AGRICULTURE AND WATER

South Africa's agricultural water scenarios: The future we choose?

South Africans need to face key water realities and plan accordingly to ensure we use our water resources sustainably whilst promoting economic development and food security. The Water Wheel reports on a comprehensive research project that produced four important future agricultural water scenarios for South Africa. Article by Jorisna Bonthuys.

The challenges of feeding South Africa's growing population in a climate-altered, resource-constrained future are substantial.

The availability of freshwater presents one of the greatest risks to South Africa and the global economy at large. Other priority risks are related mainly to climate change, biodiversity and ecology. These risks would affect a wide range of economic sectors and livelihoods, impact infrastructure and catchment management, and the management of demand into the future.

The challenge is to produce more food with the same amount or less water, given South Africa's water realities. This has been highlighted in new research on the country's water management scenarios for the future.

Experts from the University of the Free State (UFS) have investigated the different drivers and enablers that could determine South Africa's water futures. This has enabled them to develop four detailed scenarios that can now inform policy responses and adaptation practices.

This project, funded by the Water Research Commission (WRC), provides a glimpse of what is to come in future decades. Prof Anton Jordaan, a research fellow at the UFS, led this comprehensive scenario-building process. This is the first study that has attempted to develop an integrated model for coupled water-food systems, including multiple drivers, through the active participation of a diverse group of stakeholders.

The researchers considered key trends and drivers reshaping the water and agricultural future and the path ahead. They also investigated different policy responses and decision-making on water realities.

Scenarios are not predictions, forecasts, or projections, Jordaan explained. "Rather than just predicting and forecasting future occurrences, scenario planning examines plausible and possible future occurrences," he said. "The underlying idea is that scenarios that display alternative future states of the water system facilitate water managers to make robust decisions and management strategies."

Agriculture and the national water budget

South Africa has already transitioned with a water constrained economy. Water requirements for urban and domestic use account for nearly 30%. The remainder is vital for mining, bulk industries, and as cooling water for power generation.

The use of water is dominated by irrigation, amounting to over 60% of the total water use in the country, the bulk of which is used in a consumptive manner. Agriculture is a major user of the national water budget, generating a vital component of overall food security.

With the amount of water that agriculture uses, the sector contributes 2% to 2,6% of the gross domestic product (GDP). In addition, the agri-processing industry, which is dependent on irrigation, makes up 20% of South Africa's GDP and is an important source of foreign exchange earnings. It is also a crucial source of employment, particularly in rural areas, employing 15% of the labour force.

The sector is facing increasing competition from domestic and industrial users. Water demand is projected to increase with economic growth, increased urbanisation, higher living standards, and population growth. Currently, South Africa depends mainly on surface water resources for most of its urban, industrial, and irrigation requirements.

Poor management of water resources threatens the resource base on which agriculture depends, the researchers highlighted. Water quality has deteriorated in the rivers receiving large quantities of effluent. Climate change impacts could also exacerbate existing water-related challenges and create new ones over the next few decades.

Exploring alternative water futures

The researchers completed this project in four phases. Firstly, they did a comprehensive literature study and reviewed current water management policies, regulations and scenarios. Secondly, they conducted expert interviews and held participatory workshops. The scientists gathered information during interactive workshops, with semi-structured interviews, and at two national symposia from target groups such as academia, government officials, agricultural associations, and water users.

Phase three of the project entailed scenario development based on qualitative and stakeholder inputs. These scenarios were tested with experts during the national symposia and a water symposium organised by Agri SA. The scientists also developed a modelling framework for the scenario development tool. This mathematical model is based on a systems thinking approach and the principle of system dynamics.

The model was simulated for a period of 20 years (from 2010 to 2030). The researchers used data from the Breede River catchment (in the Western Cape) to test the tool for its robustness.

The scenario-building process identified almost 70 drivers that will determine the future of water management in the country. These drivers were categorised under cluster headings (social, technological, human, ecological, economic, natural, global, and political). The researchers determined the importance of these drivers through participatory research and data capturing, system dynamics and game-theoretic mathematical programming.

Unpacking the scenarios

The researchers developed four potential scenarios ranging from a best-case to a worst-case (Z) scenario.

In the **best-case scenario**, political stability, leadership, social cohesion and security are positive, as is the country's natural capital and its management. This helps to produce a sustainable environment for the growth and development of the water and agricultural sectors, directly benefitting the economy.

