



South Africa's Agriculture and Food System: A Scenarios Analysis

REPORT ON THE GCRF-AFRICAP PARTICIPATORY SCENARIOS WORKSHOP

Venue: Pretoria

Date: Monday 12th November 2018

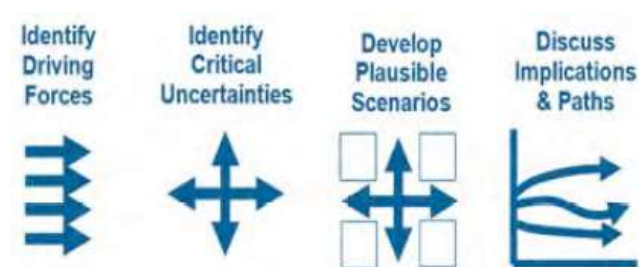
Executive Summary

South Africa is a middle-income emerging market country endowed with abundant natural resources.¹ Its agricultural sector is highly productive but also highly dualistic: a small number of large commercial operations run by predominantly white farmers exist alongside a large number of subsistence farms run by predominantly black farmers. The sector is characterized by a far greater degree of mechanization and technological application than other countries in Africa; it constitutes less than 5% of South Africa's GDP and employs around 6% of the total labour force. The country's food system - the production, transport, manufacturing, retailing, consumption and waste of food, and their impacts on nutrition, health and well-being and the environment - is at an important stage of transition and current national policy strategies aim to achieve agriculture-driven sustainable and inclusive economic growth and feed a growing population while reducing existing disparities in land ownership and distribution.

A number of evolving trends will shape the future of the food system in South Africa, including but not limited to: social and economic development; demographic shifts and urbanization; environmental governance and growing emphasis on sustainable food systems; the adoption and dissemination of agricultural technologies; and shifting dietary patterns. Policymakers in South Africa should account for the uncertainty surrounding the future trajectory of these trends and their likely impact on agricultural production and food security in policy-development and decision-making approaches.

To support this, a scenario exercise for South Africa's food system was conducted with a selected group of stakeholders from government, academia, civil society and the agriculture sector (see Appendix B for participants list). Through discussion, against a list of trends which were regarded as predictable, two impactful trends (or critical uncertainties) were selected that had *high uncertainty* in the way they would develop and shape the food system: the extent to which land reform would occur, and whether climate risks, affecting agriculture and trade, would evolve that were similar to today's ("low risks") or throw up unprecedented and unexpected challenges ("high risks"). These critical uncertainties create a 2x2 matrix that frames four potential futures – one in each quadrant. Each one of these futures was then explored, allowing participants to consider the inherent uncertainty the future holds, and understand how choices, decisions and extraneous factors might contribute to very different outcomes.

The Steps in a Scenarios Exercise



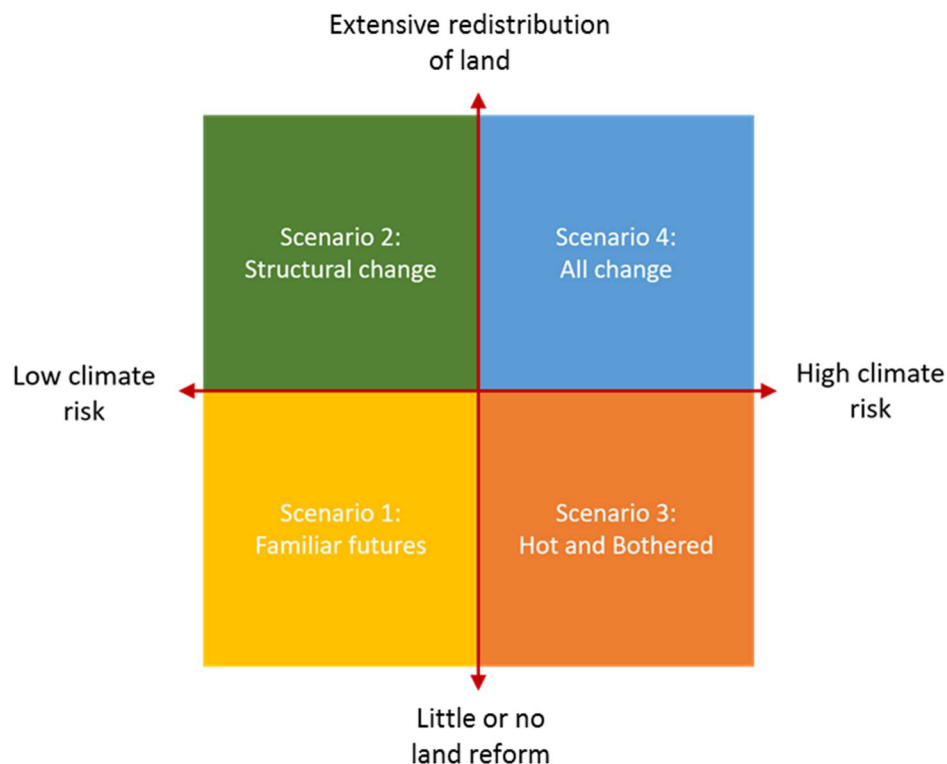
These four steps define the participatory process. First, driving forces were identified that will shape the future of the food system, in a South African context, and these were classified into those that are predictable (the "known knows") and those that are known to be important, but are less predictable (the "known unknowns"). Of the "known unknowns", two were selected as the critical uncertainties,

¹ South Africa is among the 17 world megadiverse countries: <https://www.worldatlas.com/articles/ecologically-megadiverse-countries-of-the-world.html>

used to shape the four plausible futures. The known knowns and known unknowns discussed are listed in Appendix A.

The scenarios.

Climate change risk and land reform (from minor adjustments compared to today, to extensive "land restitution" to empower farm workers and reduce inequality) were selected by the participants as the two most critical uncertainties that would define scenarios for the future of the agriculture sector and food systems in South Africa. A consideration of the plausible extremes of these two uncertainties gave rise to four scenarios:



Introduction: An overview of South Africa's Food System

South Africa's agriculture sector is highly productive. The sector produces a surplus of food despite the limitations set by the environment (climate, water, soils) which render only 12% of the country's land suitable for food production and 3% truly fertile. This efficiency in agricultural production can be attributed largely to highly industrialized, intensive and export-oriented farming – primarily owned by large-scale commercial (mainly white) farmers.

