



MPUMALANGA GREEN CLUSTER AGENCY

INDUSTRY BRIEF:

Cultivating land rehabilitation through sustainable agricultural practices in Mpumalanga



List of acronyms:

CA	Conservation agriculture
COP	Conference of the Parties
DMRE	Department of Mineral Resources and Energy
GHGs	Greenhouse gases
NDC	Nationally Determined Contribution

Purpose

In preparation for the United Nation's **Conference of the Parties** (COP26), South Africa submitted a revised Nationally Determined Contribution (NDC) to reduce domestic carbon emissions to between 420 MtCO₂eq and 350 MtCO₂eq by 2030. This meant that there would need to be a shift from intensive industrialised production mechanisms to production that is aimed towards positively contributing to sustainable development. The Mpumalanga province will be significantly affected by what is referred to as the Just Transition, essentially aiming at reducing the use of coal power generation and fuel production [2]. As mine closure and the subsequent land rehabilitation is becoming an important conversation in South Africa, this brief has been written to highlight some of the opportunities in sustainable agriculture which can be unlocked.

This industry brief is written for:

Mines who are looking to rehabilitate their land for agricultural production and for investors who want to understand the agricultural ecosystem in Mpumalanga.

The challenge

Mpumalanga province accounts for 90% of South Africa's coal production, contributing to an active mining sector as shown in Figure 1.

In 2021, the coal sector contributed R31.4 billion towards employee earnings with 92 670 direct jobs [3], which is the third largest group in the mining sector after gold and platinum group metals. However, the shift to a low-carbon economy will affect this province and its economic activities. Figure 2 indicates the employment numbers in South Africa as well as the projected decline as a result of the transition to a low carbon economy.

Key insights:

- There is a growing interest in the use of rehabilitated mine land to produce viable crop production systems and pasture to rear livestock. This has been seen as a possible means to potentially creating employment opportunities in agriculture that might mitigate against job losses due to mining closures.
- Farming on rehabilitated mine land can assist in meeting the growing demand for food, and possibly energy, especially to provinces like Mpumalanga, whose current economy largely depends on coal mining [1].
- Diversifying the province's economy through agricultural production has a strong business case, as there are opportunities for revenue generation both from the sale of the commodities and from carbon trading.
- The key opportunities to investment that will enable sustainable agriculture within the province include no-till machinery (market size: R720 million), microbial bio-stimulants (market size: R37 million and agrivoltaics (market size: R3.7 billion)
- Every mining area is unique, which presents different contexts in which agriculture can be viable. Therefore, feasibility studies and stakeholder and community engagement should be undertaken to understand the farming potential of the rehabilitated land.
- Currently, there are a number of projects underway that are assessing the viability of crop production in rehabilitated land in Mpumalanga

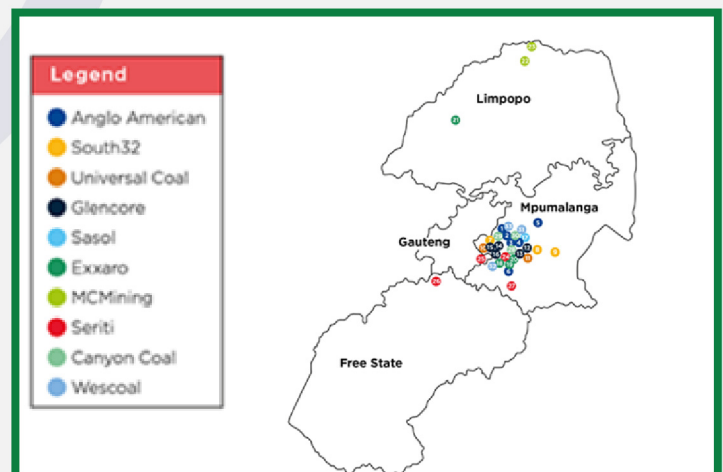


Figure 1: Coal mine distribution in South Africa (Minerals Council, 2018)

Total Coal Mining Employment in South Africa | Historical and Projected (1975-2045)

