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Rethinking Mine Land Rehabilitation Success: A Long-Term Commercial and Ecological Approach

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Abstract

Land rehabilitation in mining is increasingly seen as a long-term ecological reconstruction process rather than a simple revegetation task. This shift is essential for ensuring the sustained economic viability and ecological health of repurposed land. Traditional rehabilitation models, which focus mainly on vegetation establishment, fail to address the broader, systemic needs for land sustainability. In the mining sector, regulatory frameworks provide guidelines for acquiring a social license to operate but often do not support achieving long-term sustainability goals.

Drawing on over five decades of field experience, the current approach to rehabilitation—largely based on outsourced contracting and agricultural models—treats rehabilitation as a one-time intervention rather than a continuous process that requires expert ecological management and long-term monitoring. This leads to significant challenges for mining companies, including poor ecological outcomes and mounting costs. Short-term interventions, which overlook the need for adaptive management, often result in inadequate rehabilitation efforts that fail to meet sustainability criteria. The lack of integrated expertise and insufficient monitoring also leads to financial losses and stymies progress toward achieving sustainable land use.

In South Africa, opencast coal mining has caused widespread land disturbance. Although rehabilitation efforts have been ongoing for decades, they often fall short of achieving sustainable outcomes. A study analysing data from 41 collieries over a 22-year period revealed key shortcomings, including inadequate soil fertility, poor landform design, ineffective drainage systems, and insufficient aftercare. While invasive species management and plant composition are generally adequate, the lack of focus on soil fertility and landscape drainage hinders long-term rehabilitation success. Furthermore, insufficient aftercare, particularly in the first five years after initial rehabilitation, prevents land from reaching sustainable post-mining uses such as grazing or crop production.

These findings highlight the need for a shift in how rehabilitation is approached. A more integrated ecological approach during both design and execution, followed by intensive aftercare, is necessary for improving rehabilitation outcomes and ensuring that land is suitable for economic use once mining concludes. The current focus on short-term, inadequate interventions undermines long-term ecological recovery and economic sustainability.

A key challenge in mining rehabilitation is the disconnect between the commercial interests of investors and the realities of land rehabilitation. The traditional model where commercialised land can appreciate as a financial asset after rehabilitation is unrealistic considering the closure liability associated with the land, even after rehabilitation. Insufficient funds for initial soil improvement and a short-term view deliver legacy land, and mining companies often make unrealistic promises of achieving land sustainability (considering the Sustainable Development Goals (SDGs) as the benchmark). This approach results in rehabilitation efforts that fall short of the necessary ecological and commercial standards.

To address these issues, a fundamental shift in the financial models of mining and on-site rehabilitation culture is needed, with a focus on custodianship and long-term ecological sustainability over short-term financial returns. This involves integrating comprehensive ecological management practices, investing in aftercare, and rethinking how rehabilitated land is commercialized. Only by adopting this holistic, long-term approach can the mining industry achieve genuine sustainability in land rehabilitation. This challenge is not unique to South Africa but is a global issue, requiring coordinated efforts across the industry to achieve lasting ecological and economic benefits.