In this scenario, the private sector works well with the government. There is investment into existing water infrastructure and new water infrastructure projects (with private sector innovation and inputs). Water is seen as a fluctuating resource, as opposed to a finite resource. With policy certainty and a clear national water resource strategy, it plays an important role in developing a strong and inclusive agricultural sector and, in turn, growing the economy.

Climate change adaptation programmes are integrated (mainstreamed) in all policies and projects. Water resource allocations are well managed, with no conflict between agriculture and the mining and industry sectors for water. Efficient water management authorities are in place and there is strict enforcement of water use guidelines. Increased efficiencies in production and water use are achieved through innovative technologies.

The **frustration scenario** is characterised by a strong private sector and civil society involvement but poor governance. Even though political stability, leadership, social cohesion and security are all negative, the country's natural capital, and the management thereof, remain positive. This is driven mainly by a private sector that manages to bypass unclear and contradictory government policies. The result is high levels of frustration felt by all players in the agricultural sector. This scenario represents the 2020 status quo, according to the research.

In this scenario, a hostile political climate exists, deepening mistrust between the agricultural sector and the government. The result is poor governance at the local level and increased social unrest. The gap between the haves and the have-nots widen. Commercial farmers can farm effectively and efficiently,

Drivers and clusters for scenario planning

#	CLUSTERS	DRIVERS	
1	Natural/Ecological	• Climate change & variability • Water availability • Rainfall • Groundwater • Streamflow • Dams/reservoirs • Climate extremes (droughts / floods)	• Land degradation • Water quality • Water pollution • Soil salinisation • Ecosystem health • Land use
2	Cultural	• Innovative thinking and doing • Dependency syndrome • Entitlements • Productivity	• Cultural values • Values of care for the water • Attitude of the group
3	Technological	• Rainwater harvesting techniques • Irrigation technology • Desalination technology • Water recovery technology • Groundwater recharge • Engineered wetlands	• New Alternative technology (Super oxidants technology) • Water sanitation investment • Adoption of new crops • Precision agriculture
4	Economic	• Capital availability • Shift in production systems (SADC) • Bankability • South African economy • Water sector • Agriculture • Energy price (input costs)	• Subsidies • Economic output • Waterworks investment • Economic prosperity • Globalisation • International markets
5	Human	• Education • Capacity within the water sector • Attitude of individuals	• Cadre deployment • Leadership capacity
6	Social	• Population growth/HDI • Agricultural organisations • Community groups • Civil society involvement • Lifestyles • Poverty	• Inequality • Migration pressures • Urbanisation • Civil action • Rural safety and security
7	Political	• Land reform policy • Racial disparities • Internal political conflict • Level of conflict	• Understanding • SADC collaboration (Lesotho) • Power structure • Policy and political employment
8	Organisational	• DWS, DAFF, COGTA, DEA functionality • The capacity of government organisations to fulfil mandate	• Local governance capacity • Farmers Organisations – AFASA, NAFU, AgriSA • Commodity organisations
9	Infrastructure	• Siltation of dams • Inter-basin transfers	• New water infrastructure • Maintenance of current infrastructure
10	Institutional	• Coordination and collaboration between governance structures • Rules and regulations of water management	• Monitoring • Water management policies

while smallholder farmers struggle. The private sector and society manages natural resources and takes responsibility for water management. This leads to increasing conflict about water use and between water users and the government, especially at the local level. Violent civil action erupts around water supplies (this is exacerbated by the COVID-19 pandemic, highlighting poor water management by the government). Land invasions are on the increase. Some farmers are relocating outside of the country, taking experience and skills out of the sector.

In this scenario, the private sector is strong and functioning efficiently. Water efficiency is good in the private sector, and farming methods and water management are enhanced by innovations driven by technology as part of the Fourth Industrial Revolution (4IR). Good rainfalls enhance production, and land degradation is under control. A functioning education system leads to the responsible maintenance of natural capital (or at

least an understanding of what needs to be done). However, it comes at a cost – water and electricity tariffs are high. The agricultural sector is heavily taxed.

This scenario is a paradox of strong and weak, good and bad, and, overall, sub-optimal in relation to its potential.

