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Just compensation

Accounting for lost assets and livelihoods in mining-affected communities, Somkhele, KwaZulu-Natal, South Africa



Authorship and contribution statement

This contribution statement has been prepared using the CRediT role taxonomy.

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Disclaimer

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Livestock grazing next to a wetland, Mpukunyoni (Photo credit: All Rise)



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Foreword

South Africa's mining history has shaped the country's economy, its landscapes and the lives of countless communities. It has also shaped the ways in which we understand the consequences of extraction. Too often, the impact of mining is measured through production, employment and revenue, while the deeper relationships between people, land, water, culture, memory and belonging receive less attention. This report invites us to broaden that understanding by considering not only what is taken from the earth, but also what may be diminished in the lives of those who have long called those landscapes home.

Long before environmental rehabilitation became a statutory obligation, many African societies understood that the earth demanded care, reciprocity and restoration. The late Sanusi Credo Mutwa reflected on an ancient tradition in which mining was accompanied by an ethical responsibility to heal the earth after its resources had been taken. Whether understood as cultural memory or ecological wisdom, this perspective reminds us that the consequences of extraction cannot be measured solely in financial returns or economic growth. They are equally reflected in the condition of the rivers, the fertility of the soil, the well-being and continuity of communities, and the dignity with which people are able to live in relationship with the landscapes that have sustained them for generations.

South Africa's Constitution affirms this broader understanding of human dignity. It recognises that development and the protection of human rights are not competing objectives. Sustainable development requires that economic progress be pursued in a manner that promotes equality, safeguards the environment, and protects the rights, livelihoods and cultural heritage of all people, particularly those whose lives are most directly affected by development decisions.

The issues explored in this report arise within a complex legal, social and environmental landscape. They engage a range of statutory and regulatory frameworks governing mining, environmental management, water resources, land rights, public participation and access to justice. At the same time, they invite broader reflection on the cumulative impact of extractive industries on the enjoyment of constitutional rights and the lived experiences of affected communities. This report makes a significant contribution to that reflection.

Through community-based research and careful analysis, it documents the experiences of households in Somkhele and presents empirical evidence concerning changes in livelihoods, housing, livestock ownership, food systems, water access, environmental conditions, cultural heritage and community well-being. By seeking to quantify both material losses and the less tangible social,

cultural and spiritual consequences of displacement and environmental change, the report broadens our understanding of the multiple dimensions of loss that communities may experience.

The findings resonate with a truth that many affected communities have long expressed: that when land is transformed, the consequences extend beyond economics. They may include disruptions to cultural practice, ancestral relationships, indigenous knowledge systems, ecological balance and social cohesion. These dimensions are often more difficult to measure than financial loss, yet they remain integral to the lived experience of communities and to any meaningful understanding of justice.

Importantly, the value of this report lies not in determining legal liability or substituting the functions of courts, regulatory authorities or other statutory institutions. Rather, it provides a carefully researched body of evidence that enriches public understanding and contributes to informed dialogue on the relationship between mining, development and human rights. Reports of this nature serve an important public purpose by informing policy discussions, strengthening accountability and supporting evidence-based decision-making.

The complexity of the issues documented in this report illustrates that the impacts of extractive industries are seldom confined to a single legal question or regulatory framework. They frequently intersect across environmental governance, land tenure, livelihoods, public health, culture, participation, access to information and the enjoyment of socio-economic rights. Research that considers these interrelated dimensions holistically provides valuable insights for communities, government, industry, researchers and institutions entrusted with the promotion and protection of human rights.

It is my hope that this report will encourage constructive engagement among all stakeholders and contribute meaningfully to ongoing efforts to ensure that development proceeds in a manner that is lawful, equitable and consistent with the values of our Constitution. Evidence-based dialogue, meaningful participation, transparency and accountable governance remain essential to achieving outcomes that respect both human rights and sustainable development.

Ultimately, if this report succeeds in widening our collective understanding of what constitutes loss, what restoration requires, and what justice demands, it will have made an important contribution to South Africa's continuing constitutional journey.

Philile Ntuli, Commissioner, The South African Human Rights Commission

Executive summary

Somkhele Coal Mine, operated by Tendele Coal Mining (Pty) Ltd, is an opencast metallurgical anthracite and coal mine, which began mining in the Somkhele community in 2006, with clear effects emerging in 2007. It is still mining in 2026 and has caused extensive and multi-dimensional harm to households in the Mpukonyoni Traditional Authority Area.

This study uses data from 115 directly affected households surveyed in 2018, and measures loss and damage using an asset-based livelihoods approach. It measures the loss and damage to land, crops, livestock, cultural assets, ecological systems and health, both immediately and over 20 years. The latter measure aggregates the derivative income streams that would have accrued to households had they been able to keep their assets.

Measuring loss and damage

Scale of land loss

106 respondents or 92% of households previously owned land amounting to 270 hectares (ha). Following the onset of mining activities, they were left with 68 ha, losing 202 ha, a **75% reduction**.

Monetary value of land loss using comparable sales method (2007–18)

Using a dataset of all land that was sold in nearby commensurate plots in 2018 gives a proxy valuation of the estimated value of land held by the respondents before mining activities as R150 000 per hectare. At this per hectare price, the 106 respondents had R40,500,000 (R150,000 x 270 ha) of land before the mine, plummeting to R10,200,000 (R150,000 x 68 ha) after, which is a loss of **an estimated R30.3 million** (approx. USD1.9 mill).

Monetary value of land loss triangulation (2007–18)

Using the nearest available commensurate proxies for land value (the lowest of these) sampled in 2026, we calculate that the value of the households' land before mining was R140,400,000 (R520,000 x 270 ha) and after mining commenced the value of their land, due to absolute losses in availability rather than any pollution effect on existing holdings, declined to R35,360,000 (R520,000 x 68 ha) giving a total value of land lost as R105,040,000 (nearly US\$6.4 million), or over R105 million measured in 2026, which adjusted for inflation gives a value of R 76,392,727, or nearly **R76.4 million in 2018 Rand**.

Monetary value of land loss estimate (2007–18)

Online property listings may overstate achievable market values, but this estimate gives a per hectare value of R378k (202ha/R76.4m), well within our proxy range of R100k–R500k per hectare of actual sales in 2018. We therefore suggest that a good approximation of land loss value is 202 ha x R300k (per hectare) the mid-range point of our original full sample, giving a land loss figure of R60,600,000, or **R60.6 million**.