In recent times, however, a range of problems have exposed the vulnerabilities in the South African agriculture sector. Crop losses persist owing to unpredictable rainfall and associated droughts and are likely to continue over the next two to three decades.² Food costs are rising in response to increased costs of energy, labour and major imported inputs.³ Unemployment remains an issue, in part the result of highly mechanized farming and the use of advanced agro-processing technologies, as well as the marginalization of small-scale farmers owing to a lack of market integration, particularly among economically disadvantaged groups. And new challenges are arising in the form of increased food demand from a growing population with changing consumption patterns.

In response to these challenges, and to broader concerns around a changing climate and the potential for greater food insecurity in future, the South African government places a strong emphasis on improving the sustainability, resilience, and market connectivity of the agriculture sector. Specifically, South African environment and development policies⁴ focus on developing irrigation infrastructure to bring dry lands into production, reducing climate susceptibilities by selecting more suitable crops and varieties, increasing employment opportunities by capacity-building farmers—particularly small-holders, integrating small-scale farmers in the agriculture and food markets, and improving land equity by correcting for the Apartheid and colonial-era policies. The manner in which national-level strategies are realized at the local level will underpin the future food security, climate resilience, and economic growth of South Africa's food system. These include the National Development Plan (NDP) Vision 2030, the New Growth Path (NGP), the National Adaptation Strategy, the Agricultural Policy Action Plan (APAP), together with flagship sectoral projects like South Africa's proposed 'Agri-parks'.

However, given the speed with which the world is changing – whether from an environmental, social, technological or geo-political perspective – ensuring the country's food system is **sustainable, productive, climate smart** and able to meet the country's **food security** and **development** needs remains a significant challenge.

Numerous drivers will shape the evolution of South Africa's food system. Some we can predict with some certainty into the future (for example, population growth). Many others, however, will be hard to predict and influence (for example, geo-political stability, and the multilateral architecture of international cooperation) creating considerable uncertainty. Below we briefly consider some of the most important.

² Draft South Africa National Adaptation strategy, 2016, P19

³ National Policy on Food and Nutrition Security 2013, P 11.

⁴ See e.g. the 1997 White Paper on a National Water Policy for South Africa; the 2011 National Climate Change Response Policy (NCCRP), the Agricultural Policy Action Plan (APAP) 2015-2019; the National Development Plan Vision 2030 of South Africa; the New Growth Path (NGP).

Examples of drivers and the trends they create

The drivers shaping the food system in South Africa over the coming decades span social, technological, economic, environmental and political domains. In this section we highlight some, in order to provide context for the consideration of plausible food system futures that follows.

a) The role of the agricultural sector in future economic development

Economic growth has been limited over recent years in South Africa, especially on a *per capita* basis. While the South African economy is characterized by a well-developed financial sector, indicated by the presence of Africa's largest stock exchange in Johannesburg,⁵ the instability of its electricity supply has impacted on the confidence of potential investors. The country has reliable communications, energy and transport infrastructure which ensure good connectivity between major urban centres on the one hand and between urban and rural centres on the other. But economic inequality in South Africa is among the highest in the world. The poorest 20% of the South African population consume less than 3% of total expenditure, while the wealthiest 20% consume 65%. Reducing inequality and eliminating poverty are the two key priorities of the 2030 National Development Plan. Looking ahead over the next 30 years and beyond, the annual average growth rate of South Africa is expected to remain below 2%, but there are expectations that significant progress will be made in reducing inequality and absolute poverty.

The New Growth Plan has identified the agriculture sector as a priority sector for employment and job creation, especially in rural areas. Today, South Africa's agriculture sector contributes less than 5% to the country's GDP and only employs about 6% of the total labour force; the proportion of the national workforce engaged in agriculture as its primary source of income is expected to remain low; most new economic opportunities are expected to remain highly concentrated in urban areas. If these projections materialize in the 2050s, there will be a considerable amount of scrutiny of the extent to which the New Growth Plan would have achieved its rural development policy, especially in relation to "improvements in livelihoods for rural dwellers by upgrading farmworkers' conditions and helping rural households increase production".⁶ A key consideration for the growth of the agricultural sector is the extent to which it contributes to international trade: in 2017, export of agricultural commodities raised \$8.5bn (of which \$4.7bn was for horticulture) and imported \$5.5bn (of which \$2bn comes from cereals and oilseeds).⁷

In considering the role that the agriculture sector may play in the country's future economic development, a number of questions arise. Where will non-farm and urban economic growth occur and what will be the implications for job creation and inequality? Will sufficient manufacturing jobs be created in the context of increased artificial intelligence? What will agricultural investment look like in South Africa, and what are the implications for rural poverty reduction, farm size, use and total factor productivity? And how will production contribute to trade. Furthermore, how will food and nutrition security for citizens be ensured – and what will be the balance between domestic production and imported food?

Demographic trends also raise questions around the role of the rural economy in future economic growth. By 2050, the South African population is expected to reach 73 million; double its size in 2000. Eighty percent of the population is expected to be living in urban areas; current projections lean towards negative growth of the country's rural population as rural areas become increasingly less

⁵ <https://www.jse.co.za/>

⁶ South Africa New Growth Plan, P 18.

⁷ Data from resourcetrade.earth, Chatham House's trade database.

attractive economically and socially. To mitigate the potential population reduction in rural areas, on the one hand, and the increase in urban populations on the other, should South Africa be promoting rural investment in both on-farm and off-farm opportunities?

b) Food and nutrition security and dietary trends

Publicly available estimates indicate that approximately 6% of South Africans – 3.4 million people – are undernourished, and 27% of children aged under five are stunted. The South African Health and Nutrition Examination Survey of 2013 revealed that about 45.6% of the population was food secure while 28.6% was at risk of hunger and 26% of South Africans experienced hunger. According to that survey, just under a third (32.4%) of those experiencing food insecurity lived in urban areas while 37% lived in rural localities.⁸ Rates of micronutrient deficiency are relatively high: 13.3% of women of reproductive age are deficient in vitamin A,⁹ and 12.2% of adult males are iron-deficient.¹⁰

Reflecting the growing double burden of malnutrition in developing and middle-income countries like South Africa, overweight and obesity in children and adults is already visible in South Africa with 13% of children moderately or severely overweight and 27% of adults reported obese in 2016 (with greater prevalence of severe obesity among women). While the share of the population that is undernourished is anticipated to decline to 3% in 2030 and 2% in 2060, obesity in adults is expected to climb to 33% by 2030 and 36% by 2060. The shift among growing urban populations to more highly processed and unhealthy diets is anticipated to yield higher rates of obesity and other diet-related non-communicable disease.

