



**Western Cape  
Government**

Agriculture

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# **Economic Impact Assessment of Natural Disasters on the Western Cape Agricultural Sector**

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## 1. Introduction

The Western Cape province of South Africa has been impacted significantly in recent years by unforeseen natural and biological disasters. The current drought is a case in point, impacting on large areas of farming in the Province and significantly altering the sector's production capabilities. Occurrences of floods, hail storms, wildfires, animal disease and pest scares have also increased in frequency and severity. It is essential that these risks to the agricultural sector be comprehensively analysed in order to develop effective interventions to mitigate any negative impacts. This short report will seek to assess the economic impact of such disasters on the Western Cape's agricultural sector and also how these impacts on the sector manifest into economy-wide impacts.

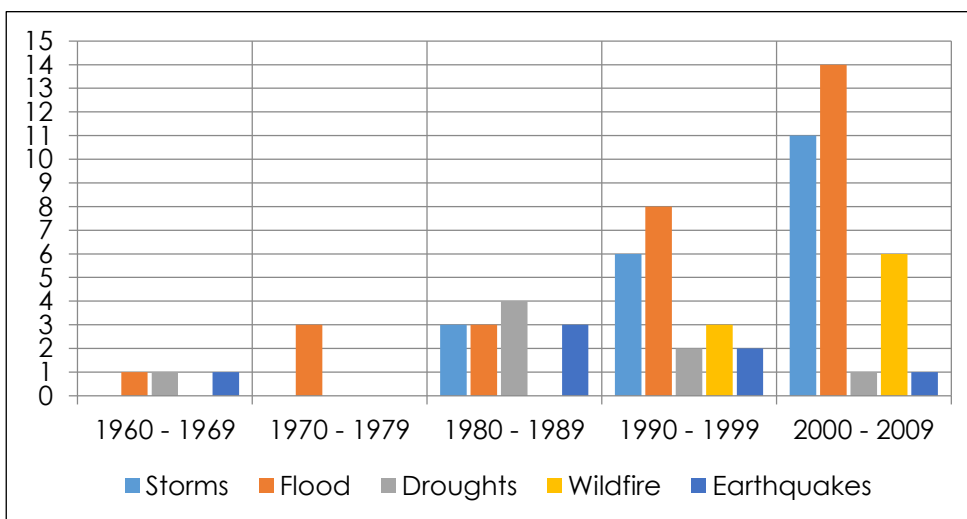
## 2. Background: Climate-Induced Risks in South African Agriculture

There is widespread consensus that climate change as a result of global warming is both a reality and that it is causing extreme weather events to become more frequent and more severe (Stern, 2007). Agricultural activities are particularly vulnerable to climate change due to the reliance on climatic variables such as temperature and rainfall.

The Centre for Research on Epidemiology of Disasters (CRED) keeps a database of all global disaster occurrences. For an event to be classified as a disaster requires at least one of the following to be true:

- The reporting of at least 10 people killed;
- At least 100 people affected;
- A state of emergency declares; or
- International assistance called (CRED, 2015)

Figure 1 shows the occurrences of natural disasters in South Africa every decade since 1960. There is a definite increase in the total occurrences of natural disasters, from a total of 3 in both the 1960's and 1970's, to 13 in the 1980's, 23 in the 1990's and 41 in the 2000's. The increase has been particularly dramatic in the occurrence of storms, floods and wildfires.



**Figure 1: Occurrences of Natural Disasters in South Africa by Decade, 1960-2009**

*Data Source: (CRED, 2015)*



The Smart Agri Project of the African Climate and Development Initiative (ACDI) at the University of Cape Town (UCT), highlights some of the biggest climate-related risks facing key agricultural subsectors in the Western Cape:

- **Field Crops:** Changes to the species, distribution and intensity of pests, diseases and weeds.
- **Irrigated horticulture:** Production and quality issues resulting from shifts in rainfall, temperature and humidity. Issues include pressures from pests, diseases and weeds.
- **Dryland horticulture:** Shifts in suitable production areas due to changing temperatures and rainfall patterns.
- **Undercover protected crop cultivation:** Increased costs of cooling, increased prevalence of pests and diseases, as well as increased prevalence of storms and associated damage to infrastructure.
- **Extensive livestock:** Rangeland vegetation changes, changes in pests and diseases, water shortages and heat stress to livestock.
- **Intensive livestock:** Heat stress to livestock, increased costs and scarcity of feed, more diseases.

