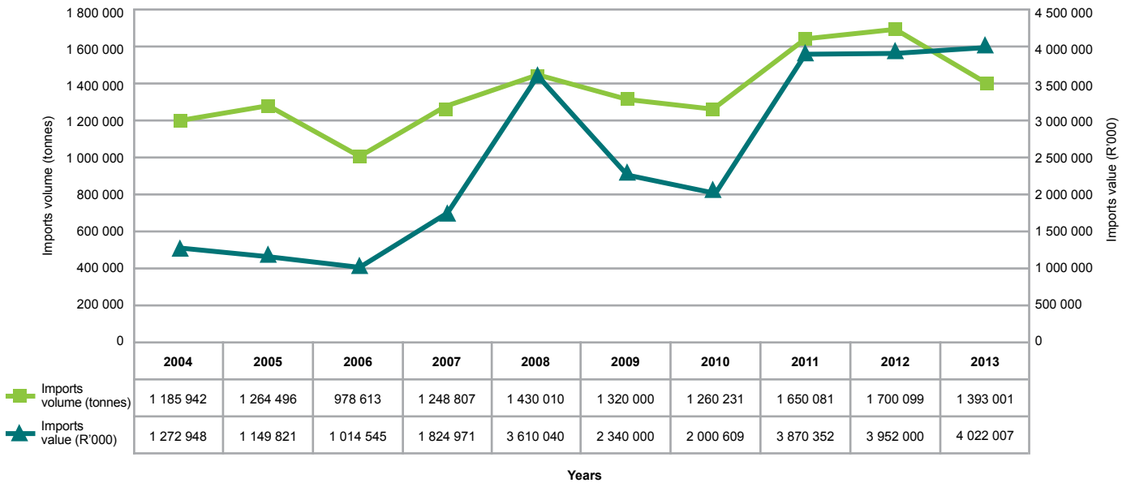
FIGURE 1: AREA PLANTED TO WHEAT AND TOTAL PRODUCTION



Source: DAFF (2014)

Nevertheless, local consumption of wheat exceeds production and South Africa is a net importer of wheat. Between 2002 and 2012, wheat imports averaged 1.18 million tonnes per annum (DAFF, 2014), rising to a high of 1.7 million tonnes in 2012 at a value of R4 billion (DAFF, 2013, 2014). In 2013, sufficient national wheat stocks led to a decrease in imports to about 1.4 million tonnes but at a similar value of R4 billion (Figure 2). The drop in the value of the rand leads to higher costs of imported wheat and affects poor consumers' ability to afford wheat-based products. Wheat is imported mainly from the Americas (USA, Argentina, Brazil, Uruguay: 62%), Europe (Ukraine, Russian Federation, Germany: 27%) and Oceania (Australia: 9%) (DAFF, 2014).

FIGURE 2: WHEAT IMPORTS



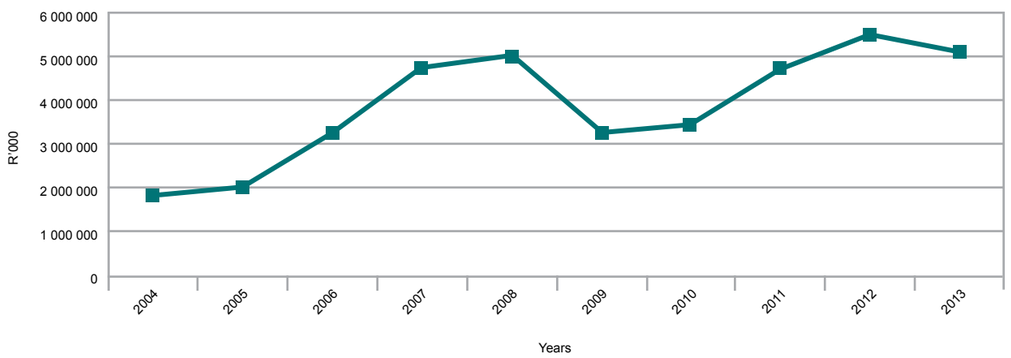
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Imports volume (tonnes)	1 185 942	1 264 496	978 613	1 248 807	1 430 010	1 320 000	1 260 231	1 650 081	1 700 099	1 393 001
Imports value (R'000)	1 272 948	1 149 821	1 014 545	1 824 971	3 610 040	2 340 000	2 000 609	3 870 352	3 952 000	4 022 007

Source: DAFF (2014)

Some wheat is exported, mainly to South African Customs Union and Southern African Development Community countries such as the Democratic Republic of Congo, Zambia, Zimbabwe and Mozambique. Wheat exports fluctuate depending on local and international producer prices, but have been generally low (<20 000 tonnes) in the last five years.

The wheat industry's contribution to the gross value of agricultural production in South Africa is currently between R5 billion and R6 billion (Figure 3).