South Africa is currently experiencing marked increases in undernourishment at the same time as a marked decrease in the cereal harvest area, which has pushed the country to be a net importer of cereals with 4% import dependency. Will increases in production in South Africa keep pace with rising demand? Will the shifts in South African diets worsen the 'double burden' of malnutrition? Will enhanced actions on micronutrient supplementation, food fortification and dietary diversity be required to improve nutrition security? Are nutrition interventions alone enough to promote greater food security or will investment in a diversified agricultural production system also be needed?

c) Environmental governance and sustainability in the agriculture sector

In South Africa, the agricultural sector is highly bimodal, characterized by both a well-developed commercial farming and a significant amount of subsistence-based agricultural production. In this dualistic system, agricultural activities range from intensive crop production and mixed farming in areas with winter-rainfall and high-summer-rainfall, to cattle farming in the bushveld and sheep farming in the arid regions. With regards to crop production, maize is most widely grown, followed by wheat, sugar cane and sunflowers. Citrus and deciduous fruits are also widely grown at commercial scale and largely destined for export, as are South African wines resulting from commercial grape production.

About 12% of South Africa's landmass is suitable for arable production and only about 3% is truly fertile. Irrigation of arable land, earmarked as a priority area for investment under the 2015–2019 Agricultural Policy Action Plan (APAP), remains very limited: only 1.5% of arable land is supplied by irrigation systems and this 1.5% produces approximately 30% of South Africa's crops. Recent droughts have led the country to import maize for the first time in a decade. Land and soil degradation and outbreaks of pest and disease also significantly affect South Africa's agricultural productivity.

⁸ Ibid

⁹ WHO (2011) Global status report on non-communicable diseases. Geneva: WHO

¹⁰ Shisana et al, 2013. South Africa National Health and Nutrition Examination Survey.

Water scarcity and limited productive land make food production an expensive economic pursuit in South Africa where profit margins from agriculture are lower compared to many other countries with well-developed commercial agricultural sectors. Imported food is often more affordable than that produced locally. This has forced many small-scale and emerging farmers to either stop farming and change to other forms of non-agricultural land use or consolidate their small farms into larger farming units. As a result, the number of farms in South Africa has declined by more than two-thirds compared to the early 1990s and the area farmed for staple food products (maize, wheat and dairy, for example) along with it. Yet, owing to the use of intensive and industrialized production systems, production has seen little if any decline.

An unresolved question concerning the development of the South African agricultural sector, and its environmental sustainability, relates to whether possible changes in demand, coupled with climate change, might—through unsustainable intensification—lead to further land degradation, the expansion of extensive livestock farming and increasing reliance on food imports in South Africa.

Looking ahead to the next 30 years and beyond, the negative effects of climate change including (but not limited to) the challenges of water availability and droughts are likely to intensify alongside the projected population growth, thus putting more pressure on available land resources. The 2014–2019 APAP lays emphasis on conservation agriculture, agro-ecology and organic agriculture as the three principal climate-smart agriculture (CSA) options that should be prioritized in South Africa. Will these principles be implemented in practice? Will agricultural production shift to marginal lands? If so, will this lead to a reduction in productivity? Could the development, adoption and utilization of stress-tolerant high-yielding varieties (in both crops and livestock) help improve agricultural yields and reduce forest encroachment? Will production be further intensified? What will be the sustainability implications of intensification? Is it possible to mitigate the risk that intensive farming practices, which typically depend heavily on irrigation systems, mechanized farming, fertilizers and genetically modified seeds will bring not only higher input costs leading to increases in food prices, but also negative effects on the environment, people's well-being and the adaptability of farmers? Will long-term intensive farming in South Africa degrade the country's farmlands and lead to declining productivity, increasing water run-off and erosion? Will, rural on-farm and off-farm infrastructure remain underdeveloped in many regions? Can the establishment of 'Agri-parks' address this specific weakness—provided they are well-resourced—to enable agricultural or food system-led economic explosion at district and municipality levels?¹¹

d) Climate change

In the National Development Plan's vision of South Africa in 2030, climate change is recognized as a major factor that is already affecting—and will continue to affect—various areas of development and the broader growth ambitions of South Africa (the South African National Biodiversity Institute - [SANBI] and the Department of Environmental Affairs provide an overview of the most critical climate trends affecting South Africa over the past six decades¹²). In particular, increased warming and droughts and highly variable rainfall patterns affect the agriculture sector, the energy sector with the spillover socio-economic consequences and impacts on industries and the livelihood of South African populations. The Vision 2030 on climate change as set out by the National Development Plan is:

¹¹ According to the Department of Rural Development and Land Reform, An agri-park is a networked innovation system of agro-production, processing, logistics, marketing, training and extension services, located in a District Municipality. As a network it enables a market-driven combination and integration of various agricultural activities and rural transformation services. See: <http://www.ruraldevelopment.gov.za/agri-parks/362-agri-parks/1170-agri-parks-read-more#.XBKLreS7K70>

¹² Climate Trends and Scenarios: Climate and Impacts Factsheet Series, Factsheet 2 of 7, Department of Environmental Affairs of South Africa; GIZ and South African National Biodiversity Institute (SANBI), 2018, available at: <https://www.sanbi.org/wp-content/uploads/2018/03/Itas-factsheetclimate-trends-and-scenarios2013.pdf>

“By 2030, South Africa has reduced its dependency on carbon, natural resources and energy, while balancing this transition with its objectives of increasing employment and reducing inequality”.

From the perspective of the National Planning Committee (NPC), the way to achieve this vision is by developing long-term strategies for both adapting to the effects of climate change, through adaptation policies, and reducing agricultural greenhouse gas emissions to a sustainable level, through mitigation policies. These adaptation and mitigation ambitions are now mainstreamed in policies such as the 2016 Draft NAPA, the 2014–2019 APAP and the Intended Nationally Determined Contribution (INDC) 2015. These policies place the adoption and promotion of CSA at the centre of climate change adaptation and mitigation objectives under the NDP and emphasize the need to build resilience to climate shocks in the agriculture sector.