Collapse of crop yields

The total crop yield before mining was 137 tonnes, which dropped to 7.6 tonnes after mining commenced, a drop of 129.1 tonnes, representing a 94% yield loss. Crop-specific losses include maize 97%, onions 97%, potatoes 80%, sweet potatoes 81%, spinach 77% and beans 91%.

Maize production losses

Before the mine, 70 households reported a collective maize yield of 76 tonnes, which declined to just 2.3 tonnes after mining commenced, representing a 97% drop in yield, with each household losing an average of 1.05 tonnes of maize, representing a collective income **loss of R167,802** for 2018 at that year's prices.

Income lost due to the drop in yields

The annual crop income before mining was R398,492, with maize alone generating R208,077. After the mine commenced operations, of the 62 respondents of the 115 (54%) who had previously sold crops, 43 of them (69%) were now unable to do so, leaving only 19 respondents (31%) who were still able to sell crops. When asked to estimate the cumulative losses incurred since the mine opened, this 43 calculated that they had lost a cumulative R8 168 001 in income since 2007 by 2018. Respondents who had previously sold surplus crops to their neighbours reported a cumulative income loss of R8,940,630. If these were mutually exclusive categories, the cumulative loss in crop income from the mine opening to 2018 would be R17,108,631, or **over R17.1 million**. However, given the separate unit volumes per crop given in the surveys we estimate that to add these would involve double counting, so we will use the conservative lower R8,168,001 value, or **nearly R8.2 million**.

Livestock numbers lost

The total livestock before mining was 7,574 animals, and after mining this dropped to 2,643 through death and grazing losses, representing a **65% decline**. This figure includes the loss of 1,244 cattle (from 1730, singularly a 72% loss), 1,447 goats (from 2273, a 64% loss), 2,016 chickens (from 3,258, a 62% loss), 164 sheep (from 220, a 75% decline) and 60 pigs (from 93, a 65% loss).

Cattle losses

82 respondents reported owning cattle before the mine, although only 73 respondents assigned monetary value to them of R14,195,600. The onset of mining caused this value to plummet to R4,376,900, a loss of R9,818,700 or 69%, or **over R9.8 million**. On average each affected household lost 15 cows.

Monetary value of all livestock loss (2007–18)

The value of all categories of livestock held before mining was R17,439,519, or over R17.4 million. After mining-related losses the value of livestock fell to R5,549,181, a **total loss of R11,890,338, or nearly R11.9 million**. It represents an average loss of R51 251 per household for livestock alone.

This amount substantially exceeds the total compensation of **R3,648,301** (Table 10) paid by the mine to respondents *for everything*, leaving an uncompensated gap of **R8,242,037**. In sum, the total mine compensation – *for everything* – only represents 30.7% of immediate livestock losses.

Houses and rondavels

The sampled households owned 436 rondavels before the mine, but this declined to 318 as the mine intensified its operations, a loss of 118. Houses decreased from 360 to 274 a loss of 86. Together all properties declined from 796 to 592, a loss of 204 structures.

Cultural, ecological, and social losses

Mining caused severe non-monetary losses, including destruction of graves, loss of spiritual relationships with land, contamination of water, increased illness, and erosion of cultural practices. These do not lend themselves methodologically or ethically to easy quantification, but the harm should not be qualitatively underestimated.

Indigenous plants

Access to 15 important indigenous plants used for food and medicine has been disrupted by the mine, adversely affecting health and wellbeing.

In addition, households have suffered *from impaired water access* – generating at least R46 388 in costs to buy water, *adverse health outcomes* (which are largely unmitigated) and have had *little response or mitigation when filing complaints* with the mine.

Losses of livestock and crops over time

Future livestock losses (20-year projection)

When households lost livestock at the time the mine opened, or shortly after, they also lost assets that would have generated value into the future. Under the corrected species-specific herd-growth equations, the projected 20-year endpoint herd is **4,823 cattle, 16,936 goats and 1,879 sheep**, giving a combined projected herd of **23,638 animals**. These figures use the stated reproduction, mortality and offtake assumptions and apply the annual growth factors consistently over the projection period.

Projected monetary value and loss (20 years, 2018–38)

We modelled future livestock losses from 2018 to 2038, using the animals lost as the baseline, and then applying detailed herd-growth equations. At the 20-year endpoint, the projected market value of the lost livestock, albeit that they are counterfactual, is **R73,625,730**, or approximately R73.6 million, using the constant 2018 average prices reported by respondents. This is for cows, goats and sheep and does not include pigs and chickens.

Future maize loss (2018–28)

The study projected the financial losses associated with an annual maize yield loss of 73.7 tonnes recorded in 2018, based on maize price forecasts provided by the South African Grain Information Service. Across the 2018–28 horizon, the 11 annual observations sum to a projected financial loss of R3,087,855.33, or **approximately R3.09 million**. This was made up from the R167,802 actual loss in

2018 (base year) added to a projected R2,920,053 for the next 10 projected years.

The compensation gap

Total quantified losses (2007–18)

Estimates of monetary losses suffered by our respondents from when the mine opened in 2007 to the survey in 2018, include **R11,890,338** for livestock, **R8,168,001** from crops, and **R60,600,000** for land. Restrictions in accessing water amounted to **R46,388**. The overall cumulative financial losses amounted to **80,704,727** (see Table 11).

Total quantified losses (2007–38)

Adding these immediate losses to the projected losses from livestock (2018 to 2038) and the ability to grow maize (2019 to 2028) gives us an aggregate loss figure of R157,249,902 or **over R157.2 million**. *Recalling*, we estimated to 2018 that land loss was **R60.6 million**, while crop and livestock income losses were **R8,168,001** and **R11,890,338** respectively, losses associated with losing water access were **R46,388**, and that projected maize (2019 to 2028) and livestock (to 2038) losses were **R2,920,053** and **R73,625,730** respectively. There is no future loss number associated with land *per se*, ecosystem services, water, indigenous plants, or to the other assets and cultural aspects of livelihood included here.

Component	Amount
Land loss in 2018	60,600,000
Crop-income loss 2007 to 2018	8,168,001
Immediate livestock loss to 2018	11,890,338
Restricted access to water (buying water) to 2018	46,388
Projected maize loss (2019–38)	2,920,053
Projected livestock stock value	73,625,730
Corrected aggregate quantified loss	R 157,250,510

Long-term losses (20-year projection, 2018–38)

The projected losses over 20 years are R157,250,510 or **over R157 million**. Of course, these losses will continue in perpetuity, unless and until mine rehabilitation occurs and new livelihoods are provided. Negligible mine rehabilitation has currently occurred.