In addition to these sub-sector-specific risks, there are some more general risks which are expected to impact on the whole agricultural sector. These include floods, droughts, hail, frost, fires and damage to agricultural infrastructure, as well as rising input prices and volatile market prices (ACDI, 2016a).

The Western Cape Government's "Climate Response Framework and Implementation Plan" highlights some potential impacts of the more general risks:

- **Droughts:** Increased competition for water resources from agricultural use and urban use increases the likelihood of reallocation of water away from farming. Highly intensive, labour absorbing, irrigation agriculture, generally with high export intensities, is affected in this case. The likely outcome is a loss of jobs in agricultural value chains, reduced local food security, increasing food prices, the consolidation of production to a fewer producers, a decline in export earnings, and a greater dependency on food produce imported from other regions of South Africa and from other countries. Furthermore, fodder becomes expensive and livestock numbers are reduced through coping strategies by farmers.
- **Hail:** The impact of hail is dependent on both the intensity and incidence in a specific region. Hail mainly leads to unpredictable loss of production and produce quality is greatly diminished for high value crops. Job losses, export revenue declines and damage to trees and orchards reduce yields and quality in subsequent seasons.
- **Floods:** Frequent and intense rainfall leads to flooding which can cause considerable losses to infrastructure, crops and soils. Degradation of land, siltation of dams and production interruptions all cause lower output.
- **Wild Fires:** increased air temperature and drier conditions leads to increased occurrences of runaway, large fires. People, animals, crops and infrastructure are at risk. Wildfire can lead to animal deaths, destruction of crops, soil crusting and loss of topsoil (ACDI, 2016b).



In addition to these direct risks, the increased prevalence of pests and diseases brings with it not just the cost burden of pest and disease control, but also the increased risk of market closures of key export markets.

### **3. Literature Review**

Various studies have been undertaken in recent years to analyse the economic impact of natural and biological disasters. These studies vary in their focus in terms of disaster type and geographical area (provincial or national), but all generally highlight the severity of the economic impacts.

It was recently ascertained that water reallocations as a result of the 2015/2016 drought could result in 30% loss of agricultural water in the Western Cape which could lead to losses in farm income to the total of R309 million and job losses of around 1 700 workers (Pienaar, 2017). The impact of the drought was also felt in the other South African provinces, with a recent impact assessment determining that at the national level the drought has resulted in a 6-7% decline in net farm income (BFAP, 2016a). Other significant economic impacts have been identified as a result of droughts (Ntombele et al., 2016), floods (Pharoah et al., 2016) and hail (WCDoA, 2014) in regions of South Africa.

The disaster impacts result in a substantial cost burden on provincial governments. Drought relief to farmers in the West Coast and Central Karoo districts in 2016 totalled R87 million (WCDoA, 2016). Damages caused by floods in 2012 in the Western Cape were in excess of R400 million (NDMC, 2013). Damages and losses caused by veld fires in 2015 in the Eden district were approximately R40.5 million (Roux, 2015).

The costs of market closures as a result of pests and diseases has also been well reported on. Studies have identified serious economic impacts as a result of the recent import ban on South African fresh produce into Thailand (Troskie et al, 2011), the EU's ban on South African citrus as a result of citrus black spot (Reynolds et. al, 2013) and the export ban on ostrich meat due to avian flu (Urban-Econ, 2012).

### **4. Potential Disaster Scenarios**

As has already been shown, the potential impacts of the climatic disasters are complex and far-reaching. For the purpose of this analysis, two key outcomes are analysed, selected due to the high likelihood and significant impacts of each outcome.

The first outcome is a decline in productivity, resulting in decreased agricultural yields and the use of more intermediate inputs per unit agricultural output. This itself will decrease the profitability of agricultural production and lead to a contraction of the sector. A decline of as little as 10% to agricultural productivity could lead to a serious contraction in the Western Cape's agricultural sector.

The second outcome is the potential market closure as a result of not effectively dealing with a pest and disease. This could be of serious consequences, particularly for export-oriented subsectors such as fruit. South Africa's fruit production is both very geographically



centralised in the Western Cape, and also highly export-oriented (BFAP, 2016b). It is also highly reliant on some of the key markets, with the European Union, United State of America, and China (including Hong Kong) accounting for more than 65% of South Africa's exports in 2016 (ITC, 2017).

These two outcomes have become increasingly likely and it is important that policy makers are well-informed enough to be able to take effective actions to mitigate the negative impacts.