FIGURE 3: GROSS VALUE OF WHEAT PRODUCTION



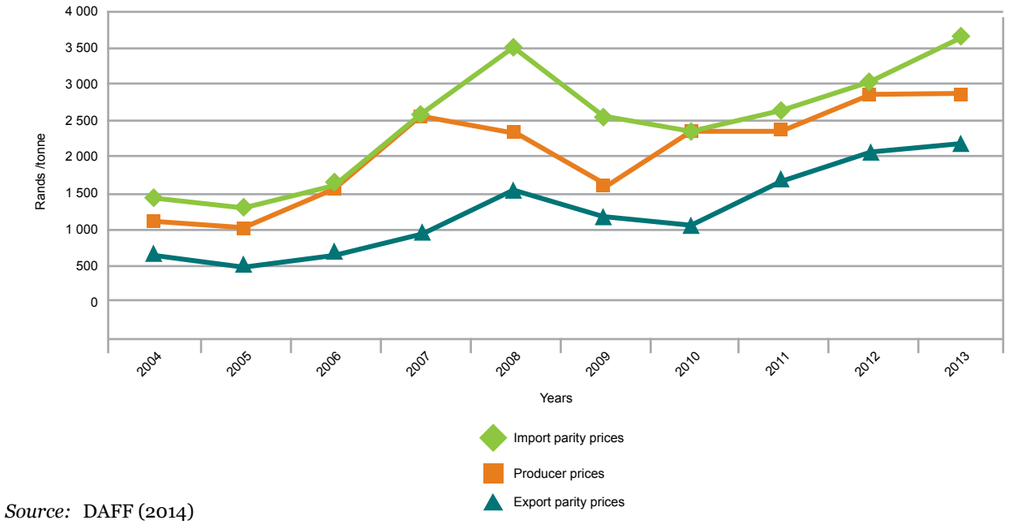
Source: DAFF (2014)

Local producer prices for wheat are influenced by international market prices as wheat is an internationally tradable product. The scrapping of Wheat Board controlled single-channel marketing in 1996 exposed farmers to market risks and resulted in a decline in area planted to wheat (see Box 1). Local prices became more unstable, fluctuating between the import and export parity price levels (Figure 4), with the product tending to trade more closely to the import price (DAFF, 2014). This is due to the increasingly heavy reliance on wheat imports. The current exchange rate is also an important factor in determining the price.

The variable import levy for wheat has been set to be triggered by a reference price of US$294/tonne.[1] In 2015, wheat prices fell below this level (±R800/tonne), thus triggering the import duty for as long as this is the case.

An additional factor for wheat farmers in the Western Cape is the so-called "transport differential". The farm-gate price of wheat is equal to the spot price that is traded on the South African Futures Exchange (SAFEX), less the transport differential and storage costs. Wheat is produced in many areas of South Africa but is traded and priced in the Randfontein grain market in Gauteng. This puts Western Cape wheat farmers at a disadvantage compared to those in the north of the country. Given the lack of any government subsidies, the burden carried by farmers is great and places their financial survival at risk, particularly if added stresses are experienced. As a result, Western Cape farmers are concerned about the impacts of climate variability and climate change on wheat yields.

FIGURE 4. AVERAGE WHEAT PRODUCER PRICES



Source: DAFF (2014)

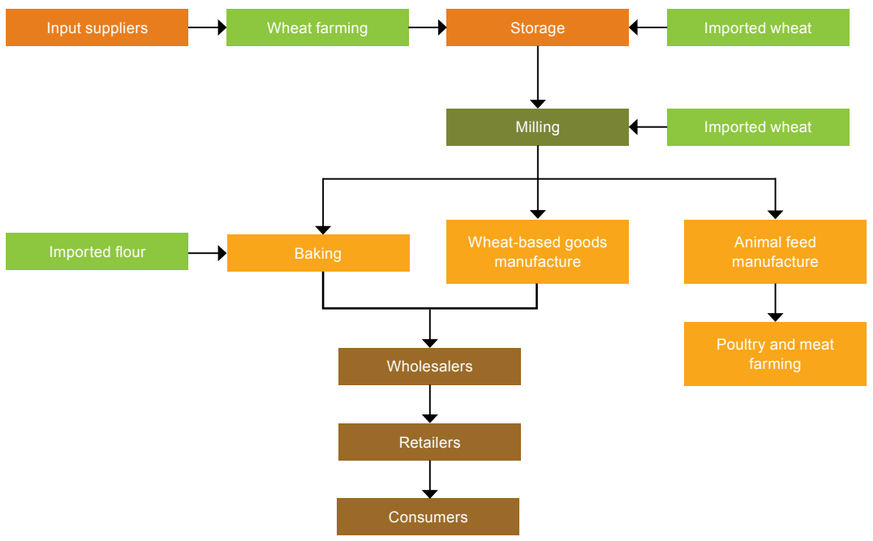
The wheat value chain (Figure 5) begins with a variety of input suppliers who provide seeds, agro-chemicals and machinery to farmers. Both harvested and imported wheat are stored before delivery to milling companies that mill it into wheat flour, bran and meal. The milled flour is used for baking (e.g. bread, rolls, frozen dough) and wheat-based products (e.g. biscuits, pasta, cereals). A small amount of poorer quality wheat is used to manufacture animal feed (farm feeds, pet foods). The wheat is transported from the farmers to the silo owner, from the silo owner to the miller and from the intermediaries to the retailers and consumers. Historically, rail transport dominated the wheat market. Since the early 1990s, deregulation and the development of a free market system have led to a shift from rail to road transport.