Compensation paid by Tendele Mine

Some compensation was paid when, for example, households were forced to move their ancestors' graves. But only 25 households, or 22%, received any compensation, 58% received none, and the remainder did not reply to the survey.

Total compensation paid

The total compensation paid by the mine to the mine-affected households in this survey **was R3,648,301**. The immediate losses (2007–18) estimated using this asset-based livelihoods approach to loss and damage total **R80,704,727**. The compensation provided by Tendele Mine appears clearly inadequate, falling short by **R77,056,426**. At the lowest estimate (given that we have some households who did not disclose) **this means that**

the mine paid just 4.7% of the immediate losses. This excludes all the projected losses and is the immediate shortfall in compensation based on the (inadequate) willing-buyer/willing-seller methodology.

Total compensation gap (2006–38)

We projected losses into the future, to illustrate the longevity of the effect of mining to this proximate community. Projecting maize loss by 10 years and herd loss to 20 (giving **R76,545,783**) gives a total loss figure of **R157,250,510 meaning the mine has paid just 2.3% of projected losses** (and no terminal value)

Conclusion

Somkhele Coal Mine has caused severe and ongoing loss and damage to the 115 mine-affected households which make up our survey. They are part of a broader community, and this pattern is expanding and continuing. The effects of the mine are that the asset-base of the livelihoods the community members previously owned, and their cultural and spiritual relationship to place, have been largely destroyed, with near legible compensation, and with future adverse effects to the income streams and lives they would otherwise have had.

Legal and governance implications

Mines in South Africa are legally bound by the Constitution and by the relevant mining and Environmental Acts. The inadequate compensation and lack of rehabilitation detailed here are in contravention of these, and irreconcilable to the duties of care that the Government of South Africa is mandated to provide for its citizens. We plead as strongly as we can that the government engage with Tendele Coal Mining (Pty) to ensure that the affected families are duly compensated, effective remedies are identified and implemented, and that adequate rehabilitation is conducted without further delay.

Afterword

Climate loss and damage from Tendele's Scope 3 Emissions (2007–25)

There is also a wider aspect of the damage caused by the mine in terms of the social and economic costs of the carbon emissions generated once the output of the mine is burned, in the context of human-induced climate change. We can estimate the total climate damage from 2007–17 at **over \$24.85 billion** in damage from the resulting CO₂ emissions. In early 2025 Rand terms (R17.6/\$), that aggregate cost is nearly **R437 billion (or R39.7 billion/year for 2007–17)**.

We estimate that an additional 4.8 million tonnes was produced up to 2025, creating 11.5 million tonnes of CO₂ emissions, at a time emissions costs were escalating (from \$1,102/tonne in 2017 to \$1,584/tonne in 2025). Damage would be in the range of \$14 billion (approximately **R250 billion**), for 2018–25. Together, for the life of the mine from 2007–25, with these very rough assumptions for 2018–25, we can estimate an historic damage amount in the order of **R687 billion** (R437 plus R250), **or \$39 billion**.

Local climate impacts

While these damages are found in transboundary pollution, it is also possible to see how climate change is also already affecting this part of KwaZulu-Natal itself, in the severe climate-amplified drought (2014–16) worsened by mine water extraction and contamination.

Climate compensation

Under South Africa's polluter-pays principle (NEMA), Tendele can be held liable for climate-related loss, ecological degradation, and financing a Just Energy Transition for affected communities. This is also a form of loss and damage that is currently unpaid.

1. Introduction

This report concerns Somkhele Coal Mine which has seriously impacted its surrounding community since 2007. In this introductory section we will introduce the mine, the community and its demographic characteristics and the methodology for assessing the loss and damage it has experienced.

Section two will then map the types of assets owned by households prior to, during and after mining activities. It further examines community 'loss' in the context of coal mining, drawing on both quantitative data and respondents' narratives to analyse the depreciation of value in assets such as housing, livestock, and land. Beyond monetary and financial valuations, this section theorises 'value' and 'loss' in broader social, cultural, and ecological terms, exploring how disruptions to cultural practices, spiritual relationships with land, and everyday interactions with nature constitute profound yet often unrecognised forms of loss. It situates the Somkhele findings within the broader literature on extractivism, environmental justice, and political ecology, highlighting how mining governance reproduces a much-depreciated valuation of assets and livelihoods in rural communities, as compared to the real costs that we have made visible using this methodology.

Section three extrapolates these asset losses over time, showing how the loss of an asset destroys the future incomes that would have accrued to its owner.

The final section four conducts a comparative analysis of the loss and damages we found, using this asset-based livelihoods approach, with the actual payments made by the mine. To undertake this analysis, the study further

examined past compensation claims and settlement records in relation to the time elapsed between the opening of the mine and the surveys conducted in 2018.

Somkhele Coal Mine

Somkhele Coal Mine is an opencast metallurgical anthracite and coal mine owned by Tendele Coal Mining (Pty) Ltd. It is situated approximately 60km north of Richards Bay and 23km west of Mtubatuba along the R618 provincial road between Mtubatuba and the Hluhluwe-iMfolozi Park, near the town of Somkhele in the KwaZulu-Natal province. The mine is made up of a number of mining areas extending across several villages (referred to as the 'Somkhele community') in the Mpukunyoni Traditional Authority Area, which in turn falls within the Mtubatuba Local Municipality. This is a Category B municipality situated in the south-eastern corner of the uMkhanyakude District along the northern coastal belt of KwaZulu-Natal, roughly 200km north of Durban and 55km north of the Richards Bay/Empangeni metropole along the N2 National Route. The Mpukunyoni area has an estimated population of 180,000.

Tendele started mining in Somkhele in 2006 in Area 2 under an old order mining right granted in 2003, and an Environmental Management Programme (EMP) approved in 2005. This right was subsequently converted to a new order mining right in February 2011 and an amended EMP approved. A further two amendments to the EMP for additional processing plants in Area 2 were approved in 2012 and 2013. Mining operations are reported to have ceased in Area 2 in January 2012 due to the depletion of anthracite reserves.