The **conventional wisdom scenario** is characterised by a government with centralised policies that do not support private sector investment and entrepreneurship. That includes the introduction of rules and regulations to control society and limit the private sector's influence. Even though political stability, leadership, social cohesion and security are all relatively positive, the natural capital, and the management thereof, still declines. The government has invested significant resources in agriculture. Still, the priorities are skewed towards subsistence smallholder farming at the expense of commercial agriculture, with unfortunate results. In this scenario, nationalisation is a key focus area for the government, and parts of the agricultural chain are absorbed into the state machinery. Land reform policies lead to an increase in the smallholder farming sector, changing the farming landscape.

There is increasing distrust between the private sector and the government. Food production declines due to changing farming methods, the degradation of soils, and climate change volatility, which is not well-managed due to low levels of innovation in the sector. The poverty trap continues, becoming more pronounced. Food insecurity increases. Farmers are stealing water from each other to survive. Water infrastructure is also constantly vandalised. Many towns are without water as there is poor or no infrastructure. The levels of conflict between water users are high. Water resources are polluted. Due to low standards of education, skills within the sector are thin. Climate extremes continue to disrupt normal agricultural production.

The **Z scenario** is the worst-case scenario. Collapsing political stability, leadership, social cohesion and security are so widespread that the natural capital is affected. The management thereof can also not take place as intended. Poor leadership, both within government and the water management sector, leads to policy uncertainty. The government and the private sector are polarised.

In this scenario, water is exploited for political leverage and votes. The level of conflict between different sectors is high. Water infrastructure is not maintained and is becoming dilapidated. Dams and rivers are highly polluted, and water theft is rife. Citizens and businesses are not paying their water bills, and mismanagement opens up space for further corruption. The government is cutting budgets for dealing with climate change. Skills in the agricultural sector are dwindling. In this scenario, commercial farmers are leaving South Africa and relocating. There are high levels of insecurity in rural areas. Criminals increasingly target farmers. Unrest and unemployment are on the increase. Food insecurity is one of South Africa's major risks and outcomes of this scenario.

Some red flags

Several things might propel South Africa, and specifically agricultural water management, in the wrong direction.

The first red flag is the absence of a social pact between the major stakeholders, i.e. the government, agribusiness, farmers, farmworkers and society at large. "The distrust between the government and the commercial farming sector, and the negative statements from political leaders are issues that need to be addressed," according to the report. "This is also characterised by an increased gap between white commercial farmers and black farmers."

The second red flag is the government's capacity to govern without the albatross of corruption hanging over South Africa. According to the research, this distracts attention from good governance and forces leaders to focus on party-political issues instead of on the state's needs. This is especially relevant at the municipal level, where water quality and water availability are determined by proper service delivery and water infrastructure maintenance.

"Rather than just predicting and forecasting future occurrences, scenario planning examines plausible and possible future occurrences."

The third red flag is centred around the economy and its resilience to withstand the negative impacts of, firstly, the 2015-2019 drought, and, secondly, the COVID-19 pandemic (since 2020). The pandemic serves as an instigator to propel South Africa from the frustration to the traditional and most-possibly the Z scenario. If that happens, the private sector will expand to other investment regions and cease further investment in South Africa, they foresee.