Looking ahead over the next thirty years and more, climatic impacts on production of key crops such as maize and high-value export horticulture, as well as on animal husbandry, are expected to be largely negative. However, the extent to which weather extremes will develop beyond current projections is uncertain (and improving the skill of estimating the risks from future extreme weather is a significant research need). Threats to production from climate change include higher prevalence of agricultural pest and diseases, droughts and reduced water availability prompting increased demand in irrigation infrastructures. Declines in average rainfall are expected during the summer months in maize-producing areas while rainfall during winter months is expected to increase in wheat-producing areas, mostly in the Free State. Climate projections for South Africa over the next 30 years (up to 2050) and beyond also indicate significant warming,¹³ as high as 5–8°C, over the South African interior (though somewhat reduced over coastal zones) and a general pattern of drier conditions to the west and south of the country and wetter conditions over the east of the country. There exist large regional differences in climate and rainfall variability patterns across South Africa, however, understanding of climate vulnerability in different horticultural and wine-producing areas is low.

Significant uncertainty remains around how seriously South Africa’s agricultural sector will be affected by more extreme climatic changes and increased frequency and intensity of extreme events. How severely will food supply be affected in terms of quality, quantity, prices and nutritional value? How will investments in adaptation and mitigation measures affect the resilience of the South African agriculture and food systems?

e) Agriculture and food system technologies

As indicated above, economic and wealth inequality is very high in South Africa, representing a priority development issue which has earned policy attention from various administrations since the end of apartheid in the 1990s. In the context of the agriculture sector, economic inequality manifests in the inability of poor small farmers to adopt new agricultural and food system technologies and afford capital-intensive inputs. This lack of access to new agricultural technologies among small-scale farmers has been acknowledged at the policy level. For example, the 2014–2019 Agricultural Policy Action Plan states that:

“commercial farmers have historically been relatively well advanced in terms of technology, although quite dependent on imported technology, whether through imported machinery and agrochemicals, or under license as is the case of genetically modified (GM) seed. On the other hand, smallholders and subsistence producers have been less endowed in terms of technology.

¹³ Ibid

The question is why South Africa's innovation system is unable to support a growing commercial sector and a needy smallholder sector".¹⁴

Coupled with the poor state of rural infrastructure, low adoption of new technology across the food system—including post-harvest and food processing technologies—is a driver of significant post-harvest losses in South Africa and a barrier to market access for many rural farmers. Furthermore, despite the potential of breakthrough technologies such as CRISPR gene-editing, immutable blockchain ledgers for supply-chain transparency, and artificial intelligence application to extension services, there is little current use of these within the South African agriculture sector and food system.

South Africa nevertheless aspires to achieve an investment of 2–3 % of agricultural GDP into research and development (R&D) annually.¹⁵ In addition, consistent with the 2014–2019 APAP which has placed CSA uptake at the centre of efforts to build climate resilience in the agriculture sector, there is increasing investment in CSA innovations including early-maturing and drought-tolerant crops. The ongoing deployment of Agri-parks is another means through which the South African government is seeking to foster rural development, job creation and food security policy pronouncements under the New Growth Path and the 2013 Food and Nutrition Security Policy.¹⁶

Factoring in the current and future role of technological innovations in the food system— especially in agricultural productivity and production—is important in the development and implementation of national food security and nutrition policies and plans. The extent to which South Africa will be able to adopt and benefit from emerging technologies, especially in the interest of smallholder farmers, will depend on a host of factors including the costs of such technologies and associated intellectual property rights. How will benefits of technological advancement be disseminated in the future? Will the costs of these technologies be prohibitively high for small-scale farmers? Will the associated intellectual property rights be designed in such a way as to facilitate smallholder access and ensure that well-off farmers are not the only ones able to reap the benefits of new technologies? Will the Agri-park networks realize their objectives of generating new jobs, reducing inequalities in the agricultural sector and improving the livelihoods of smallholder farmers? Are there any disruptive or breakthrough technologies on the horizon which will be a game changer in South Africa's agriculture sector and food system more broadly?

The scenarios approach

As the discussion above illustrates, there is considerable uncertainty surrounding the domestic factors that will determine how South Africa's food system will evolve between now and 2050. Such domestic factors are also increasingly shaped by significant uncertainty in the way the rest of the world will develop, from a technological, social and geo-political perspective. The rise of inward-looking nationalism, the undermining of the post World War 2 architecture of international cooperation (exemplified by the United Nations and World Trade Organization) and the emergence of tensions based on inequality, fundamentalism and climate risks, all influence a country's domestic agenda, including its ability to integrate with international markets.

Any 'best estimate' forecast of such a complex system over a long timeframe will certainly be wrong. Accordingly, plans to develop South Africa's agriculture and food systems should be sensitive to this

¹⁴ APAP 2014-2019, P106

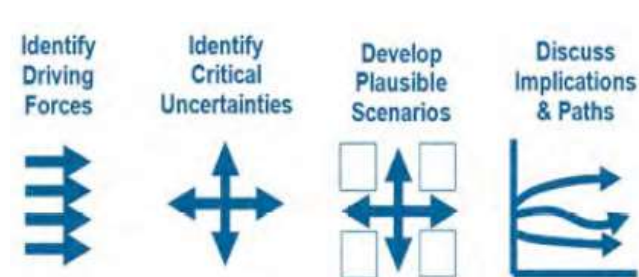
¹⁵ Ibid, P107

¹⁶ More details on AgriParks and its components at: <http://www.ruraldevelopment.gov.za/agri-parks/362-agri-parks/1170-agri-parks-read-more#XBT9GPZ2tuk>

uncertainty. They should allow decision-makers to explore how choices and events might shape different futures and identify strategies that are resilient to uncertainty, i.e. ‘no regret’ options that should pay off in a range of possible futures, rather than the one we hope for or expect.

A scenario exercise can help identify resilient policy by exploring the range of possibilities that the future may hold. What kinds of policies can be robust to different plausible futures? Which policies developed for today might lock the system into undesirable trajectories for the future? As a tool for strategic decision-making under uncertainty, a scenarios exercise identifies the two most impactful drivers with high uncertainty as to how they will develop and creates a 2x2 matrix that frames four potential futures—one in each quadrant (see figure 1 below). Each one of these futures is then explored, creating a rich, narrative-driven scenario into which other drivers, with more certainty as to how they will develop, can be integrated.