Table 1: Tendele's mining rights and approved EMPs

Mining area	Type	DMR reference	Year of approval
Area 2/3	Old Order Mining Right	KZN 30/5/1/2/2/216 MR	2003
Area 1	New Order Mining Right Addendum 1	KZN 30/5/1/2/2/135 MR	2007
Area 2 Conversion	Conversion of Old Order to New Order Mining Right	KZN 30/5/1/2/2/216 MR	2011
Area 2	Amendment to Area 2 EMP Include 2nd washing plant and calcining plant and fuel storage	KZN 30/5/1/2/2/216 MR	2011
Area 2	Addendum to Area 2 EMP to include 3rd washing plant	KZN 30/5/1/2/2/216 MR	2012
Luhlanga (Area 8) & KwaQubuka (Area 9)	Section 102 EMP amendment	KZN 30/5/1/2/2/216 MR	2013
Area 4 and 5 (Emalahleni, Ophondweni, Mahujini)	Mining Right for Area 4 and Area 5 and EMP	KZN 30/5/1/2/2/10041 MR	2016
Luhlanga Box Cut 0	Addendum to EMP to include Box Cut 0	KZN 30/5/1/2/2/216 MR	2020

Source: Ecofluence Consulting, 2023: Environmental Management Programme Audit Report, Somkhele Anthracite Mine, Mtubatuba Municipality, KwaZulu-Natal

The Mining Right for Area 1 was granted in May 2007, with the approval of the associated EMP in June 2007. Tendele started mining in Area 1 in July 2007, and reserves were exhausted sometime in 2021. In March 2013, the Mining Right for Area 2 was amended to include Luhlanga (Mining Area 8) and KwaQubuka (Mining Area 9) following the approval of the amendment of the EMP in May 2012. Mining commenced shortly thereafter first in Luhlanga and then KwaQubuka. Approval was granted to extend operations at Luhlanga in July 2020 and mining operations ceased during mid-2022.

A third Mining Right, for Areas 4 and 5, was awarded to Tendele on 31 May 2016 and its EMP approved on 26 October 2016, but these decisions were declared invalid by the Gauteng High Court on 4 May 2022, although not set aside and were sent back to the Minister to redetermine the appeal following a new consultation and EIA process. At the time of this study the appeal process was still pending although Tendele had already started mining at Emalahleni in May 2024 and started preparatory activities, including the clearing of indigenous vegetation, in Opondweni in January 2025. These mining rights are summarised in Table 1.

Of the three mining rights that Tendele holds, the two that pertain to the study area are the rights for Areas 1 and 2, and Luhlanga (Area 8) and KwaQubuka (Area 9), which are expansions of Area 2, as shown in Figure 1. Although Mining area 3 is depicted in Figure 1, it has not been mined.

Mining areas 1 and 2 (and the expansion of Area 2 of Luhlanga and KwaQubuka) are recorded in the following Google Earth images (Figures 2–4), of before the mine (2003), at the time of the surveys being recorded (2018) and now. They show aerial views of the significant damage that has been caused to the landscape of Somkhele and the surrounding villages by the operations of the mine since 2006.

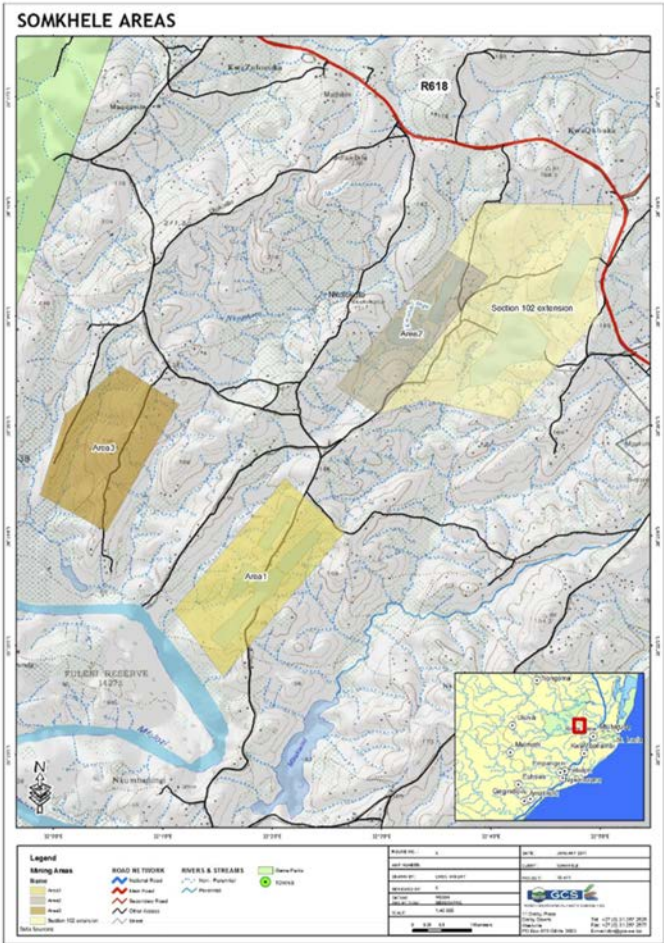
Notably, the extent of the loss and damage calculated in this study is not a full measure of the total damage caused by Tendele’s mining in Mpukunyoni to date. However, notwithstanding the study’s focus on the areas already mined, the estimates presented in this study are also applicable to the villages affected by Tendele’s new mining areas under its third mining right for Mining areas 4 and 5 where mining is currently occurring or will occur, and any other communities similarly affected in the region.

The three figures below show the expansion of the mine, from its original agricultural state in 2006, to 2018, when our surveys were collected, through to today in 2026.

The demographic characteristics of the surveyed Somkhele households

There are 115 households who completed the questionnaires in 2017 and 2018, and this dataset is the foundation of this study, which takes that data and

Figure 1: Google earth picture of Somkhele



Source: GCS Water and Environmental Consultants (2011)

Figure 2: Somkhele mining area in 2003



constructs measurements of loss and damage. The 115 households were situated close to Tendele's Somkhele Coal mine (specifically Areas 1, 2, 8 and 9 (KwaQubeka) and have been directly impacted by its coal mining activities.

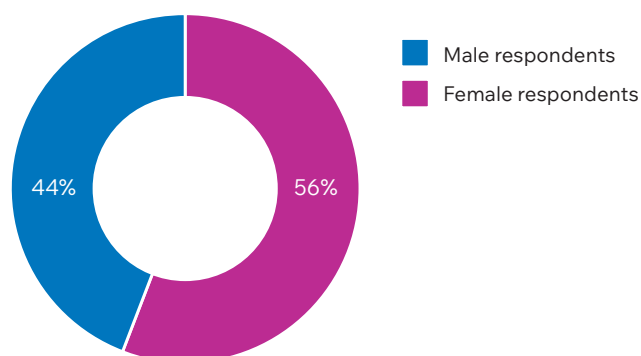
The survey covered 115 households, each representing a distinct homestead unit. Households are largely multi-generational, often comprising adults, children, and extended kin.

