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Factsheet Resilience Solutions for the Wine sector in South Africa

This Factsheet is a part of the Private Markets for Climate Resilience (PMCR) project to evaluate systematically the potential market for climate resilience solutions in the private sector. Focusing on agriculture and transportation, current practices and opportunities highlight products, services and finance in six emerging markets — Colombia, the Philippines, South Africa, Nicaragua, Kenya, and Vietnam.

Nordic Development Fund

Inter-American Development Bank

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Wine sector in South Africa

Wine is one of South Africa's flagship agricultural sectors, with both a long history and a global status, and is a significant earner of export revenue. In 2018, South Africa was the ninth country in overall volume production of wine, processing 3.4% of the world's wine that year. As wine is located in specific terroir in the southern region of the country, there are limited opportunities to shift the industry further south to accommodate changes in climatic zones.

A changing climate is already affecting wine grape production in South Africa, and climate projections anticipate increasingly adverse conditions. Climate models suggest that the coastal regions, in which most of South Africa's wine is grown, should expect a temperature increase of roughly 1.5°C above pre-industrial levels by 2100. Changes in precipitation are difficult to predict in the region due to the influence of varied topography, but run-off from rain is expected to be 10-20% less by 2050, principally due to higher evapotranspiration rates.

Wine producers are already reporting increases in the number of extremely hot days (above 36°C), and shifts in seasonal patterns of temperature, wind and rain. Climate shifts are driving phenological changes and complicating vineyard management. For example, uneven bud-break in spring due to warmer spells combined with delayed onset of spring are complicating the timing and predictability of the ripening of berries and the harvesting of grapes.

The South African wine industry is growing in value, but continues to grapple with issues of labour relations, perceived elite status, international markets and rising input prices. Given this, climate challenges form just one of the resilience challenges being confronted.

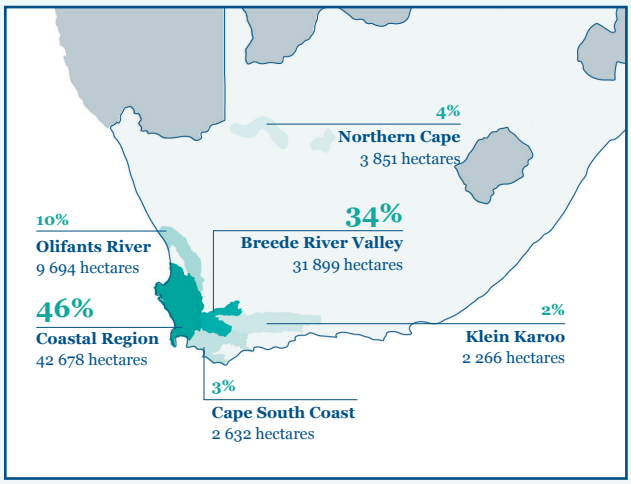
Sector facts (2018)

Total production:
annual harvest of 960.2 million litres.
Total area of production: 93,000 hectares.

Number, size and types of producers: 3,800 wine grape growers, many of which farm a mix of crops. Boutique farms of less than 30 hectares and annual production under 100 tonnes of grapes, represent 43% of producers in the sector. An estimated 37% of growers produce between 100-500 tonnes, 12% produce between 500-1,000 tonnes and 8% produce between 1,000-5,000 tonnes. There are only 7 producers with an annual production of over 5,000 tonnes of grapes.

Type of production: The South African wine grape industry is commercial and capital intensive. Almost all growers operate on freehold land. Enterprise form varies across the grape production sub-sector from family-owned farms to industrial co-operatives.

Top Winegrowing Regions South Africa
(hectares)