Most wheat produced ("bread wheat" cultivars) is for human consumption: bread (60% of total wheat flour), biscuits, breakfast cereals and rusks, with small quantities of "durum wheat" used for pasta (DAFF, 2014). Some wheat is also used for seed and animal feed. Other non-food and industrial uses of wheat gluten and starch (Figure 6) include producing ethanol, absorbing agents for disposable nappies, adhesives, coatings, polymers and resins.

[1] About R4 574 at 3 March 2016 exchange rate.

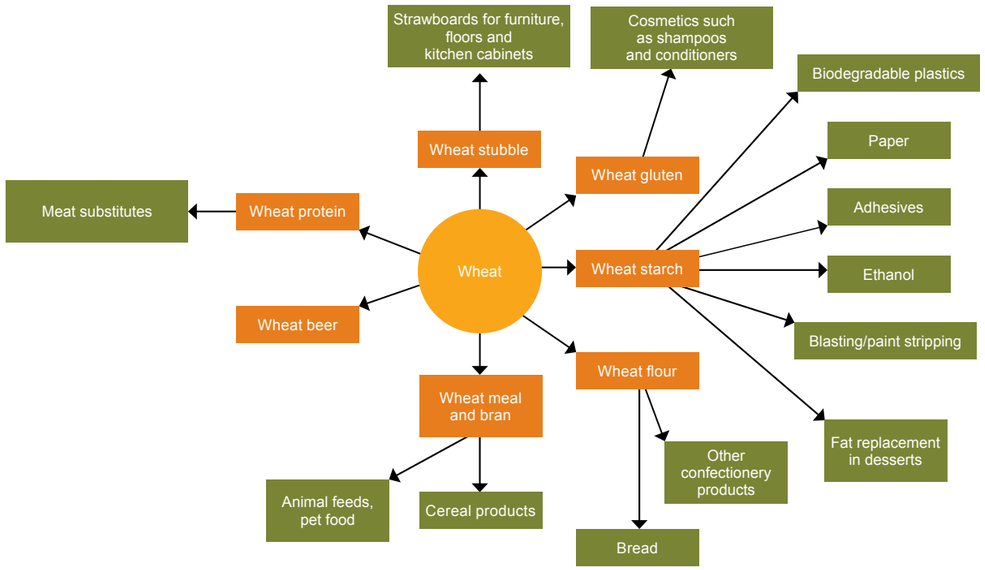
The milling industry, the baking industry and the retail sector are the main role players in the value chain. The milling industry, which produces wheat flour, bran and meal wheat, makes up a total capital investment of about R3 billion in South Africa (DAFF, 2014).

FIGURE 5: THE WHEAT MARKET VALUE CHAIN



Source: DAFF (2014)

FIGURE 6: WHEAT VALUE CHAIN TREE



Source: DAFF (2014)

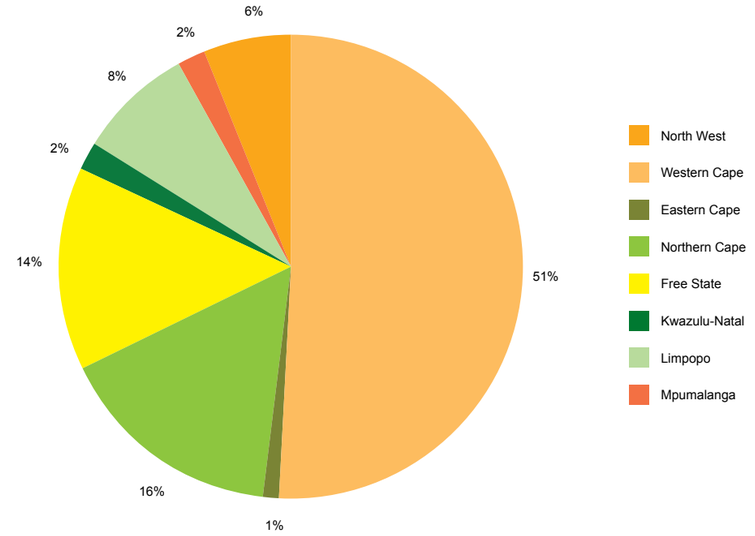
The wheat industry is vulnerable to local and international fluctuations in supply and demand, and varying product prices. There is a high level of investment in infrastructure (storage, mills). Significant changes in local production, including unfavourable climatic conditions, combined with international production variations, affect the entire value chain. These are ultimately transmitted via price. Consumers have felt these impacts in the form of rising prices of staple wheat-based foods such as bread (FPMC, 2004). It is possible that a large share of the miller-to-retail margin goes to the retailer (FPMC, 2004). Indications are that retailers respond more quickly to shocks that stretch their market margins than to those that squeeze them, a situation attributed to the anti-competitive nature of the food market chain (Alemu and Ogundeji, 2010).