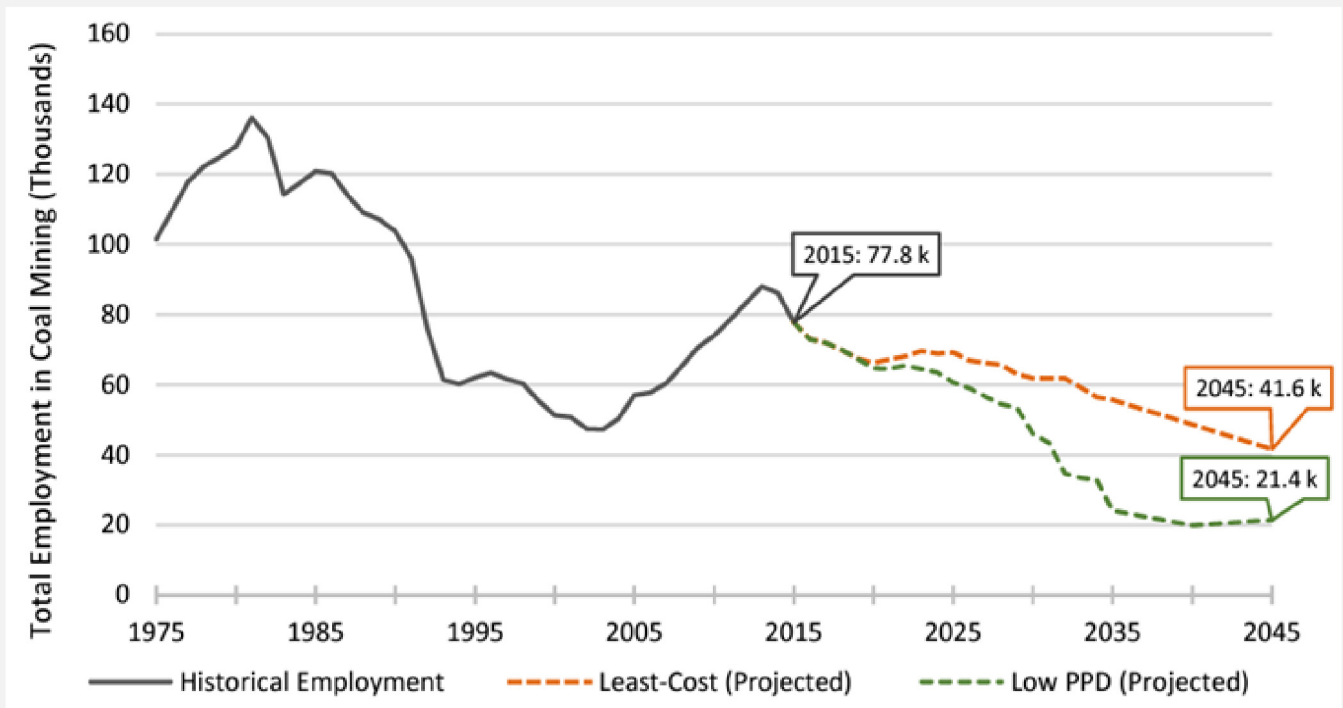


Figure 2: Historical and projected coal mining employment in South Africa (Strambo et al, 2019)

Opportunities

The shift as a result of decommissioning of coal mines will lead to a high number of job losses; however, these job losses can be mitigated through a series of interventions which include:

- Capitalising on historical assets to rebuild the economy
- Converting historical areas to tourism facilities and shopping centres
- Converting closed mines into tourist and recreation facilities e.g. creating national parks with different indigenous species
- Incentivising mine workers to become entrepreneurs
- Mobilising communities to set economic agendas on economy diversification
- Establishing commissions to deal with coal Just Transition by developing and aligning policies with creative-mentality
- Strengthening partnerships and cooperation with other stakeholders to improve agricultural production (adopting best technology and innovation practices)

One of the objectives of the Just Transition in South Africa is seizing the opportunities and managing the risks associated with climate change. This is achieved by incorporating the overarching goal of improving the lives and livelihoods of all South Africans, particularly of those most impacted. In Mpumalanga alone, there is an alarmingly high unemployment rate of youth and women (51.6%)

despite being rich with minerals and contributing to the overall mining jobs performance [3]. With agriculture as an already active sector in the province, land rehabilitation towards sustainable agricultural production has a strong business case [4]. This is evident as seen in other countries with the same status quo as Mpumalanga. Mining land can be used for agriculture as the rehabilitated land can be used for varied range of large-scale agricultural activities, given available technology and innovation tools [2]. The agricultural activities can succeed mining as part of the concurrent rehabilitation of the mined-out areas in surface mining operations.

Agriculture investment opportunities

There are a number of opportunities for investment in mine land rehabilitation that can drive agricultural activities and stimulate employment in the region. Table 1 summarises these opportunities, with further information in the following section. There is a strong business case for the investment in agriculture, with opportunities for generating revenues from both the sale of the commodities and from carbon trading. For more information on opportunities for carbon trading within the agriculture sector, please refer to this [industry brief](#).