The Steps in a Scenarios Exercise



A participatory scenarios workshop engages key stakeholders in a carefully-facilitated four-stage process of: (1) identifying the driving forces of agri-food system change, the key trends in relation to those drivers, and the certainty with which we can project those trends into the future; (2) identifying critical uncertainties, those drivers that are both uncertain and collectively identified as most important in shaping the agri-food system; (3) developing a narrative of the four scenarios represented by the combinations of the extremes of the two critical uncertainties; and (4) discussing the implications of policies across these scenarios.

Identifying the most critical uncertainties

The South Africa Participatory Scenarios Workshop involved participants from a range of organizations including the National Agricultural Marketing Council (NAMC), the Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN), the Department of Agriculture Forestry and Fisheries (DAFF), the Dairy Standard Agency (DSA) as well as academic partners from the AFRICAP team (see Appendix B for details of participants).

Whilst all of the drivers and their trends—some of which are considered above (and others identified in Appendix B)—are clearly important in determining whether or not South Africa’s food system in 2050 will be sustainable, productive and climate smart, they vary in terms of their uncertainty. For example, while there may be some uncertainty about the extent of population growth and urbanization that will occur, there is little doubt that both will increase significantly. In a similar vein and as indicated, while most climate projections point to warmer and drier conditions and changing

patterns in rainfall, there is uncertainty about how these changes will concretely materialize in different regions and around the risks associated with such changes.

Workshop participants identified, discussed and ranked in terms of perceived importance, the following shortlist of uncertainties for South Africa:

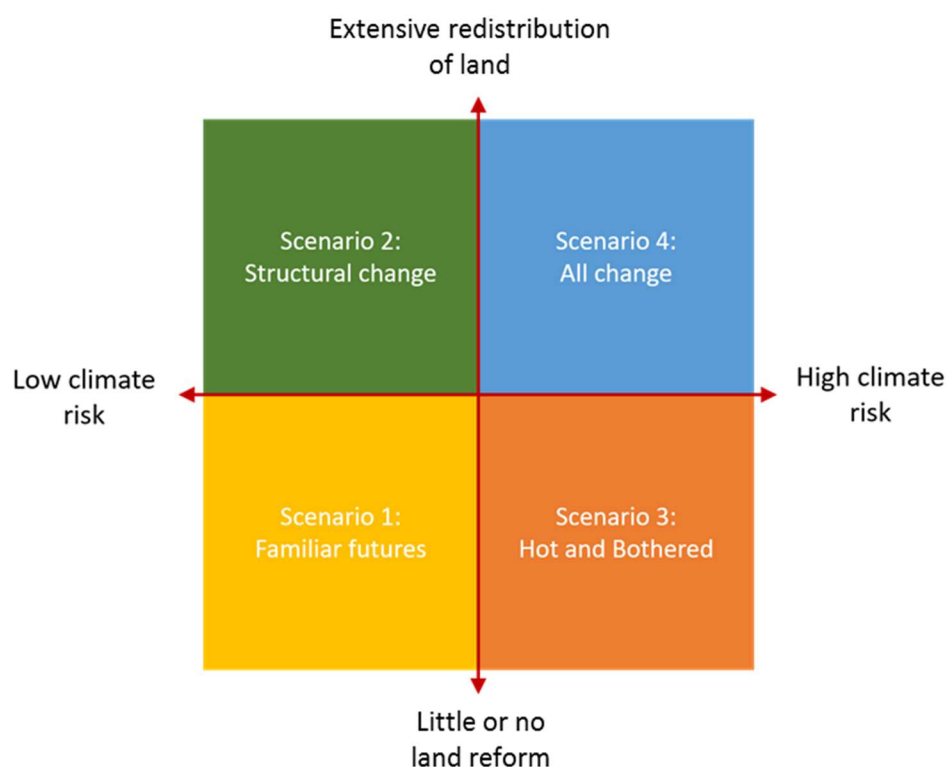
Uncertain Trends	Key Questions	Ranked Importance in Shaping South African Food System
Climate change/risks	<ul style="list-style-type: none"> • How will changes in rainfall and water availability affect food production and demand, pests and diseases, and land use? • What can be grown where, in view of rainfall patterns and water availability? • What options for adaptation are there in the agricultural sector? • How will climate change elsewhere affect the potential for trade (export markets and import trade flows underpinning food and nutrition security)? • How will government mitigate the impacts of climate change? • Will international efforts to address climate change be successful? 	1 st
Land Reform	<ul style="list-style-type: none"> • How will land reform be achieved? • How does the uncertainty around land reform affect and limit near-term financial investment? How will it affect investors, jobs and economies in agriculture, the resilience of the agricultural sector, and trade? • How will reduced farm size and scale affect competitiveness in the local and national economy? • Will land reform restrict or enhance exports? • Will governance be efficient and adequate to avoid land grabs? • How will politics influence land reform implementation? • How will land reform affect food security? 	2 nd
Agricultural trade and markets	<ul style="list-style-type: none"> • How will land reform affect global trade? • Will trade and markets be out of reach for smallholders? • How will subsistence farmers integrate with local markets? • How will climate change and geo-political drivers affect global prices and their volatility, as well as the requirement for, and availability of, imports? 	=3 rd

Technology/market innovation and adoption	<ul style="list-style-type: none"> • Will regional alliances be strengthened, allowing wider technology adoption? • Will food regulation and trade continue to be harmonized? • What degree of political voice will be afforded to stakeholders from across food value chains, both nationally and internationally? • How will new and emerging technologies shape agriculture and food? 	=3 rd
Political and economic stability/inequality	<ul style="list-style-type: none"> • How will political dynamics affect the food system? • How will changes in politics affect job markets? • How will changing politics affect stakeholders? • Will those with political influence drive land reforms and agricultural production? 	4 th

The Scenarios

The two most important and hard-to-predict drivers identified were (1) climate risks, and (2) land reform. These key uncertainties can be used to describe four plausible but very different futures, defined by a combination of extremes of the two:

Four scenarios for the future of South Africa's agriculture and food system



Scenario 1: Familiar Futures

This scenario depicts a future in which the agriculture sector and food system in South Africa is minimally affected by climate impacts—in other words, that the risks from climate change are not significantly different from those observed today—and in which limited to no land reform has occurred. Under this scenario, the warming of South Africa’s climate is far below levels anticipated under the most extreme climate projections and rainfall patterns are fairly predictable. Farmers—including smallholder farmers who are most vulnerable to uncertainties associated with rainfall—are able to plan adequately. Dry spells are short-lived and any crop failures due to extended periods of droughts or flooding are not severe. This is a scenario that results from effective and timely global action to achieve the Paris Agreement but in which there is little appetite from government to implement significant land reform. A business-as-usual agricultural policy platform has been maintained to deal with the relatively low risks from climate change.