Gender and age distribution in Somkhele

The gender distribution of respondents indicates a relatively balanced sample, albeit with a modest skew towards female respondents. As illustrated in Figure 5, female respondents comprised 56% (64 respondents) of the total sample, while male respondents accounted for 44% (51 respondents). This slight overrepresentation of female respondents may suggest a prevalence of female-headed households or South Africa's rural socio-economic dynamics where men are absent due to migrant labour.

Figure 6 demonstrates that the largest proportion of respondents were in the 50-59 age category making 34% (38 respondents) of the sample. Within this age category, male respondents contributed a substantial proportion of 19% (22 respondents) to the total sample size while female respondents constituted 14% (16 respondents). The 60-69 age group followed, constituting 29% (33 respondents) of the sample size. Female respondents are overrepresented

Figure 5: Household gender distribution



in this age group contributing to 14% (16 respondents) of the sample population, while their male counterparts comprise only 6% (7 respondents). The 30-39 and 40-49 age group represents a small proportion of the sample size contributing 13% and 15% respectively. Within the 30-39 age category, female respondents dominated males by more than half accounting for 10% (11 respondents) of the sample size, while male respondents constituted 3% (3 respondents). There was less representation of respondents within the 0-29 and 80-89 age group with 5% (6 respondents) and 3% (3 respondents) comprising the sample size respectively. Accordingly, female and male

Figure 3: Somkhele mining area in 2018



Figure 4: Somkhele mining area in 2026

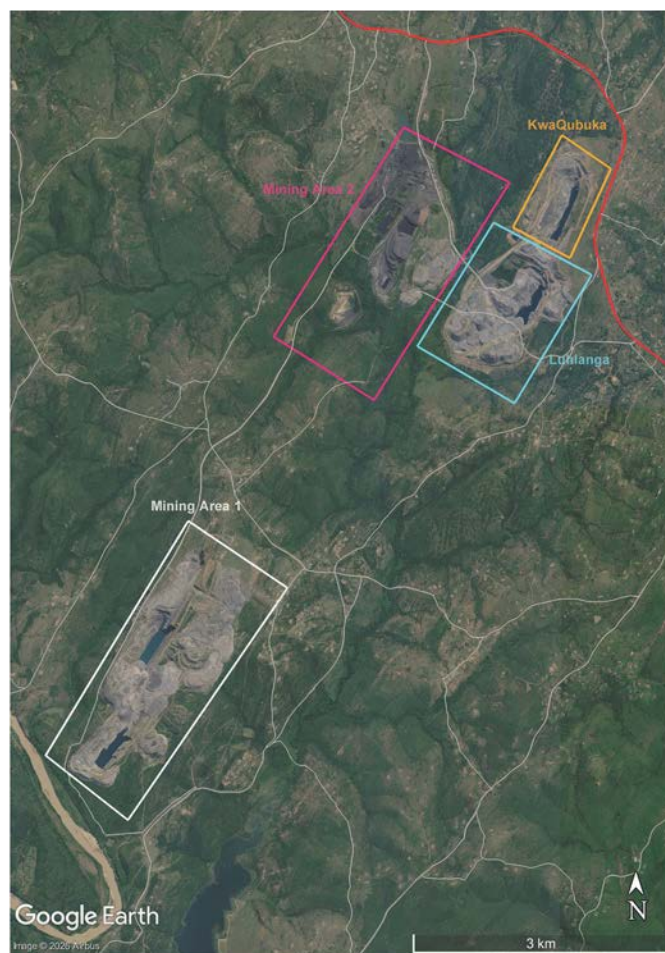
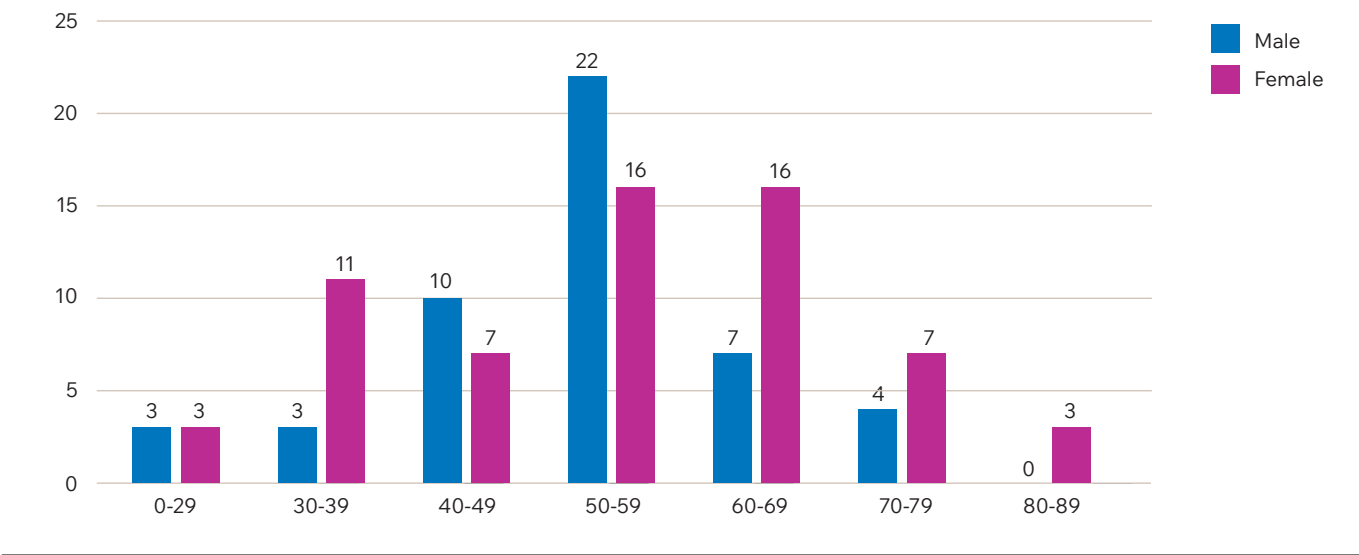


Figure 6: Age distribution by gender



respondents were equally represented within the 0-29 age group both comprising 3% of the sample size. Similarly, within the 80-89 age group female respondents also constituted 3% of the sample, while no male respondent was recorded in this category.

Family structure

As noted in this section, the household of Somkhele family structures are multi-generational, comprising grandparents, parents and children living together. In addition, families also include additional members of the extended kin indicating that they tend to be larger than average families. For instance, across the 115 families that were surveyed, a total of 717 were recorded translating to an average of six children per household. Furthermore, an additional 118 extended family members were recorded. When combined with the number of children, this brings the total number of dependents and extended family members within households to 835, resulting in an average of seven individuals per household. It is worth noting that family structures in Somkhele are likely to shape how households respond to poverty shocks arising from livelihood disruptions linked to coal mining. The relatively large average household size suggests a higher dependency burden, which may place significant strain on household well-being. Indeed, a study by Anakpo and Kollampambil (2023) on the relationship between family structure and household wellbeing in South Africa found that large, multi-generational, and extended families have significant negative relationships with household income and consumption.