The wheat industry is highly concentrated, although small millers' entrance into the market is changing this situation. The four largest millers had 87% of the market share in 2004 (FPMC, 2004), with smaller millers making up the remaining 13%. Most of the major millers have vertically integrated with the major bakeries, which contributes to managing supply chain risks.

Wheat is produced throughout South Africa. In 2013, the Western Cape (51%), Northern Cape (16%) and Free State (14%) accounted for 81% of total production (Figure 7). According to the most recent results for area planted (for 2014), the winter rainfall area accounted for 310,000 hectares (65%), with a further 70,000 hectares (15%) planted in the summer rainfall area and 97,000 hectares (20%) under irrigation (BFAP, 2015). In recent years, production has risen in the Western Cape but decreased in the Free State, partially due to increasingly difficult climatic conditions. The Western Cape production region has cool wet winters and wheat is planted between mid-April and mid-June. In the summer rainfall production regions elsewhere in the country, wheat is planted from mid-May to the end of July. It is also grown under irrigation during other seasons but this production system is limited by available water supplies and costs.

On-farm wheat production employs about 28,000 people across the country. The milling industry employs around 3,800 people, and there are further job opportunities throughout the value chain (baking, goods manufacture, animal feed production).

FIGURE 7: WHEAT PRODUCTION AREAS OF SOUTH AFRICA BY PROVINCE, 2013

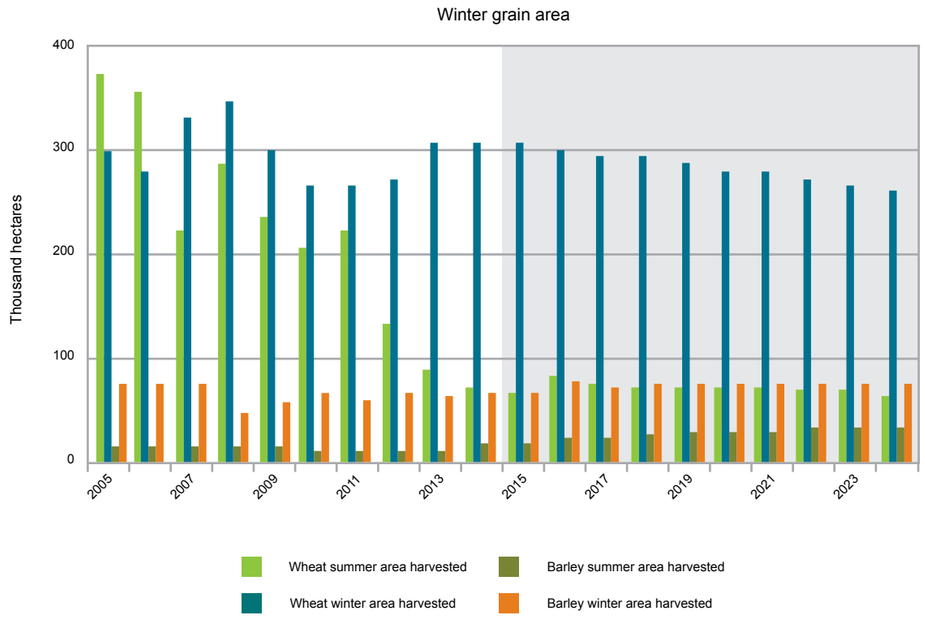


Source DAFF (2014)
Note: Gauteng = 0%

3. RECENT TRENDS AND OUTLOOK FOR THE WHEAT VALUE CHAIN

In recent years the area under wheat in the summer rainfall production areas has declined while that in the winter rainfall area has remained fairly stable (Figure 8). However, over the last 25 years, wheat areas planted in the winter rainfall regions have declined more than 50%, from a high of 660 000 ha in 1988 to 265 000 hectares in 2011 (Wallace, 2013). This was mostly a result of the deregulation of the industry (scrapping the single-channel fixed-price system), after which the market risk that farmers in marginal production areas were exposed to became too great. The Bureau for Food and Agricultural Policy (BFAP) expects that, in the longer term, the area planted to wheat in the winter rainfall areas (Western Cape) will decline by a further 40,000 hectares as producers switch to canola and a more sustainable crop rotation system. The wheat area in the summer rainfall regions will stabilise at the current lower level (BFAP, 2015). Increased plantings in the summer rainfall regions would be possible if rainfall and soil moisture conditions improve.