Large-scale farming of commercially viable crops such as maize remains the predominant farming system. This is for one of two reasons: either the land reform process has not succeeded in enhancing legal land ownership with secure tenure rights for smallholder farmers; or a smooth process of land redistribution has not been accompanied by a comprehensive rural development plan delivering financial and technical support to historically disadvantaged smallholder farmers and farm dwellers. The low levels of land reform in this scenario illustrate, to some degree, the inability of the government to adequately achieve certain policy objectives, including its plans to “address the historical dispossession and transformation of the majority of the dispossessed into wage-workers, to ensure rural economic development, food security and improved livelihoods”.¹⁷ In the absence of significant land reform, inequality between commercial and small-scale subsistence farmers and farm workers remains constant or is at higher levels than before, leading to possible unrest and dissatisfaction with government. In this context, the government target to enroll 300,000 households in smallholder schemes by 2020 is not realized while the objective under the New Growth Plan to raise employment rates is not met.

Climate change adaptation and mitigation measures, locally and globally, are successfully implemented and there occur few climate shocks on a scale different from today’s variability. The adaptation and mitigation measures identified by the government under national policies such as the 2016 Climate Change Adaptation Strategy are implemented and delivering incremental, rather than transformational, results with regards to increasing the resilience of South Africa’s agriculture to climatic shocks. Adaptation measures include changes (albeit small) to the crops grown in different areas as well as the adoption of new varieties of current crops that maintain or increase yields. In addition, agricultural technologies under this scenario continue to improve, although these are not taken up substantially by smallholders as inequalities are either maintained or have risen. Food production has increased domestically, leading to higher food stocks and exports of staple and commodity crops. Even though there are outbreaks of pests and disease, these are not significantly more damaging than before. As the commercial agricultural sector prospers, certain parts of the economy thrive, such as those selling agricultural inputs (e.g. seeds and pesticides). There are opportunities for food producers to be drivers of economic growth, but these opportunities are only realized by those that can invest in value chains and access markets.

Although climate shocks do not have a dramatic impact on the agriculture sector, farming remains a low-income-generating activity due to lack of support from the government and development actors. Levels of rural-to-urban migration remain high in regions where non-agricultural employment

¹⁷ See Land Reform policy discussion document at:
https://www.sahistory.org.za/sites/default/files/landpolicyproposals_june2012v_1.pdf.

opportunities are not available for unskilled workers. A growing urban population leads to rising demand for food in urban areas and a shift in dietary trends towards more highly processed, high-calorie and meat-based food, leading to increased prevalence of diet-related non-communicable diseases in cities.¹⁸ Imports are important to ensure dietary diversity as the domestic commercial farming sector produces predominantly maize. Increased food demand has brought about rises in food prices and heightened the vulnerability of the urban poor and rural dwellers. All these ingredients converge to make a toxic situation in which social unrest in urban areas is possible.

Scenario 2: Structural Change

In this scenario, the government has implemented a programme of land reform, which delivers deep changes in land ownership and tenure, and the impact of climate change on South Africa's agriculture sector are largely similar in magnitude to those experienced today. As in the Familiar Futures scenario, predictions of high levels of warming, extended droughts and highly variable and uncertain rainfall patterns have not materialized because of significant global efforts. The land reform process has been profound and painful, with, in some cases, expropriation of land without compensation. The land reform process has not succeeded in addressing all of the issues identified in the Land Reform Policy discussion document.¹⁹ In particular, whilst land reform has delivered a radical and rapid break from the past, it has significantly disrupted agricultural and food security.

There has been relatively little change to crops and farming systems because of the government's emphasis on commodity cropping for linkage to global markets. However, the land reform process has exacerbated certain climate constraints already present in 2019 in certain regions (e.g. extreme events like drought, limited water availability, limited capacity to produce fruit and vegetables, limited crop diversity and production of nutritious crop varieties). One example is the management of water supply and availability of irrigation facilities for farming. To enable the process of land reform, it was made part of the Comprehensive Rural Development Plan;²⁰ as a result, radical land reform created greater numbers of smaller farms, which are less resource-efficient and more water-intensive. This breaking up of large scale, efficient enterprises, into a more equitable distribution of land, in many places, created greater conflict over natural resources more generally (whether for water, or a need for more land under production, even creating conflict for land among the extractive industries). In some places, the penalty for breaking up productive, large-scale farms, was overcome by forming progressive cooperatives of small farms, which collectively, work in a similar way to the former well-resourced commercial farms they replaced. This spatial difference in the impact of land reform depended on local governance arrangements; reformed farm enterprises; and the impact of local Agri-parks creating a critical mass of communities that are able to work closely together.

Greater household involvement in agriculture, through more equitable distribution of land, delivers improved household food security for the poor in South Africa. Furthermore, households organized in cooperatives have access to more trading partners and so are able to participate in markets to which they did not previously have access. International partners (both within Africa and globally) are increasingly investing in the sector and, with agriculture becoming a stronger income-generating activity, urbanization has slowed: rural communities thrive more than they have for decades.

¹⁸ Trends in the increase of obesity in urban areas, especially among females is well reported: in 2013, 40.1% prevalence in obesity was observed among females compared with 11.6% prevalence in obesity among males. See O Shisana et al (2013), South African National Health and Nutrition Examination Survey (SANHANES-1). Cape Town: HSRC Press.

¹⁹ See land reform policy discussion document at:

https://www.sahistory.org.za/sites/default/files/landpolicyproposals_june2012v_1.pdf.

²⁰ See land reform policy discussion document at:

https://www.sahistory.org.za/sites/default/files/landpolicyproposals_june2012v_1.pdf.

The land reform process was conducted strategically, in a participatory and inclusive manner. Whilst it did not lead to civil war, economic growth is reduced (as the productivity of agriculture declined, on average), but prosperity was shared more equally. Hence, there are more winners than 'losers' in this scenario. Where expropriation without compensation did occur, it avoided significant targeting of land under intensive production because of the potential impact on staple food security. Furthermore, land reform was accompanied by supporting mechanisms for incoming farmers, such as access to water and provision of extension services, financing and input subsidies. The redistributed land is owned by individual farmers, which encourages investment and uptake of agricultural innovations, particularly those innovations that are labelled climate smart. Amongst the 'losers' are commercial farmers losing much of their land; though most are compensated, albeit at below market value. Vertical integration in the sector has been established by linking small-scale farmers to large commercial farmers. Among the winners in this scenario were private-sector representatives, government, international investors, smallholder farmers and financial institutions.