Methodology for loss and damage measurement

This report presents, discusses, and analyses data collected from a sample of 115 households that experienced loss and damage in its multiple and intersecting forms as a result of mining activities in Somkhele, KwaZulu-Natal from 2007 to 2018. In analysing the data, an *asset-based livelihoods approach* was employed to quantify household-level loss and damage arising from mining activities (Bracking and Chibvongodze,

forthcoming). This approach estimates total household losses by aggregating the value of damage across a range of physical assets, including land, housing and other infrastructure, livestock, and agricultural production, but not as a one-off loss, but *over time* as a consequence of the person losing the derivative income streams that would normally derive from holding the assets. This approach is closer to the reality experienced by those affected, and incorporates a deeper element of justice than do mainstream loss and damage assessments and the common practice of one-off pay-outs by mines (Bracking and Chibvongodze, forthcoming).

Asset-specific measurements were developed for each category of loss – buildings, animals, crops etc – to provide the most accurate representation of the losses experienced by affected households, and how these aggregate over time. For example, the study not only quantified the collective loss in crop production reported by respondents but also estimated the monetary value of these losses using prevailing market prices up to 2026. This approach enabled both the physical and economic dimensions of crop losses to be captured, thereby providing a more comprehensive assessment of the impacts on household livelihoods. Where direct market values were unavailable, carefully justified assumptions were applied to construct an accurate measurement protocol. These assumptions are all explicitly and transparently explained. For example, the value of land was estimated using market prices of comparable plots for sale nearby based on the willing buyer–willing seller principle, while livestock values were derived from prevailing market prices for indigenous breeds.

To estimate the long-term economic implications of livestock losses, the study applies a deterministic herd growth model and equation to project the potential growth of the herds that would have existed in the absence of mining-related losses. The model projects herd growth over a 20-year period, from the baseline year of 2018 to 2038, using established demographic parameters for indigenous livestock, including calving, lambing and kidding rates, mortality rates, and annual



An indigenous fig tree (umkhiwane), Mpukunyoni (Photo credit: All Rise)

offtake rates. The projections estimate the cumulative herd size and corresponding economic value at five-year intervals. As will be shown in the third section of this report deterministic herd growth equations are used to calculate the future growth of cattle lost to mining based on the reproductive performance of the Nguni breed, particularly its expected calving rate, while equivalent breed-specific fertility and survival parameters are applied for goats and sheep. By comparing the projected herd size and value with the observed losses, the model captures not only the immediate replacement cost of livestock but also the foregone productive and economic value that households would have accumulated over time. We control for grazing capacity and herd mortality in these calculations, by modelling with established estimates of herd mortality.

Alongside the economic income losses recorded as a consequence of losing assets, this report also captures

the loss and damage to other social and livelihood related assets, such as water access, household health, and cultural and spiritual wellbeing. It was possible to quantify some of these, but not all, and the harm to communities that is purely qualitative should not be underestimated. The indicators developed, and their underlying assumptions, guided the measurements and analysis and enabled a holistic assessment of how mining has reconfigured livelihoods, including the economic, material and cultural conditions, and everyday rural life of the Somkhele communities impacted by coal mining in northern KwaZulu-Natal. To facilitate clear understanding and interpretation of the data, 189 data codes were developed to calculate the number and value of assets, based on the questions contained in the questionnaires. These asset-based indicators were then used to measure the loss and damage, across the range of assets, to these households.

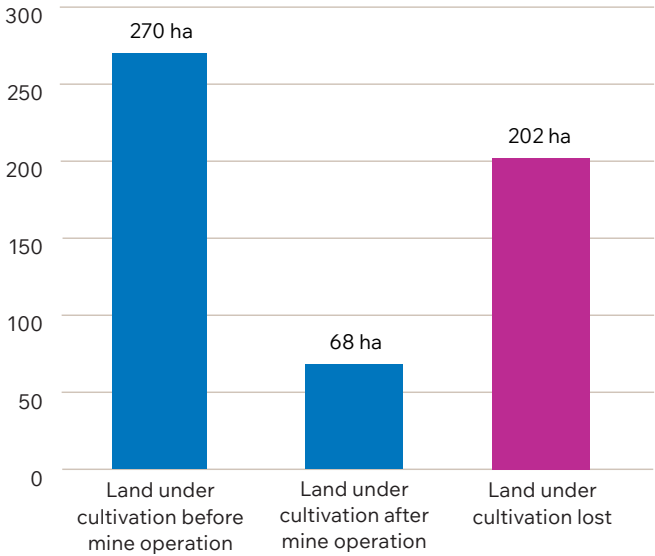
2. An asset-based livelihoods measurement of loss and damage in Somkhele

This section examines the types of assets owned by households before, during, and after the onset of mining activities. It analyses community asset losses associated with coal mining by integrating quantitative findings with respondents’ narratives to assess the decline in the value of key livelihood assets, including housing, livestock, and land. To estimate the long-term economic implications of livestock losses, the study applies a deterministic herd growth model and equation to project the potential growth of the herds that would have existed in the absence of mining-related losses. In addition to estimating monetary and financial losses, the section conceptualises value and loss from broader social, cultural, and ecological perspectives. It explores how the erosion of cultural practices, the disruption of spiritual connections to land, and the deterioration of everyday relationships with the natural environment represent significant, yet frequently overlooked, dimensions of loss experienced by affected communities.

Collective land ownership and loss in Somkhele

A total of 106 respondents (92%) reported once owning land, while 9 respondents (8%) indicated that they had no access to land. As illustrated in Figure 7, those respondents owned farmland in Somkhele collectively held approximately 270 hectares prior to the commencement of mining operations. Following the onset of mining activities, this landholding was significantly reduced to 68 hectares (25%), representing a loss of 202 hectares. This decline constitutes a 75% reduction in farmland previously available to the respondents. Like most rural societies, the community of Somkhele in rural KwaZulu-Natal depends on the land for livelihood and asset base formation. Evidence gathered from the data suggests that land functions as an important economic resource for subsistence agricultural production that sustains food security and household income generation. Subsequently, the dispossession of land reflected in the decline of its ownership is likely to heighten the community’s susceptibility to food and income insecurity due to reduced crop production. Conversely, a decrease in crop production weakens the community’s capacity to withstand poverty shocks as access to self-produced food is limited. Additionally, the reduction in land ownership dismantles the structures of subsistence rural economies, forcing communities to transition from a self-controlled food and labour system to that dictated by external market forces. This disruption of a self-sufficient rural economy exposes the community to external shocks such as escalating food prices and the precariousness of the labour market. These exposures compound the direct effects of land loss, which are, in varying degrees, the loss of access to food, hunger, increased poverty, out migration, family breakdown and loss of intergenerational wealth (Moore, 2005; Shackleton, 2020).