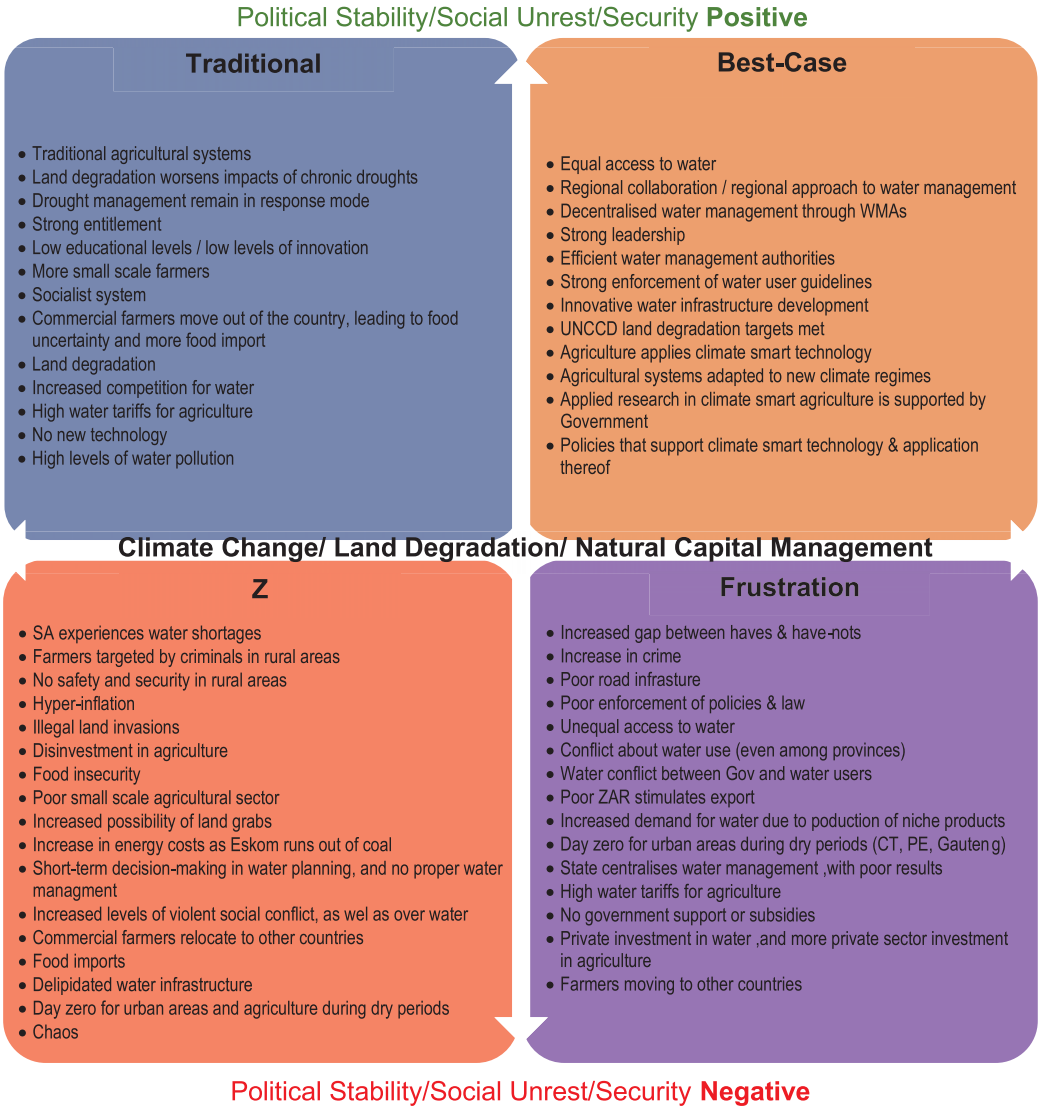
The fourth red flag is the absence of successful land and water reform in the country. Few of the land reform beneficiaries – newly established black farmers – are thriving due to various reasons. "The lack of progress in land and water reform sends out a negative message to citizens, and commercial farmers are blamed for not making land available for land reform (which is not the case since the government holds titles for millions of hectares of unproductive land). Learning from the example of Zimbabwe, it is clear that the lack of progress with successful land and water reform holds the potential to fast-track South Africa to the Z scenario."

A paradigm shift in water management is a pre-requisite to prevent negative scenarios, the researchers emphasised.

Possible water futures

According to the research, the best-case scenario is only possible if the private sector, the government, and civil society together take full and joint responsibility for future water management.

"The worst-case scenario is looming on the horizon if corruption and incompetence are not dealt with effectively in all sectors of society; if the gap between the haves and have-nots continues to increase; and if an environment for job creation and economic development is overshadowed by political opportunism, social unrest and social intolerance," the researchers indicated.



"Best-case scenario is only possible if the private sector, the government, and civil society together take full and joint responsibility for future water management."

"The 2021 position is characterised by frustration for all stakeholders – and this frustration might propel the country to the Z scenario with devastating impacts on future water management if not managed properly."

The private sector is frustrated because it seems that the government has become more centralised and autocratic in its actions, the research indicated. "Our feedback and results indicated that we currently find ourselves in the frustration scenario with a tendency to shift towards the traditional and Z scenarios if the private sector withdraws its investments," the researchers indicated.

In three of the four scenarios, agriculture will be at the losing end. Only the positive best-case scenario outcome will benefit agriculture and the country at large.

The attempt to a best-case scenario is possible through coordinated action, the researchers pointed out. Amongst the most crucial for the shift to the best-case scenario is for all stakeholders to make a paradigm shift to better understand water and its challenges for sustainable management.

All stakeholders need to take responsibility for sustainable water use and water management, Jordaan emphasised.

"As a country, we need to treat our water as life itself," he said. "We need to apply the same vigour illustrated in the management of the pandemic, protecting our water resources."

The final report will be published later this year.