## 5. Micro-Level Impacts

Considering the complexity and dynamic nature of the abovementioned scenarios and the resultant impact on the agricultural sector, a few crude assumptions and calculations are required. Using a mixture of farm-level information and production economic indicators the study attempts to aggregate the value of agricultural output and its associated costs per unit of production. The baseline is then used and compared to the total value of production in the event of a natural disaster.

For the sake of the analysis, the natural disaster incurred (e.g. drought or hail) is assumed to result in yields falling by 10% for all the major crops in the Western Cape. The economic impact in this case is provided in Table 1. Keeping market prices constant, the direct impact of yield losses due to the natural disaster would cost the economy R3.2 billion, whilst the impact on employment would be a net loss of approximately 17 000 jobs (9 831 permanent and 7 148 seasonal).

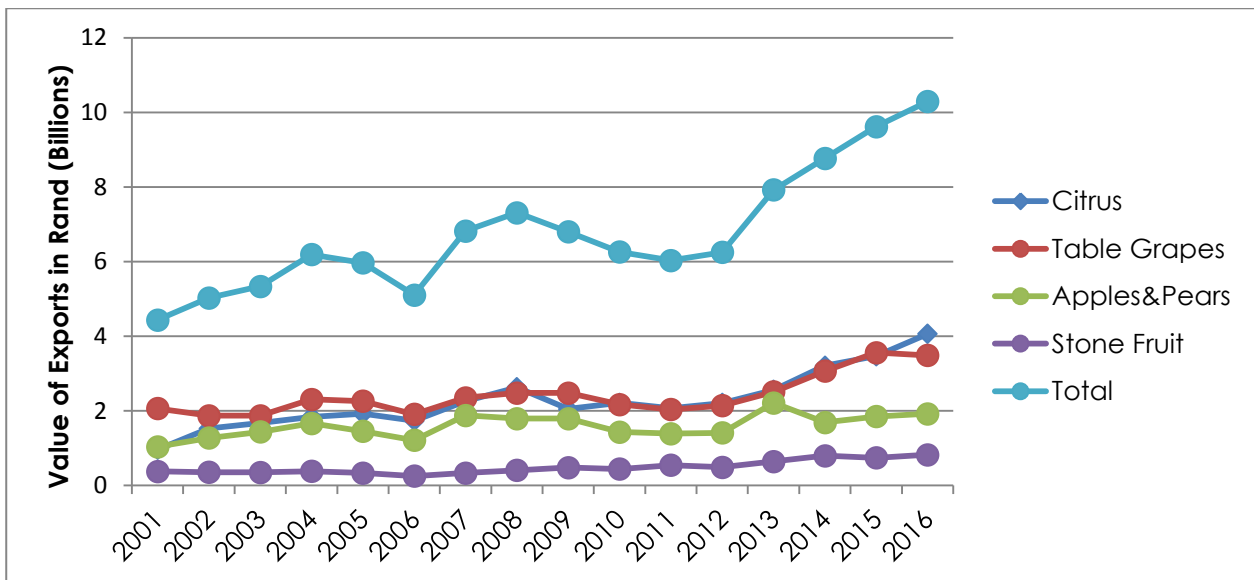
**Table 1: Economic Impact Assessment**

Indicator	Base Value	Net Change
Value of Agriculture Production (Crops)	R 32.3 billion	R 3.22 billion
Employment	169 607	17 016
Permanent		9831
Seasonal		7148

The second scenario involved the situation where the exports of key exported fruits from the Western Cape (citrus, table grapes, pome fruits and stone fruits) are banned from entering key markets such as China (including Hong Kong), USA and the European Union (including the UK).

Figure 2 below indicates the real value of exports of these fruit categories. The combined value of fruit export to these countries was R10.3 billion in 2016 (Quantec, 2017). Furthermore, South Africa has also expanded the country's market share from 27% in 2001 to 39% in 2016. Thus, not only will the agricultural economy lose R10 billion in export revenue, but considerable investment to expand these markets will be lost that may take several years to open again.





**Figure 2: The Value of Western Cape Fruit Exports to China, USA and the EU**

*Data Source: Quantec, 2017*

It is clear that both natural and biological disasters pose a serious risk to the Western Cape's agricultural sector with the threat of serious loss in output, value added and employment. In the next section it will be determined the degree to which these impacts will translate to losses at the economy-wide level.

## 6. Economy-Wide Modelling

For the purpose of this study, the economy-wide impact assessment involves not assessing the direct impacts of climate-related natural disasters, but rather to look at what the potential impacts will mean for South Africa at the economy-level. The previous section calculated the direct impacts for the Western Cape of the two disaster scenarios, this section takes it a step further to assess what these impacts on the provincial agricultural sector will mean more broadly for the South African economy.