FIGURE 8: WINTER GRAIN AREA HARVESTED — RECENT HISTORICAL AND PROJECTED TO 2024



Source: BFAP (2015)

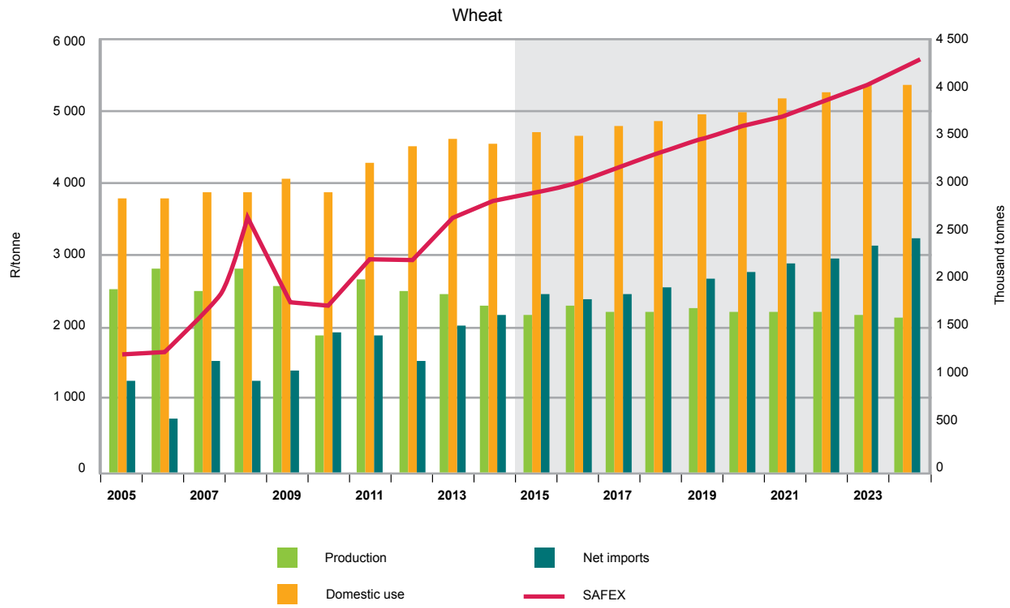
According to projections based on expected trends in international and local wheat prices, the variable import tariff, a weakening exchange rate and improved yields, production levels will be maintained at around 1.6 million tonnes in the long run, despite declining area (BFAP, 2015) (Figure 9). A global oversupply of wheat and resulting low dollar prices are expected to continue in the short term, although rising demand will eventually balance out supply and demand globally and prices will rise. In South Africa, wheat imports will have to keep rising to feed the growing population and will soon exceed local production. For this reason, local prices of wheat and wheat-based foods will be even more influenced by international prices, the currency exchange rate and the variable import tariff. Thus, despite a decline in global wheat prices, the average SAFEX wheat price is projected to continue to rise over the next few years (Figure 9).

BOX 1

Assessing the drivers of wheat production trends in South Africa (adapted from BFAP, 2015)

South Africa's total wheat area reached a maximum of almost 2 million hectares in 1988, with dryland wheat in the Free State covering more than half of that area (1 million hectares). The first major drop in wheat hectares occurred in 1992, following a government programme to incentivise farmers to convert wheat fields to grazing pasture and natural grazing. This decline in hectares was exacerbated by the severe drought. The trend of declining area in the Free State continued, resulting in only 70 000 hectares of wheat (irrigation and dryland) being planted there in 2014. The Free State irrigation wheat area remained quite stable at around 33 000 to 34 000 hectares, but north-western and southern Free State farmers have largely stopped producing dryland wheat. Only the eastern Free State farmers are still planting a significant area to dryland wheat. A major driver of the decreasing trend in yields in the southern Free State is the fact that this region is receiving less rain during September and October, which are crucial months for winter dryland wheat production. This changing environment has influenced farmers' willingness and ability to plant wheat and will probably also affect their ability to react to future wheat market signals.

FIGURE 9: WHEAT PRODUCTION, CONSUMPTION (PRODUCTION + IMPORTS), TRADE AND PRICE – RECENT HISTORICAL AND PROJECTED TO 2024