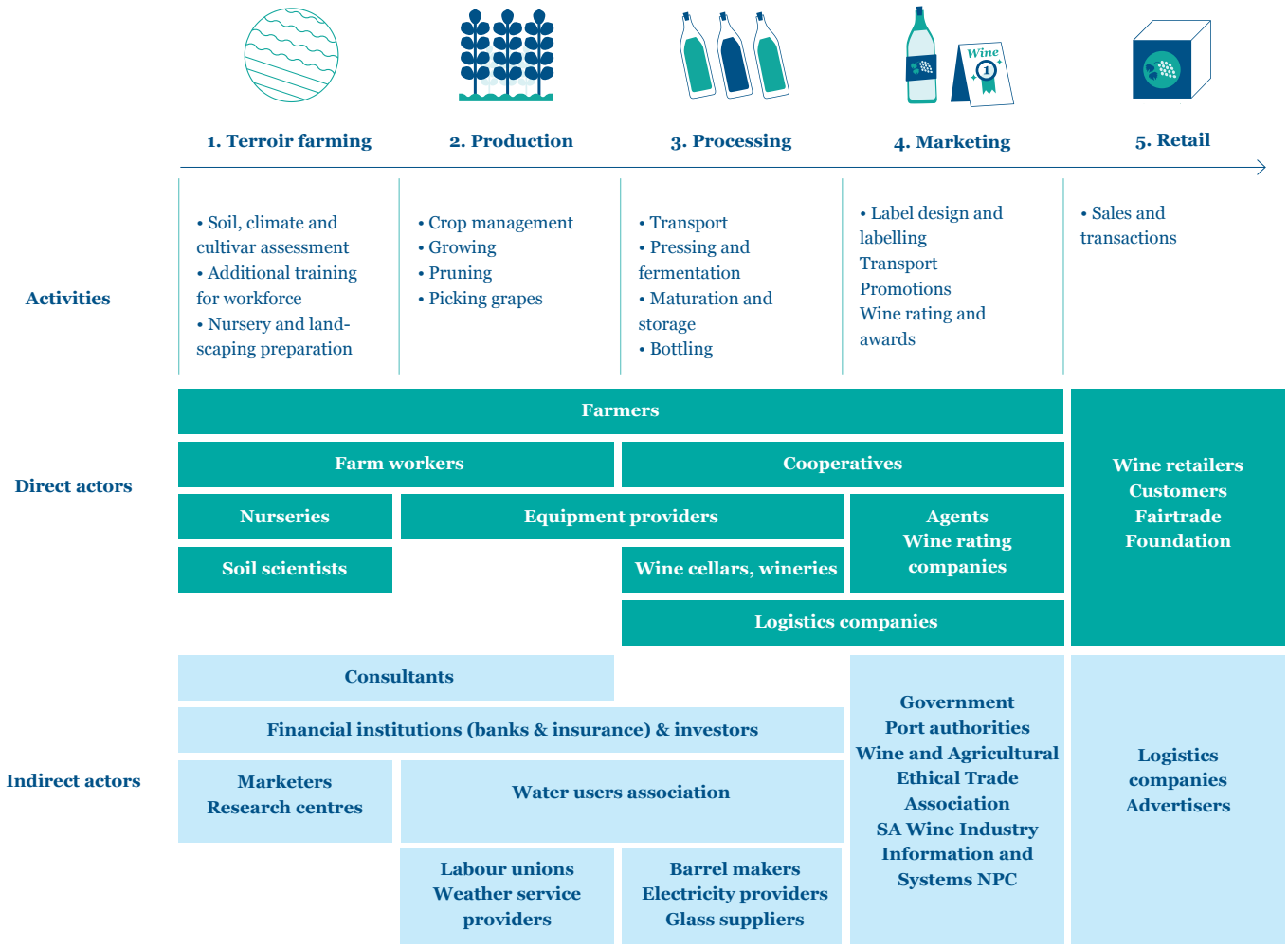
Anton Cartwright

"We simply don't know exactly what to prepare for, but we know we are in trouble (from climate change)." ***Michael Back, an experienced Western Cape wine farmer and wine maker***

For a list of references, see the References Section of the PMCR Report.

The wine value chain

The value chain builds on five main processes from terroir farming to retail. The summarised value chain from production to retail shows specific activities and actors engaged in such activities.



Changes in the weather that could affect production

• *Temperature risk* is associated with the development of grapes, as the acid in the berries turns to sugar before the berry is mature as a result of hotter days and nights. This is the main temperature related threat to the South African wine industry.

• *Reduced rainfall* and *insufficient irrigation water* during hot summer months, in conjunction with *higher temperatures* and *increasing competition for water*, is already affecting grape production in many areas.

• *Higher winds* and *warmer weather*, in conjunction with *periodic droughts*, are stressing vines and making them more vulnerable to diseases. While producers are able to balance with one-off dry or hot years, cumulative hot and dry years place undue stress on vines and lead to declines in production and quality.

• The increasing *risk of wildfires* for Western Cape agriculture is considered to be linked with changing climates.

• There is industry-wide concern that more *frequent dry years* will stress vines beyond their coping capacity and that *higher temperatures* will make it difficult to maintain acid-sugar ratios long enough into the summer to maintain the high *quality* of produced wine.

Main climate-related impacts affecting the value chain

• *Higher temperatures* and *drier weather* reduce yields and quality, and rising input costs due to climate makes wine unprofitable. Lower profit margins lead to less labour employed and contributes to social disruption.