Scenario 3: Hot and Bothered

In the future described as "hot and bothered", the impetus for land reform did not follow through into significant action. At the same time, the Paris Agreement's ambition failed to gain momentum, as one after another, countries withdrew due to narrow self-interest. As a result, the climate is increasingly affecting the food system. This arises both through weather affecting domestic production, and climate impacts elsewhere creating volatility in the markets. Furthermore, people displaced by climate are creating significant pressure on borders around the world, further reinforcing inward-looking nationalism and making free trade more costly and less reliable. In South Africa, these factors create an upsurge in food prices, with increased drought risks undermining household food security for the many rural poor. This increases hunger, malnourishment, unemployment, rural poverty and social unrest. The lack of significant land reform, coupled with increased climate risks, means that overall productivity stagnates: this in turn increases reliance on imports for nutritional security at a time when the market is becoming less reliable. The need for nutrition security means that—without diversifying the export-led sector (horticulture and wines) to supply the domestic market—the country is caught in a vicious circle: increasingly relying on trade to raise foreign exchange to buy imports necessary for food security, when production locally, and trade internationally, is becoming more uncertain.

In South Africa, unchecked climate change leads to unpredictable and low rainfall; frequent and extended droughts and considerable floods; as well as rising temperatures causing increasing water loss. In combination with pest and disease outbreaks, there are amplified crop losses and heightened livestock stress. This creates a shortage in domestic food production and lower supply for domestic consumption thereby reducing South African exports. Furthermore, the increased water requirements of crops under these higher temperatures has increased demand for irrigation water, even in non-drought years, and conflicts seriously with other sectors, such as water demand in urban areas. South Africa's failure to deliver the investments on new CSA technologies prescribed in APAP 2014–2019, and on the national policy to make the agriculture sector resilient to climate change, enshrined in the Draft 2016 National Adaptation Strategy, is now sorely felt. The 2016 National Adaptation Strategy emphasized the promotion of conservation agriculture and CSA with a focus on irrigation techniques and the use of environmental stress-tolerant crop varieties. The long timescales involved in South Africa developing and implementing the necessary R&D and infrastructure have caused the country's agricultural sector to lag behind in terms of climate resilience rather than adapting before the worst is felt.

The early 21st-century status quo in terms of economic inequality and disparity in land ownership has been maintained due to limited land reform, which in turn has exacerbated the impacts of runaway climate change on different categories of farmers. This is because adapting to high climate risks requires access to financial, infrastructural and technological resources since agricultural and food system-related activities have become increasingly technology dependent and expensive, especially for larger scale farms. While agricultural innovations and technological tools may be accessible to larger scale commercial farmers, the same cannot be said for smallholders for whom secure legal land ownership remains out of reach in the absence of significant land reform. Without such rights, small-scale farmers struggle to access financial and technical support in valorizing their land, leaving them technologically disadvantaged, and facing economic conditions that have already deteriorated due to high climate risks. Nonetheless, adaptation to a limited extent remains possible through traditional, labour-intensive and low-capital farming methods. Medium-scale farms—a growing sector in the first part of the 21st century—struggle to adapt as they are too large for low-technology approaches and too small to achieve the high income necessary to underpin technology adoption. Many farms go under.

Largescale commercial farmers who—compared to smallholders—have more capital and thereby better access to technology, are major drivers, contributors and beneficiaries of the South African agricultural and food markets in this scenario. In contrast, smallholder systems with little capital and adaptive capacity continue to struggle with the unpredictable climate and associated crop and livestock losses. This means that they contribute very little to national agricultural production. Smallholders and landless communities migrate to urban areas in search of a means of livelihood and depend on government for subsidies and funds. The high food prices caused both by domestic decreases in food crop or livestock production and exposure to world food prices exacerbate the disparity and inequality between rich and poor, with some unable to feed themselves even with government handouts. The consequence is growing racial tension and unrest among the increasingly urban and rural poor. Furthermore, farmers practise intensive farming in high-potential areas and expand agriculture to bring more areas under cultivation leading to land degradation and scarcity. The most obvious losers in this scenario are poor and vulnerable smallholder farmers, because significant land reform has been lacking. Relative winners include technology developers and agro businesses with the means to access, adopt and implement innovative climate-smart food-system technologies. However, everyone—to a greater or lesser extent—struggles in this scenario due mostly to government failure to operationalize the agricultural resilience prescriptions contained in its former draft adaptation strategy and the lack of delivery on land reform.

Scenario 4: All change

In this future, land reform has been deep and extensive, including for instance the allocation of small parcels of land to smallholder farmers who now enjoy stronger legal land ownership and tenure rights. This has led, in part, to the segmentation of larger areas of land previously owned by largescale commercial farmers, into many small farms managed by smallholder subsistence farmers. This itself leads to an overall loss in productivity (but increase in equality) in the South African agricultural sector.

This loss in productivity is, however, exacerbated by insufficient tackling of climate change at the global level as countries focus instead on national self-interest. Domestically, the impact of changing weather is coupled with a lack of preparedness resulting from a past failure to drive climate-smart policies. Outbreaks of pest and disease increase, as does the unpredictability and high variability of rainfall with more frequent floods occurring as well as extended dry spells leading to drought. These impacts are such that crop production and animal husbandry become very challenging for all farmers, but especially smallholders. The severity of climate shocks has also affected infrastructure (e.g. roads, storage facilities and agro-processing machinery) occasionally reducing the flow of food into local markets and creating a lack of local resilience over time. With larger numbers of smaller farms, and more volatility in production in general, there are reductions in food production affecting food security (especially among the poor) and livelihoods (even for large-scale farms). After a decade of social unrest and food insecurity, there are increasing moves to form cooperatives or other collaborative structures, helping to overcome some of the economy of scale issues through e.g. sharing of equipment, investment in irrigation, and improving access to markets.