Figure 7: Respondents’ land ownership and loss: before and after mining operations



The impact of mining activities on land

Some respondents attributed the decline in crop production with the encroachment of the coal mine onto agricultural land. For instance, one respondent pointed out how the expansion of mining led to the loss of both her fields and the river that watered her crops. She characterised the occupation of her fields by the coal mine as akin to having her possessions taken away. She had this to say about the impact of mining on land ownership:

‘Our field was taken by the Mine and the valley where the water was coming from was taken by the mine’

(Household #59 respondent)

When asked why she ceased producing crops, another respondent stated that when the coal mine encroached onto her fields it forced her to abandon farming activities altogether. She had this to say about how the mine disrupted her lived experiences with subsistence farming: ‘Tendele Mine took our land where I used to plant crops’ (Household #21). Another respondent further highlighted how a nonconsensual occupation of the fields by the coal mine dispossessed her from accessing the grazing areas, ultimately limiting her ability to rear livestock, she recounted that:

Figure 8: One of the fields used for crop production



A field like this one shown here with melons waiting to be harvested (Photo credit: All Rise)

‘Tendele Mine took my grazing land without my consent or communicating with me or one of my family members. The mine is on our land’

(Household #20 respondents)

It is important to note that the 25% of the respondents that have retained cultivating land despite expansion of the coal mine have expressed dissatisfaction with the decline in land quality. Indeed, some respondents reported that the mining activities have contributed to soil and air pollution that has stunted crop growth, negatively impacting yields. For instance, a respondent from household #88 noted that the crops that she grows are no longer healthy like they used to be before the soil was contaminated by the coal mine. In describing how the coal mine has introduced environmental risks and disrupted food production, she lamented that:

‘The soil has been badly contaminated by the coal dust. We lost the fertile land we used to plant the crops, and this has reduced our yields...’

(Household #88 respondent)

The experiences of affected respondents in Somkhele are consistent with findings from other studies examining

the relationship between mining expansion, land dispossession, and livelihood disruption in rural contexts. For instance, in their study on the impact of platinum mining in the rural communities of Limpopo, Mnwana and Bowen (2022) argue that the expansion of mining activities in former homeland areas, while seen as a panacea to the rural unemployment problem, presents complex challenges among rural communities. These challenges manifest in community resistance to the socio-environmental risks and harms associated with mining activities that might threaten rural agricultural systems and sustainable livelihoods. Similarly, like the narratives provided by Somkhele community members, Shackleton’s (2020) study on the interaction of mining activity and rural livelihoods in Limpopo show that mining activity is a major driver of land loss in most rural areas.

Consequently, due to this land loss caused by mining, Shackleton argues that its activities have directly contributed to reduced crop production thus negatively impacting on food and income security. Moreover, he argues that rather than creating employment in vulnerable rural communities in Limpopo, mining activities have led to land degradation, dust pollution and the contamination of soil further exacerbating communities’ susceptibility to poverty, diseases and landlessness. It is therefore important for this report to further examine how land loss negatively affected crop productivity, asset accumulation (in terms of livestock ownership and loss), access to shared natural based resources such as grazing fields, wild fruits, herbs and water bodies.

Estimated monetary value of communal land and loss in Somkhele

Communal land is generally valued lower than commercial land due to formal zoning classification, which were retained as a legacy of Apartheid, in complex rural governance relationships between commercial, communal and Trust land. Due to these classifications, customary communal land is often excluded from formal land markets, resulting in official valuations that substantially undervalue its economic and social functions. Valuations of communal land often fail to capture the productive, extractive value, cultural, and livelihood functions of rural land, particularly in areas governed by customary tenure (also see Shackleton et al., 2000, Moore, 2005). In Somkhele there is indeed an absence of recorded direct market transactions – often called ‘willing buyer/willing seller’ transactions – and reliable official valuation data on land. However, the established international process for presenting land valuations, including in South Africa, is to use a definition of market value based on the amount that an asset would exchange for between a willing buyer and willing seller on the date of valuation. Conditions for this include that it is a non-coercive exchange done knowledgeably as an arm’s length transaction. Obviously, the community had a conditioned form of choice once a mining license had been granted (which limits the fit of this methodology), but assuming this methodology for valuation follows established practice. But Somkhele falls under a traditional authority and has no recorded land sales. So to assess the value of the 202 hectares of land lost by the 106 respondents to mining activities, we first use an average valuation from all land sales in commensurate neighbouring areas in 2018 (a Comparable Sales Method) and then triangulate by working backwards from selected advertised land sales in 2025, chosen for being most like the plots lost.

For this we can use Mtubatuba, the nearest formal settlement, and construct a commensurate proxy for per hectare values from 2018 sales data, particularly using Kwamsane, a low-income node. This triangulates from nearby formal markets, although we will still need to adjusting for a greater rural context. In 2018, KwaMsane erven (plots) sold for an average of about R361,000 (based on 94 recorded sales), but because those plots are so small ($\approx 200 \text{ m}^2$ or 0.02 ha), the per hectare calculation comes out at an inflated R18 million/ha. By comparison, Mtubatuba erven were larger ($\approx 500\text{--}1,000 \text{ m}^2$ or 0.05–0.1 ha) and sold for around R525,000 (based on 118 recorded sales), which equates to about R5.25 million/ha. These figures highlight how ‘urban’ plot sizes distort per hectare values. By weighting the proxies for rural context ($\approx 10\%$) and considering that Somkhele plots are typically 1–5 hectares, a reasonable proxy range emerges: R100k–R500k per hectare. For rural land under traditional authority, like Somkhele, another benchmark comes from agricultural land values in northern KwaZulu-Natal, which in 2018 averaged between R80,000 and R150,000 per hectare. However, those figures are based on commercial farms with few improvements, which tends to understate the value of land in a semi-rural settlement like Somkhele. To balance the inflated semi-urban per hectare values with the understated agricultural averages, we choose R150,000 per hectare (the top of the purely agricultural range) as a realistic estimate for Somkhele’s land value at the time of the mine compensation window, as this would

reflect the high quality of this semi-rural settlement. At this per hectare price, the 106 respondents had R40,500,000 ($R150,000 \times 270 \text{ ha}$) of land before the mine, plummeting to R10,200,000 ($R150,000 \times 68 \text{ ha}$) after, losing an estimated R30,300,000 (approx. USD1.9 mill).