• Wine suffers reputational damage due to "luxury good" status and water requirements. Due to longer and more intense periods of drought, *water availability* is being strongly impacted and the national competition for water is increasing.

Carmen Lacambra

Resilience solutions

Leading resilience solutions: *knowledge services and technologies for precision farming and alley cropping.*

Precision farming

Precision farming is based on the use of sensor technology and software solutions to manage crops based on high quality and detailed information on plant/vine health and soil properties, including the level of moisture, nutrients, pests, etc. Precision farming techniques involve the use of Internet of Things (IoT) technologies, robotics, drones and satellite imaging, among other. Precision farming enhances yield, reduces input costs and improves vine health, and so provides an emerging business opportunity for farmers and intermediaries.

Resilience contribution: Precision farming increases soil and water conservation, and enables earlier detection of vine stress. It contributes to higher yields and more efficient and cost-effective use of inputs, including water, fertilisers, pest and herbicide.

The resilience solution was assessed using the ***B*Resilient Process Model*** (BRPM). The BRPM analysis was undertaken to analyse the crop management process using precision farming as a resilience solution targeting a climate-resilient wine industry.

Resillence outcome	**Climate-resilient wine industry**		
Process **Crop management**	 **Phase I** **Terroir selection**	 **Phase II** **Precision farming**	 **Phase III** **Resource efficiency**
Risks	*Hotter* and *drier* weather will change regions in which *quality* wine grapes can be produced and decrease the aggregate *production area*.	Vines stressed by *heat* and *water shortage* Early transition of grape acid to sugar, affecting end-product *quality* Unseasonal *frosts* strike production Increased *fire* risk Workers unable to work efficiently on hot days	Water, carbon, oak, cork and plastic constraints increase *costs of production* or require new products. Carbon intensity of economy makes wine *less competitive* internationally.
Actors	Farmers Advisors Soil laboratories Nurseries Technical advisors Labour unions	Farmers Advisors Data analysts Equipment brokers Aerial surveillance companies Insurers	Farmers Advisors Aerial surveillance companies Recycling companies Forest Stewardship Council Energy providers Large retail outlets
Options	Attention to terroir for better fit of cultivar with soil and (future) climate	Use of precision farming for reduced use of water, chemicals and electricity Renewable energy	Packaging reduction and re-use, energy and water savings Renewable energy
Tools	Training and guidance on the process and equipment required.	Soil moisture probes and aerial surveillance Data analysis tools	PV panels, grey water recycling FSC certified wood barrels

Market opportunities: Precision farming is already a rapidly growing industry. Currently, precision farming is adopted by less than 25% of all wine farmers. There is a business case for using precision farming on farms above 40 hectares for drones, and lands above 50 hectares for satellite imagery. Farmers could make better decisions on vine location and on irrigation to existing vines. Effective and efficient irrigation scheduling is key in producing wine at lower costs and within water scarce environments such as the Western Cape. Currently, there are over 10 companies offering precision agriculture products and services. It is estimated that the market for precision farming services in South Africa's fruit and nut industry amounts annually to USD 10 million.

Alley cropping

Alley cropping provides long-term benefits to soil quality, vineyard micro-climate and pest management. It also provides short-term benefits in terms of cash-flow and revenue diversification. Alley cropping on its own is rarely associated with climate change adaptation or resilience. However, *diversity* is a key feature of *stable* and *resilient systems* and by converting a vine mono-culture into a more biodiverse system, alley cropping contributes to climate resilience in a number of ways.

Alley cropping impacts *water management* by altering the hydrologic cycle through increased water infiltration. Nutrient cycling and soil quality are impacted as alley crops cycle the nutrients to the surface through plant litter. *Reduced soil erosion* by wind and water help maintain soil quality, and the leaf canopy of the alley crop can reduce soil damage by rain.

Pest management can be strengthened through the habitat diversity created by alley crops, which in turn attracts a more diverse set of pests and predators. By supporting *biodiversity,* and associated populations of natural enemies, pest cycles can be interrupted, reducing the need and cost of chemical sprays.

Resilience contribution: Where effectively applied, alley cropping reduces moisture and soil carbon loss and cools vineyards. Alley cropping can provide fodder or pasture options and can be used in fire management and to enhance soil fertility.

The resilience solution was assessed using the ***B*Resilient Process Model*** (BRPM). The BRPM analysis was undertaken to analyse the *crop management process* using *alley cropping* as a resilience solution targeting a climate-resilient wine industry.