The reduction (and increasing volatility) in production and profitability result in increases in both food prices and food imports, and both of these factors are exacerbated by high climate risks (and periodic crop failures). This increase in food imports creates greater exposure to world commodity prices, which themselves are volatile due to global shifts in climate risks leading to impacts on geo-politics. High and varying prices also provide increasing incentive for public and private investment in novel production pathways: vertical farming, hydroponics, lab-based meat production, and other innovations. These investments help make the food system more resilient, but are too little, too late, and too focused on the urban middle class to provide equitable solutions. The rural poor suffer greatly. Rather than secure land tenure underpinning rural development, land reform has created poverty traps while ever-increasing climate risks have undermined the potential gains from secure land tenure. Instead of creating a rural renaissance, migration to urban centres remains a key driver of a lack of rural development.

The capitalization and valorization of land newly owned by smallholder farmers was not a given under high climate shocks, particularly as the land reform process was not supplemented by a government supported rural development plan, which was initially earmarked as an important facet of the land reform process.²¹ Had rural development been significantly supported during the land reform process and investments made in CSA, rural resilience and the development of cooperative farming amongst smallholders, there would have been potential for formerly landless people to be relative winners. However, a lack of joined-up and far-sighted policy means that the reality of land reform in a world of high climate risks creates losers of the landless. This foments social unrest with the government—another loser in this scenario—guilty of a failure to invest in food system adaptation schemes aimed at creating resilience of the agriculture sector to climate change, as prescribed in APAP, the NDP Vision 2030 and other climate change policies.

²¹ See land reform policy discussion document at:
https://www.sahistory.org.za/sites/default/files/landpolicyproposals_june2012v_1.pdf

Policy Implications

The descriptions of the four scenarios have exposed the magnitude of uncertainty as to how South Africa's agriculture and food systems will evolve over the next decades. Successful development of the food system in South Africa requires coordinated thinking about the domestic and international impacts of climate change, through trade's sensitivity to climate impacts elsewhere.²² Furthermore, it requires coordinated investment in the agri-food sector and its supporting infrastructure, and a deliberate linkage between domestic production, imported food and nutrition security.

In this context of high uncertainty, what are the implications of policy decisions made today and what policy decisions are robust across the four scenarios? Some of the implications, arising from discussions at the scenarios workshop, include:

- The outcomes of the land reform process will certainly affect (positively or negatively) the ability of South Africa as a country to feed its populations in 2050 and to use agriculture and food systems as a powerful tool for rural economic development, poverty alleviation and access to international markets. The impacts of land reform might be positive; that is, enabling a booming food system-based rural economy and by implication contributing to a food-secure South Africa; or they could be negative, affecting agricultural production if—despite the secure tenure rights earned by smallholder farmers as a result of the land reform process—they are not capable of valorising their land through profitable farming activities. The success of land reform therefore in part depends on future drivers, such as climate change, that can increase risks for small farmers, and undermine the benefits. Strengthening the security of tenure for farm dwellers living on commercial farms is one of the main objectives of the Tenure Reform component of the Land Reform programme.²³ A lack of tenure rights for farm dwellers and / or uncertainty among commercial farmers as to how their tenure rights are going to be affected by the land reform process can represent a serious disincentive for investment. It is therefore important that the land reform process is accelerated and perhaps completed over the next 10 years, in order to remove the range of concerns stakeholders have about the process.
- One specific process that may facilitate the land reform process is the Agri-parks programme led by the Department of Rural Development and Land Reform (DRDLR) in collaboration with the Department of Agriculture, Forestry and Fisheries (DAFF). The Land Reform policy discussion document highlights the need to design a government-supported rural development plan, which would make provisions for financial and technical support to farm dwellers earning secure tenure rights over their land. With the Agri-parks programme, smallholder farmers will be able to participate in a networked food system innovation scheme, using its logistics, training and extension services and therefore benefiting from the economy of scale. In addition, there is a specific policy objective to increase agriculture-based rural employment by one million in the medium term. This policy objective is currently challenged by ongoing trends in declining agricultural employment, which may be counterbalanced by improved support services (e.g. Agri-parks) brought about by the land reform process. Decisions to enhance the interaction and mutual supportiveness of the land reform programme and the Agri-parks programme should therefore be prioritized today, with a view

²² Challinor, A., Adger, W.N., Benton, T.G., Conway, D., Joshi, M., Frame, D., 2018. Transmission of climate risks across sectors and borders. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*. <https://doi.org/10.1098/rsta.2017.0301>

²³ See Land Reform policy discussion document at: https://www.sahistory.org.za/sites/default/files/landpolicyproposals_june2012v_1.pdf

to ensuring food security and the agriculture-based economic viability of rural areas in South Africa over the next decades.

- To adapt to an increasingly variable climate over the next decades and to build the resilience of the agriculture sector to the effects of climate change in the context of current and future climate uncertainties, South Africa needs to implement current policies. The effects of climate change to the South African food system are already visible and—based on the projections indicated above—climate shocks are likely to continue to impact on agricultural productivity and overall production over the coming decades to 2050 and beyond. How exactly such impacts will materialize is however highly uncertain. South Africa has committed to making its agriculture sector resilient to climate change.²⁴ Across a number of sectoral policies (e.g. the 2011 National Climate Change Response Policy (NCCRP), the 2014–2019 APAP, the 2015 Intended Nationally Determined Contribution, the white Paper on a National Water Policy for South Africa 1997), the country is committed to investing in adaptation and mitigation measures to improve the agriculture sector's resilience to climate change. Areas earmarked for investment include CSA technologies, conservation agriculture, agro-ecology and innovative irrigation techniques, which ensure better utilisation of water resources. Investment in the design and adoption of new innovative irrigation schemes will respond to the concern expressed in the NDP Vision 2030 which observed that water extraction for irrigation is exceeding rates of replenishment in many parts of South Africa. Therefore, it is important that the extraction of water from the underground reservoir or aquifer for agricultural purposes is done sustainably. Otherwise, the land reform process yielding several small farms would further decrease the availability of water for agriculture which is already scarce due to drought and the unsustainable use of water resources.

Furthermore, the climate risks to the food system are not a consequence of domestic changes in agriculture alone. Global markets are affected by climate change elsewhere and food price volatility will spill over and affect input prices, domestic market prices and, in extremis, the cost of humanitarian aid. A climate-smart food system requires integration of planning to adapt, mitigate and build resilience across multiple policy domains. In a worst case scenario, a drought in South Africa could be coupled with a multiple breadbasket failure elsewhere,²⁵ and a lack of availability of, and high price for, imports.

²⁴ See the Draft 2016 National Climate Change Adaptation Strategy

²⁵ <https://www.foodsecurity.ac.uk/publications/extreme-weather-resilience-global-food-system.pdf>