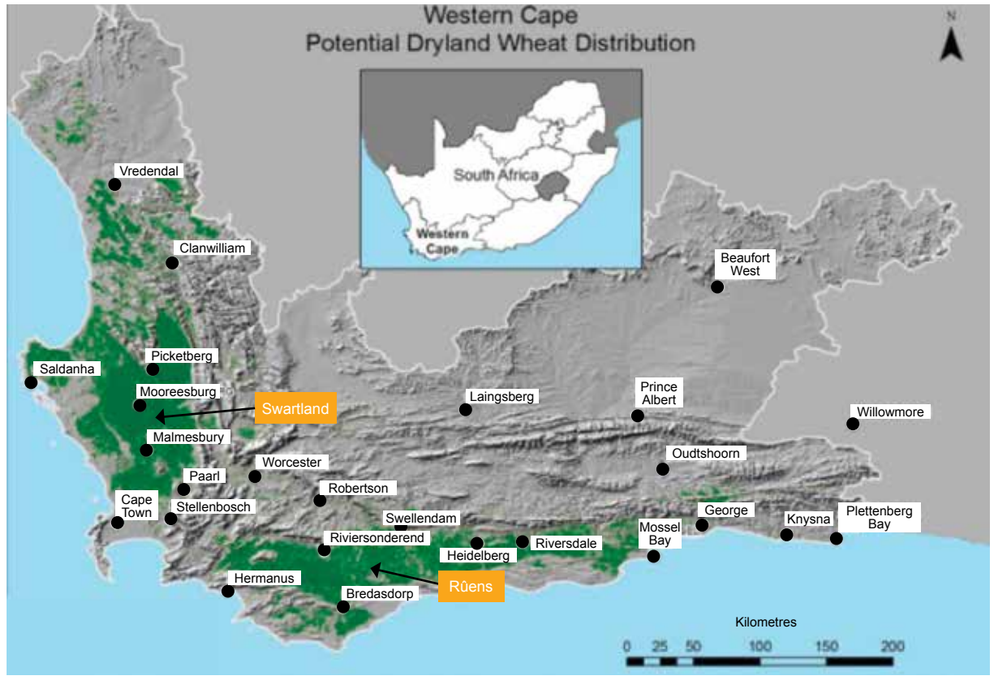
Source: BFAP (2015)

4. WHAT ARE THE RECENT HISTORICAL AND CURRENT CLIMATE RISKS TO THE VALUE CHAIN?

Sections 4 and 5 focus primarily on the core wheat production regions of the Western Cape, namely the Swartland and the Rûens (Figure 10), with a brief reference to the summer rainfall production regions.

The climate of the Swartland and Rûens wheat production regions is generally warm to hot, dry summers and moist, cool winters. The Swartland has more consistent although on average lower winter rainfall than the Rûens. The Rûens receives some summer rainfall, ranging from 25% of annual rainfall in the west to 45% in the east. Rainfall is more variable than in the Swartland, particularly in the eastern Rûens. Dryland wheat production yields (0.5 to 3.5 t/ha) are considered low compared to the major wheat-producing countries, due mostly to variable climate conditions and low soil fertility.

FIGURE 10: WHEAT AREAS IN THE WESTERN CAPE — INCLUDING AREAS WHERE WHEAT MAY BE PRODUCED SPECULATIVELY DEPENDING ON CLIMATE OR MARKET CONDITIONS



Source: Wallace (2013)

The key current climate risks for wheat production include:

- A late and/or inadequate start to the rainfall season in April–May–June, less total seasonal rainfall and erratic distribution of rainfall with long dry spells lead to reductions in yield and grain quality;
- Warm and rainy conditions during the harvest period promote fungal diseases and outbreaks of pests causing reduced yield and grain quality;
- Heavy rainfall leads to localised flooding and water logging in heavy soils, resulting in diseases and poor growth and yield;
- Intense rainfall events followed by extended dry periods;
- Heat waves and high maximum temperatures in the growth season, particularly during the flowering and fertilisation period, result in reductions in yield and grain quality;
- Hailstorms and strong winds damage or destroy the plants and ears.

Droughts sometimes occur, such as the severe drought of 2003 which had a significant impact on wheat yields in the Swartland. The final impacts of the 2015/16 drought are yet to be calculated.

When extreme weather events like droughts and heat waves damage wheat yields and quality, the impacts are felt further down the value chain. This can happen as a result of loss or damage to infrastructure, such as roads and bridges, electricity pylons and lines, stores and farm equipment. Road closures prevent farmers and distributors from moving harvested grain. In addition, the direct impacts on yields and quality reduce the value of the crop throughout the value chain and production deficits have to be countered through increased imports.

5. HOW IS CLIMATE CHANGE EXPECTED TO CHANGE THE CLIMATE RISKS?

Based on the current understanding of climate processes, climate change will cause shifts in locally important climate systems or processes, such as shifting the rain-bringing frontal storm tracks further south during winter. Already, weather data shows that year-round warming has occurred (0.2°C per decade), with more pronounced warming in mid to late summer. There are also fewer rain days during summer–autumn (January to April) and early spring (August) in some areas, but more rain days in early summer (November–December). This may indicate a progressively later start and end to the rainy season. Wheat farmers in the Western Cape are already noticing this trend. As yet, there are no obvious trends in total rainfall during the core winter rainfall season or annually across the wheat production areas.

The climate models used to project climate changes in the Western Cape from 2040 to 2060 (Midgley et al., 2014) indicate the following:

- Higher minimum and maximum temperatures, more so inland than along the coastal areas.
- Increases in annual temperatures of 1.5°C to 3°C, with the coastal areas tending towards the lower end of this range.
- More hot days and fewer cold and frost days.
- Reduced annual rainfall by mid-century (most climate models agree on this, with a strong indication of drying in the western parts of the region).
- In the short to medium term (before mid-century), the possibility of increased rainfall on the windward mountain slopes and in autumn and spring.
- Possibility of increased rainfall in the eastern part of the province, which could include the eastern Rûens.
- Increased frequency of droughts, floods and heat waves, and possible changing pattern of hail and strong wind (there is greater uncertainty in these projections).