Resillence outcome	**Climate-resilient wine industry**		
Process **Crop management**			
	Phase I **Assessment of microclimate and pest threat, choice of alley crop**	**Phase II** **Growing alley crops**	**Phase III** **Sales of alley crops**
Risks	*Heat stress* and *water shortages* impact negatively product quality. Uncertain production and lower margins impact profitability.	*Heat stress* and *water shortages* introduce new *pests* and *diseases*. Alley crops can introduce new *pests* and *compete for water* and *nutrients*.	Wine *quality deterioration* and *timing* of sales. Wine farming becomes unprofitable due to *capital investment* and delayed *returns*.
Actors	Farmers Etymologists Consultants Academics	Farmers Advisors Workers	Farmers Retailers Packaging companies
Options & Tools	Alternating cash crops for harvest during growth stage of vineyard. Training and guidance. New equipment that does not damage alley crops.	Alternative income and improved vineyard microclimate. Increased diversity of insects, nitrogen and carbon fixing in soil. New integrated pest management skills. New growing skills required.	Niche products or staple vegetables. Sale in open market or given to workers. Results from trials and professional/ extension advice. Access to new markets for alley crops.

Market opportunities: Alley cropping can be applied widely in the wine sector. It can provide alternative enterprise, revenue and employment opportunities, all of which enhance the resilience of the farming community in the face of multiple social and environmental pressures. Better application of this vineyard management practice is needed, so as to realise more profit, less crop disruption and enhanced soil fertility over time. Between 30-50% of the industry already deploys some form of alley cropping – most commonly a ground cover. What is lacking is the type of research that can enhance the use of this intervention to reduce risk and enhance profits.

> *"South African farmers used to treat soil as a medium that they controlled and which held their plant nutrients. Only recently have they begun to realise that soil is more complex, and they have begun working with the idea of terroir. It is a new approach that offers new potential."* ***Wine farmer, BRPM Workshop with sector stakeholders***

Greatest opportunities related to identified resilience solutions

• *Alley* and *cover cropping* is one example of an innovation that requires a programmatic roll-out from current levels around one third to full uptake. This would require an estimated 2,000 farms adopting the practice. There is also scope for ensuring that the benefits derived from alley cropping are even greater. This would require research that allows farmers to tailor their alley cropping decisions to suit their context.

• Given the increasing pressure of production efficiency under diminishing resources, monitoring has become more important and *precision farming* has emerged as a key management approach in the agriculture sector in South Africa.

• *Precision farming* continues to grow in spite of programmes being perceived as expensive. The falling cost of surveillance due to the use of drones is lowering costs and facilitating uptake.

• The current frontier for farmers involves converting the wealth of data gathered by new surveillance technology into improved and implementable farming practices. This is a gap slowly being filled by a new type of agricultural consultants. In addition to farming practices, some consultants are linking the gathered data to markets, quality accreditation bodies and financial institutions.

Anton Cartwright

• There is significant potential for financial institutions, such as credit an insurance providers, to take advantage of the data generated by precision farming solutions. For example, financial institutions could offer *incentives for resilience* (e.g. reduced premiums or other rewards), and insurers could sponsor the purchase of drones or data analysis software in exchange for access to the gathered data. This would not only allow the farmer to manage resources better, but also permit the financial institution to have greater insight into their client's viability.

Climate resilient business

DFM Software solutions manufactures and markets highly specialised end-user applications for the agricultural industry. DFM has been providing software support and hardware support to the South African agricultural sector for the last 17 years.

The *Continuous Logging Soil Moisture Probes*, developed by DFM, inform farmers of surface temperatures, soil moisture content and temperature. Through continuous soil moisture content logging, farmers are able to prevent over- and under-irrigation, prevent unnecessary crop stress, promote root development and improve fertiliser uptake. This refined management capacity can save electricity and other expensive farming inputs. Reports that soil moisture probes can save up to 50% of irrigation water with no loss of yield are available in the citrus industry, while in irrigated maize production a 30% water saving is possible.

The data collected by the probes are downloaded to the *DFM Probe Utilities Software*, a user-friendly package that provides the farmer with an abundance of information. In so doing, the system is able to prevent over and under watering, enhance root development of vines (or other crops), create the ideal air - water balance in the root zone, prevent unnecessary crop stress, improve fertiliser uptake, optimise salinity management, and manage soil water buffer. DFM has sold 65,000 units, and it is estimated that roughly half of the irrigation farmers in the country use some form of soil moisture probe, and accordingly that there is scope for expansion of their product.

"Aerial surveillance used to be expensive and crude. Drone innovations in recent years have changed that. We can now identify which plant is doing well and which one is not within an orchard or a vineyard."
Aerial surveillance representative for Yara (fertiliser company)