Table 1: Key opportunities for investment in mine-land rehabilitation in Mpumalanga

Opportunity	Key Technology	Drivers	Barriers	Term	Estimated market size
Soil remediation through conservation agriculture.	No till machinery.	<ul style="list-style-type: none"> • A requirement to reduce carbon emissions associated with sector contribution to reduction of carbon emissions to 50% by 2030 according to EU's Green Deal (2019)¹. • The Carbon Tax Act No 1 of 2019 aimed at reduction of GHG. • Opportunity to generate income from agricultural carbon trading. 	<ul style="list-style-type: none"> • Requires new production systems which support low emissions. • It takes time for farmers to realise profits (risk of profit losses). • Recording systems for carbon trading can be onerous for farmers. 	Medium to long term.	Estimated R720 million ² .
Soil remediation through bio-stimulants.	Microbial bio-stimulants.	<ul style="list-style-type: none"> • Repurposing of mine and (mine land rehabilitation) which contributes to achieving the priorities of National Development Plan 2030 (2013). • Increased appetite for soil remediation projects for mine. • land rehabilitation in the province. • Opportunity for increased productivity and profitability due to quality and yield maintenance. • Reduced yield drops associated with the adoption of conservation agriculture at inception stages. 	<ul style="list-style-type: none"> • Inconsistent financial information provided by mines and Department of Mineral Resources and Energy (DMRE) for land rehabilitation. • High cost of remediation technologies. • Lack of industry standards in South Africa. • Bio-stimulants fall under subcategory of fertiliser by definition; therefore, administrative red-tape for certifying products for commercial use. 	Short to medium term.	Estimated R37 million ³ .

¹ EU's Green deal: The European Commission adopted a set of proposals to make the EU's climate, energy, transport and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels.

² Assumptions: 10% conversion, Area = 240 000 ha prospecting closure, Cost of CA infrastructure = R 190000 (30 000/ha), Market size = R720 million

³ Assumptions: Sprays within foliar applications at 2-4 L/ha, 240 000 ha prospecting closure & land availability, Bio-stimulants = R158/L, Market size = R37 million

<p>Water-energy-food nexus.</p>	<p>Agrivoltaics</p>	<ul style="list-style-type: none"> • Ability for dual use of land compared to large land requirements of establishing solar farms. • Demonstration of value through on-going feasibility studies on the technology in Mpumalanga. • Reduced carbon Intensity as required for continued trade including due to the EU's Green Deal (2019). • Reduction in water demand for agriculture due to improved water use efficiency. • Prospecting mine closures in the country to release land for agricultural production. 	<ul style="list-style-type: none"> • Primarily applicable for shade-loving crops. • Limited space for machinery that can be deployed under the frames. • Lack of financial incentives to fully explore this opportunity. 	<p>Medium to long term.</p>	<p>Estimated R3.7 billion market for agrivoltaic systems⁴.</p>
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Soil remediation through conservation agriculture and bio-stimulants.

Mpumalanga has a land area of 2.5 million ha, of which 48% is grazing land and 38% is arable land. With the closure of many mines in the coming decades, it is envisaged that the land will eventually revert to agricultural developments. Most recently, Sasol has handed over farmland to the government to support the development of emerging farmers. With an increasing appetite for feasibility studies in crop production, more investment towards research and development should be targeted to support this transition. The policy and regulatory frameworks for mine closure are currently being updated to enable viable post-mining economy to improve societal and environmental benefits.

Overall this implies that conservation agriculture opens a new window for the diversification of economies in Mpumalanga. Conservation agriculture (CA) is a farming practise that involves the diversification of crops, uses minimum tillage infrastructure and leaves 30% of residues as mulch to improve soil structure and soil biological activity. CA is seen as an ideal system for sustainable and climate-smart agricultural intensification, through which farmers can attain higher levels of productivity and profitability while improving soil health and the environment. Barriers to entry include lack of financial incentives for transitioning fully into this technology.

Furthermore, the time frame for realising the benefits of this technology are long and require high cash injection. Bio-stimulants are substances or microorganisms applied to plants with the aim to enhance nutrition efficiency, abiotic stress tolerance and/or crop quality traits. These offer a faster adaptation of crops to environmental stress and can be used to improve crop tolerance especially on rehabilitated land.

Remediation through Agrivoltaics.

In South Africa, agrivoltaics could be leveraged to address the need for renewable energy and intensive commercial farming to provide industrial, agricultural and potable water, food, quality jobs and energy for local communities. Agrivoltaics enables small business development and job creation in a way that is greater than solar PV alone as they offer a dual land-use system for energy and agricultural production. This makes agrivoltaics well positioned as a technology to deploy to support a Just Transition in South Africa and in the Mpumalanga region. Over 240 000 ha mining land in Mpumalanga has been identified as requiring rehabilitation.