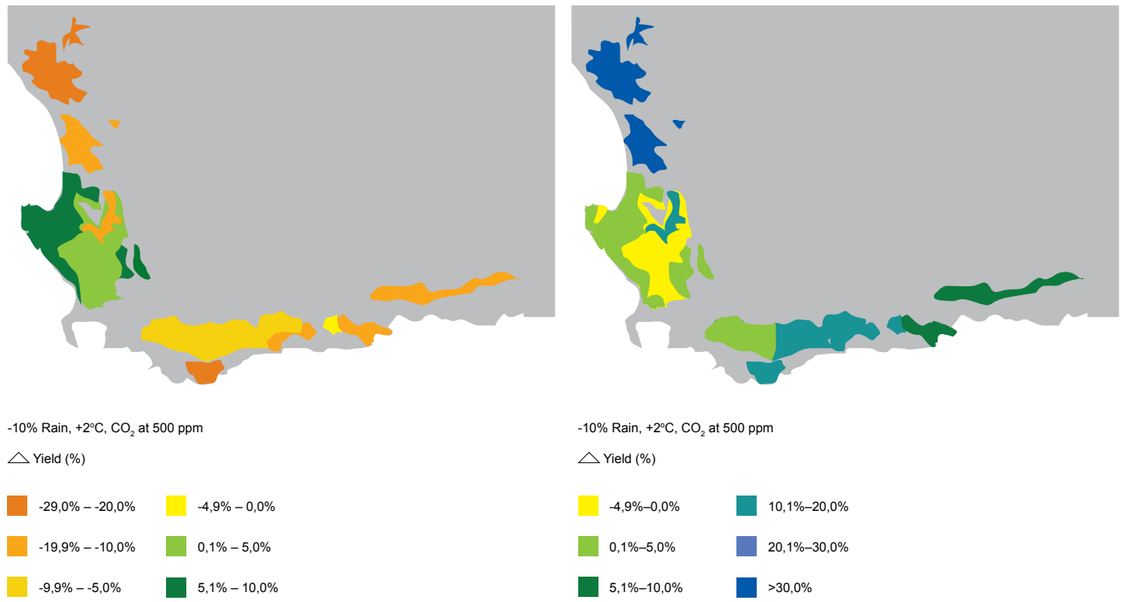
Climatologists are advising decision makers to consider both increased and decreased rainfall as possible outcomes. Decreased rainfall poses the highest risk for wheat farming.

According to Schulze and Davis (2012), winter wheat yields should increase slightly by 0.5–1.5 t/ha/season in the intermediate future in the Swartland and Rûens regions, due to the positive “fertilisation” effects of rising atmospheric CO_2 concentrations. In the more distant future, yields are projected to decrease by 0.5–1.0 t/ha from present yields.

Wallace (2013) found that wheat yield variability and risk patterns are likely to remain similar to those currently experienced in the western wheat zone of the Western Cape production area. However, cultivar choices under future climate conditions will influence this outcome, particularly in the Swartland. Agro-climatic zones that are already considered risky and marginal for wheat production are likely to experience increasing risks (Figure 11). Rising atmospheric CO_2 concentrations have a positive “fertilising” effect on plant growth and yield. When Wallace (2013) modelled this, the impact varied considerably between zones. However, together with expected increases in rainfall in some areas, this largely compensated for yield losses due to future warming across most of the province.

Significant threats of climate change to grain production could lie in changes to the distribution and intensity of pest species, the spread of diseases and the growth of weeds. Very little is known about this.

FIGURE 11: CROP YIELDS IN TWO RAINFALL SCENARIOS OVER THE PERIOD 2040-2060



Source: Wallace (2013)

Note: This is the output from a model where the settings were: CO2e (greenhouse gases) reach a level of 500 parts per million in the atmosphere; a temperature increase of 2°C over known climate baseline data; an increase in rainfall of 10% (left map) and decrease of 10% (right map).

A study conducted by BFAP (DEA, 2014) took an integrated approach incorporating economic (e.g. price drivers) and social impacts (food access) in order to project possible effects on the wheat value chain and food security. Climate model projections of increasing winter rainfall in the summer rainfall wheat producing areas (mainly Free State) showed a yield increase of more than 1 t/ha. In the Western Cape a small decline in winter rainfall is projected to result in a decline in yield. Collectively, these changes result in a projected decline in national wheat production of just over 100 000 t/ha. This is expected to be compensated for by increased imports. Food security is therefore not a question of supply but rather of access, both in terms of financial means or own supplementary production (DEA, 2014).