The assessment uses a static CGE model to ascertain the percentage changes in key economic variables. These changes are then applied to projections in macro-economic variables by the International Monetary Fund (IMF, 2017) and agricultural data from South Africa's Department of Agriculture, Forestry and Fisheries (DAFF, 2017).

The CGE model is chosen for its ability to assess not only the direct impacts of a shock but also the indirect impacts that are incurred as sectors demand intermediate inputs for production in the economy's various sectors. The model used distinguishes between 49 different sectors producing 85 different commodity groups.

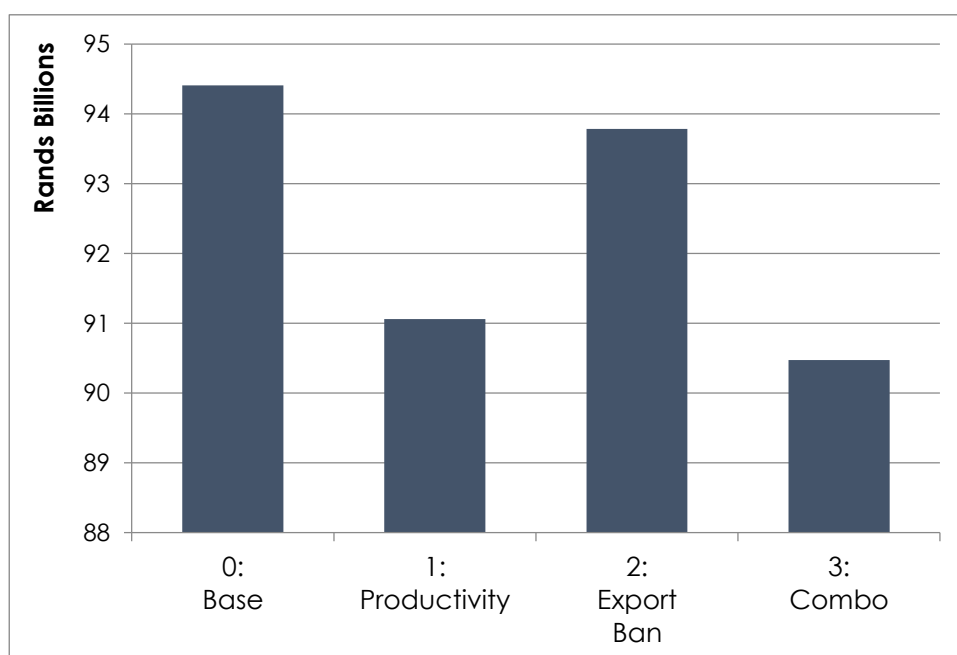
Three scenarios are developed to look at the potential impacts:

1. A climatic induced disaster (drought) leads to a 10% decline in agricultural productivity in South Africa.



2. Due to the increased prevalence of pests, a ban is placed on South African fruit exports to the European Union (EU), United States of America (USA) and China (including Hong Kong).
3. Combined occurrence of scenarios (1) and (2).

The change in agricultural Gross Domestic Product (GDP) for each scenario is shown in Figure 3 below. In the first scenario the decline in productivity means that agricultural producers are able to produce less with the resources and inputs available, so value added in the sector declines in relation to sectoral output. As agricultural output also declines in this scenario (by 8%), there is a substantial R3.3 billion drop in agricultural GDP. In the export ban scenario, whilst output in the sector declines the productivity of the sector remains intact. The loss in exports as a result of the fruit ban still leads to a R0.6 billion drop in Agricultural GDP. In the third combination scenario, the total drop is R3.9 billion.