With respect to mine land rehabilitation, feasibility studies in the province are currently underway to assess crop adaptability on mine-affected land. Internationally, there are feasibility studies with agrivoltaics that focus on the production of high-value crops such as golden kiwis, blueberries, macadamia nuts, strawberries and leafy vegetables.

⁴ Assumptions: Est. 93632 of which 14% of high potential arable land is being mined (GreenCape, 2021), 10% conversion = 1310.48, system cost (for infrastructure) = R 2.8 million, Market size = R3.7 billion



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Agrivoltaics offer an opportunity for cultivation of produce throughout the year thus improving climate resilience. Because the primary benefit is a micro-climate that is conducive for shade-loving crops, agrivoltaics offer protection of crops to winds and other harsh environmental conditions. The focus for this system has been high-value crops. Agrivoltaics offer the use of land to also produce energy for use in heating, cooling and drying facilities in packhouses as well as irrigation.

The surplus energy produced through this system can even be transmitted back into the local grid and sold on to a utility company or to other off takers. Agrivoltaics improve water use by plants by significantly reducing transpiration rates. This is as a result of the cool micro-climate that the solar PVs above the crops provide, thus reducing evapotranspiration rates. This is important as it reduces water losses during crop production which is important in the water-energy-food nexus as production under this system is sustainable and more adaptive to climate change.

The barriers for the production under this system include limited space for machinery that can be deployed under the frames and the high capital costs associated with transitioning into this system. This technology can be considered prime for investment due to increased appetite for research and development of technologies for land rehabilitation in the province.

Current macro-environment

- Mining companies have included land rehabilitation and considered agriculture as a potential solution for social upliftment and job creation in the province as part of their sustainability strategy and alternative economies post mining.
- Significant technical, financial and legal input is required to tap into the new and emerging opportunities highlighted in this brief.
- There are currently difficulties in obtaining legislative approvals for mine affected waste use and closure activities.

Project examples

There are projects currently underway which are possible case studies of the principles and tenets of ensuring economic growth beyond mining.

Sibanye Stillwater in collaboration with West Rand Development Agency and Gauteng Infrastructure Financing Agency is embarking on a project to establish an alternative economy post mining for West Rand [5]. The objective is facilitating the creation of a sustainable post-mining economy and development framework with a particular focus on high value agricultural and associated industrial development. This integrates reskilling and upskilling current mine workers in order to create new generation farmers, entrepreneurs and industrialists and comprehensive and sustainable local socio-economic development. In Mpumalanga, similar work is being considered for Dipaliseng municipality to drive the promotion of a green economy through investment in agricultural production [6].

Glencore mine recently published their winter wheat trial which was testing small-scale agriculture development opportunities using mine-affected water and rehabilitated land in Mpumalanga. The findings provide an opportunity for mines to consider how the ideas presented can be both leveraged and transferred to other agricultural pursuits in the resource sector's Just Transition programs. The work highlights that repurposing utilises elements of the existing mining infrastructure for a different activity post closure with agricultural production as a focal point [7]. Conclusions from the work highlighted that the future economic viability of the agriculture sector has to be determined. Re-use of post-mine assets may also support alternative employment and livelihoods for local communities. A very good case study for this agricultural intervention is the repurposed mine in Kenya where agricultural production was initiated on a 20ha land targeting labour intensive agricultural commodities such as cotton and potatoes.

Exxaro is committed to the effective and efficient rehabilitation of land beyond compliance and has rehabilitated 2 277ha of land [8], with plans to rehabilitate more land. The company has set a goal to transfer 90% of post-mining land to emerging farmers in local communities, while creating strategic partnerships with farmers to advance agri-economies. With access to land and support, farmers have the potential to start viable agri-businesses, creating jobs at scale. For mines that are reaching their end of life in the next 20 to 30 years, it is imperative to start their rehabilitation strategies on time so that there is sufficient time to diversify its land and infrastructure for agriculture and ensure that these alternative economies have traction and are sustainable [8].

Conclusion

As mine rehabilitation continues to become a focal point in Mpumalanga, the investment opportunities highlighted in this brief offer an opportunity for diversification of the economy and local employment. However, it is important to highlight that mines differ and therefore the context in which agriculture can be viable differs. It is important to undertake feasibility studies on the different agricultural commodity options, as well as stakeholder and community engagement, in order to understand the farming potential of the rehabilitated land.

Further information

For more information, please contact agri@mpumalangagreencluster.co.za

For more resources produced by the Mpumalanga Green Cluster Agency, including the latest Agriculture Market Intelligence Opportunity brief, please visit:

mpumalangagreencluster.co.za/resources

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