These results represent a worst-case scenario, assuming that no adaptation takes place. However, farmers are already adapting to climate change by reducing drier or higher risk areas planted to wheat and using more climate resilient cultivars. Other adaptations to maximise whole-farm profitability and reduce risk under current conditions include (Hoffmann, 2010; Wallace, 2013):

- Implementing crop rotations according to best practices for a region and maximising the benefits of nitrogen-fixing species (legumes) preceding a wheat crop.
- Converting to conservation agriculture practices to conserve soil moisture (see Box 2).
- Optimising stocking rate of ewes to take advantage of increased stubble and pasture resulting from the above point.
- Increasing dairy and pasture component, producing oats and other fodder crops on poorer soils – particularly for farms near major towns or cities.
- Promoting the development and testing of cultivars suited to risky areas.
- Increasing farm size (economies of scale).
- Allocating part of the farm (20%) to continuous small-grain mono-cropping to maximise the opportunity to take advantage of high grain prices.

BOX 2

One of the most effective and financially beneficial (for most farmers) advances in recent years is the switch to conservation agriculture (ARC, 2014; de Wit et al., 2015). Conservation agriculture is a farming system where three principles are applied at the same time: minimum disturbance of the soil, year-round soil cover and sound crop rotations, including legumes. Seed and fertilizer are sowed directly in the stubble of the previous crop. Conservation Agriculture Western Cape and the Western Cape Department of Agriculture have been at the forefront of research in this area. It has been so successful that many farmers believe they would be out of business if they had not adapted to these methods. Conservation agriculture, which has moisture conservation as a central theme, is a suitable and effective response to climate variability, regardless of longer-term climate scenarios.

Impacts of climate change on the wheat supply chain will be felt in the transport sector responsible for distributing wheat between sources of supply and ports, and areas of demand. Good transport infrastructure and a cost efficient transport system will be essential to keep the prices of staple wheat-based foods as low as possible. Efficient access to rural centres of demand is particularly important, especially if rural subsistence and smallholder farmers stop being able to produce some of their own food due to harsher climatic conditions.

The national requirement to reduce energy demand and transition to a low carbon economy will lead to an increasing cost of energy, which will also affect the transport sector of the value chain. Switching to cleaner fuels will be one way of dealing with potential price increases while contributing to greenhouse gas emissions reductions.

An area of risk in the value chain which may become greater due to climate change is fungal disease outbreak in stored wheat, before it can be milled. Wetter spring weather can interfere with the harvest and increase this risk. This initial quality and spoilage risk escalates to a food safety risk when toxic organisms infect the wheat used to produce food for human consumption. Monitoring systems and greater vigilance will be essential.

Currently, there is limited insurance availability and crop insurance is expensive. Farmers are expected to absorb greater impacts of year-on-year and multi-year climate and yield variability. When climate extremes cause damage to the wheat crop, farmers are hard hit. In addition, the “transport differential” results in lower farm gate prices. It will be unsustainable to expect farmers to continue carrying all the risk. Value chain actors such as financial institutions, retailers and government (through strategic policy development and support) will have to become more active partners in order to spread the risk more equitably. Failure to do so could harm the wheat industry and necessitate heavy reliance on imports in future. Under the expectation of a continuing weakening of the exchange rate, this could cost the country and consumers dearly.

6. WHERE ARE THE OPPORTUNITIES FOR STRATEGIC RESPONSES IN THE VALUE CHAIN?

At farm level, the future of wheat production will be the outcome of a set of factors that include gradual climate change and/or rapid changes in climate extremes (e.g. more frequent and deeper droughts), together with local and global shifts in supply and demand and thus producer prices. Alternatively, more profitable crops such as canola will in some cases replace the areas planted to wheat. Whatever the production outcomes, demand will almost certainly continue to rise.

The post-farm value chain currently receives grain from local suppliers and from imports. This is shifting, and is expected to continue shifting, towards a situation where South Africa's wheat imports will outstrip local production within the next 10 years. Climate change could speed up this shift. On the other hand, timely investment in adaptation (hardy cultivars, conservation agriculture, more efficient use of irrigation water, innovative crop–livestock production systems and crop rotation systems) and new production areas could lead to renewed growth in production. Currently, risk reduction is handled almost solely by the farmers themselves.

Opportunities for greater support from the value chain and investment lie in:

- Supporting effective knowledge and extension to farmers dealing with climate stress.
- Participating in partnership research models to support locally relevant on-farm technology development and more sustainable "climate-smart" ways of farming (e.g. value chain businesses could join current partnership efforts between the Western Cape Department of Agriculture and the Agricultural Research Council).
- Investment in scaling up conservation agriculture to all wheat farmers (ARC, 2014).
- Developing new areas of wheat production (e.g. Eastern Cape) in order to diversify the production base and spread the risk owing to climate events; this would go hand-in-hand with developing the associated transport, storage and milling infrastructure.
- Developing innovative insurance models and products to provide affordable options for farmers.
- Working with government to drive the rehabilitation of the rail network servicing the silos (low carbon and cheaper transport).
- Switching the transport fleet to lower-cost greener transport fuels.
- Lobbying government to develop forward-looking integrated policies which support effective responses to climate change in the agricultural sector, and incentives for investments in climate change adaptation in the wheat industry – in the bigger interest of national and household food security.

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