**Figure 3: Agricultural GDP under Natural Disaster Scenarios**

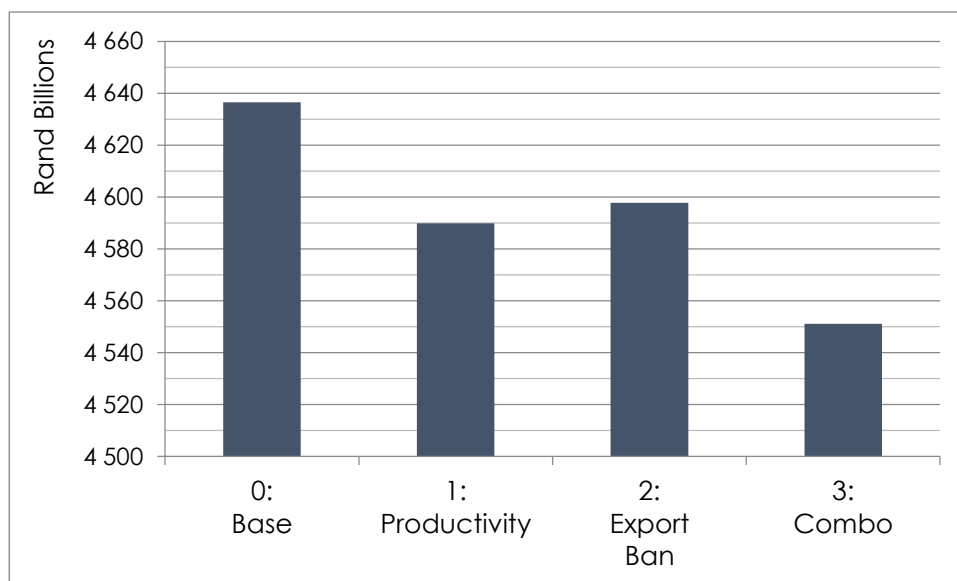
The impact will be different for different sub sectors. This is particularly so for the export ban scenario where, as can be seen in Table 2 below, the decline in the value of fruit and vegetable output declined by R28 billion, with meat declining by just over R1 billion. However in the productivity scenario the value of meat production declines by more than fruit and vegetables (R2.2 billion compared with R2.0 billion)

**Table 2: Change in Output of Key Agricultural Commodities**

	Base Value (R Million)	Net Change (R Million)		
		1: Productivity	2: Export Ban	3: Combo
Cereals	34 739	-1 158	-629	-1 760
Fruit & Veg	66 215	-2 029	-28 405	-29 516
Meat	81 062	-2 163	-1 176	-3 289
Dairy	14 101	-437	-227	-654



Agriculture forms an important part of the South African economy. The sector is a significant producer of final goods for domestic and international consumers, as well as to producers in several other sectors who use agricultural products as production inputs. The significance of agriculture to the economy can be seen when looking at the impact of the agricultural shock at the economy-level. Figure 4 shows overall Gross Domestic Product under each of the 3 scenarios. The importance of a thriving agricultural sector is evident when it is observed that just a 10% drop in productivity leads to an overall cost to the economy of R47 billion. The export ban also puts a substantial cost on the economy, with the net loss in GDP totalling R39 billion. A combination of the two would mean an economic loss of R85 billion.



**Figure 4: Overall GDP under Natural Disaster Scenarios**

Table 3 shows the employment numbers under each scenario, with employment broken down by skill level using the level of education: primary, middle, secondary and tertiary. In all the scenarios, the proportional drop is highest for lower skilled jobs. There was a total job loss of 255 thousand job losses as a result of a 10% decline in agricultural productivity, 205 thousand as a result of the export ban and 458 thousands in a scenario simultaneously combining both of the two scenarios.

**Table 3: Employment Numbers under National Disaster Scenarios**

Skill Level:	Base	1: Productivity	2: Export Ban	3: Combo
Primary	2 698 992	2 633 736 (-2.4%)	2 654 911 (-1.6%)	2 590 231 (-4.0%)
Middle	3 821 763	3 746 448 (-2.0%)	3 760 357 (-1.6%)	3 685 500 (-3.6%)
Secondary	5 527 995	5 431 666 (-1.7%)	5 446 067 (-1.5%)	5 350 136 (-3.2%)
Tertiary	4 020 251	4 002 161 (-0.4%)	4 003 226 (-0.4%)	3 984 951 (-0.9%)
Total	16 069 000	15 814 012 (-1.6%)	15 864 561 (-1.3%)	15 610 818 (-2.9%)

The disaster impacts will indeed be most acutely felt by the agricultural sector due to the reliance on climatic factors for production. However, due to the integrated nature of agriculture into the mainstream economy, there are ripple-through effects which will be felt throughout the economy. Because of this, natural disaster shocks imposed on the





Western Cape agricultural sector are shown to have serious implications even at the national economy level.

## 7. Conclusion

To conclude, natural and biological disasters pose a serious threat to the Western Cape agricultural sector. The potential losses that could be incurred are so substantial that the impacts on the Western Cape agricultural sector filter down to significant negative impacts even at the level of the South African net economy. For this reason it is critical that all role players are aware of the risks so that producers can undertake the necessary risk reduction strategies and that governments at the national and provincial level are equipped and capable of avoiding the negative impacts where possible and at the very least to mitigate these impacts.

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