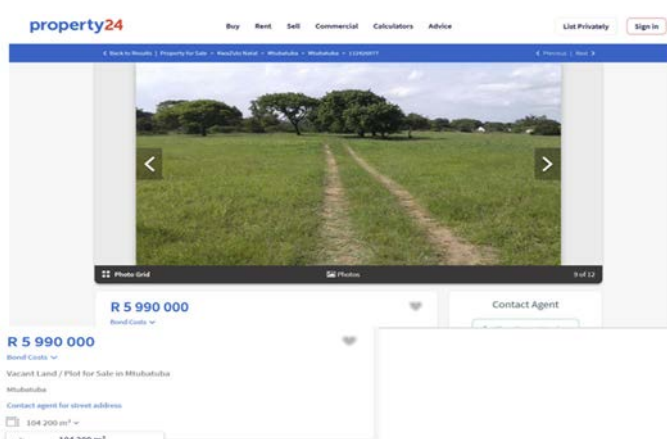
To test the validity of this estimate, we triangulate from a search of vacant land available for sale in neighbouring areas in 2026 using property listing websites such as Property24 (www.property24.com) and SA home traders (www.sahometraders.co.za), South African property listing companies, chosen to be most like those lost. The search was conducted on the 16th of February 2026 and search terms such as ‘Mtubatuba’ ‘plot’ ‘vacant land’ were used to identify the market value of underdeveloped land in surrounding areas. The findings indicate that vacant land in the neighbouring areas of Somkhele sells between R520,000 and R590,000 per hectare (see Figures 9 and 10). If we are to use the least priced of the proxies, the value of land the respondents had before mining was R140,400,000 ($R520,000 \times 270 \text{ hectares}$) and that value declined to R35,360,000 ($R520,000 \times 68 \text{ hectares}$) illustrating an estimated **loss in land value of R105,040,000** (US\$6,396,000). This figure is the value measured in early 2026. Given South Africa’s annual CPI inflation rates from 2019 through 2025 (approximately 4.10%, 3.24%, 4.61%, 7.03%, 6.09%, 4.38%, and 3.20%), the cumulative inflation between 2018 and 2025 is approximately 37.5%, making R 76,392,727, or nearly **R76.4 million in 2018 Rand**. In 2026, the former owners will not be happy that, had they kept their land, it would collectively have a proxy market value of over R100m.

While searching prices from online property listings may overstate achievable market values, it is also notable that this estimate of loss gives a per hectare value of R378k (202ha/R76.4m) in 2018, well within our original proxy range of R100k–R500k per hectare, for plots chosen as more accurate proxies. We therefore suggest that a good approximation of land loss value is $202 \text{ ha} \times R300\text{k}$ (per hectare) the mid-range point of our original full sample, giving a land loss figure of R60 600 000, or **R60.6 million**.

Crop production levels before and after mining activities among respondents

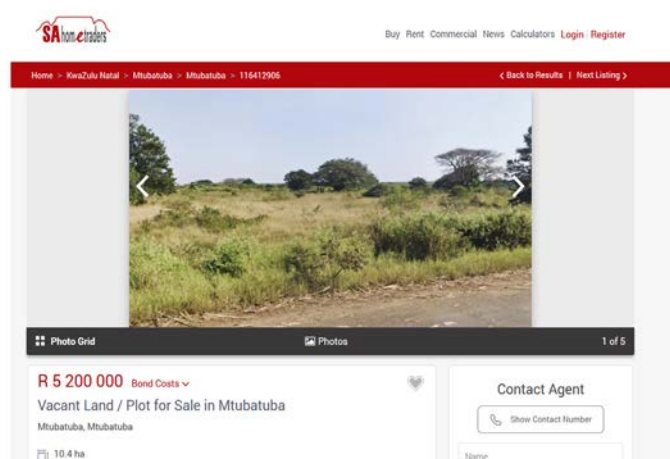
The data demonstrate a reduction in annual crop yields among the 113 households that reported producing crops before the introduction of mining activities in Somkhele, highlighting the significant impact of mining on local agricultural production and food security. Table 2 presents the crop production levels reported by respondents before and after the commencement of mining operations. Of the 113 households that reported producing crops before the commencement of mining activities, 70 households reported a collective maize yield of 76 tonnes, reflecting the crop’s importance as a staple food prior to mining. Following the commencement of mining activities, maize production declined sharply to just 2.3 tonnes. This represents a loss of 73.7 tonnes of maize production which translates to 97% of maize yields lost due to a loss of 202 hectares of cultivating land. On average, each household lost 1.05 tonnes of maize. Similarly, 19 households reported that onion production decreased from 38 tonnes before mining operations to 1.05 tonnes following the onset of mining, reflecting a

Figure 9: The value of vacant land in Mtubatuba, near Somkhele



Source: Property24 (2026)

Figure 10: Undeveloped vacant land close to Somkhele



Source: SA Home Traders (2026)

loss of almost 37 tons of onions, and a 97% loss in onion yields. Consequently, the average loss in onion yields per family is 1.9 tonnes. Potato production also experienced a substantial decline, with 13 households reporting that it fell from 3.8 tonnes prior to mining activities to 0.76 tonnes, thereafter, resulting in a loss of approximately 3 tonnes (80% loss in yields). For potato yields, the average loss per household is 0.23 tonnes. Moreover, 12 households reported that sweet potato harvests declined from 7.5 tonnes before mining operations to 1.4 tonnes after mining commenced, indicating a loss of about 6.1 tons (81% loss in yields) of produce and an average loss of 0.5 tonnes per household. The findings reflect that 20 household's spinach production declined from 7.5 tonnes prior to mining activities to 1.7 tons, thereafter, representing a loss of 5.7 tons of spinach (77% loss in yields) and an average loss of 0.29 tonnes per household. Further, 9 households indicated that before the mine operated, they harvested a total of 3.9 tonnes of beans which declined to 0.35 tonnes after the mine intensified its operations. This indicates a 91% loss in yields and an average loss of 0.39 tonnes per household.

The cumulative yield of all crops produced before the commencement of mining activities was 137 tonnes which

drastically decreased to 7.6 tons after mining operations, representing a loss of 129.1 tonnes in yields (a 94% in yield loss).

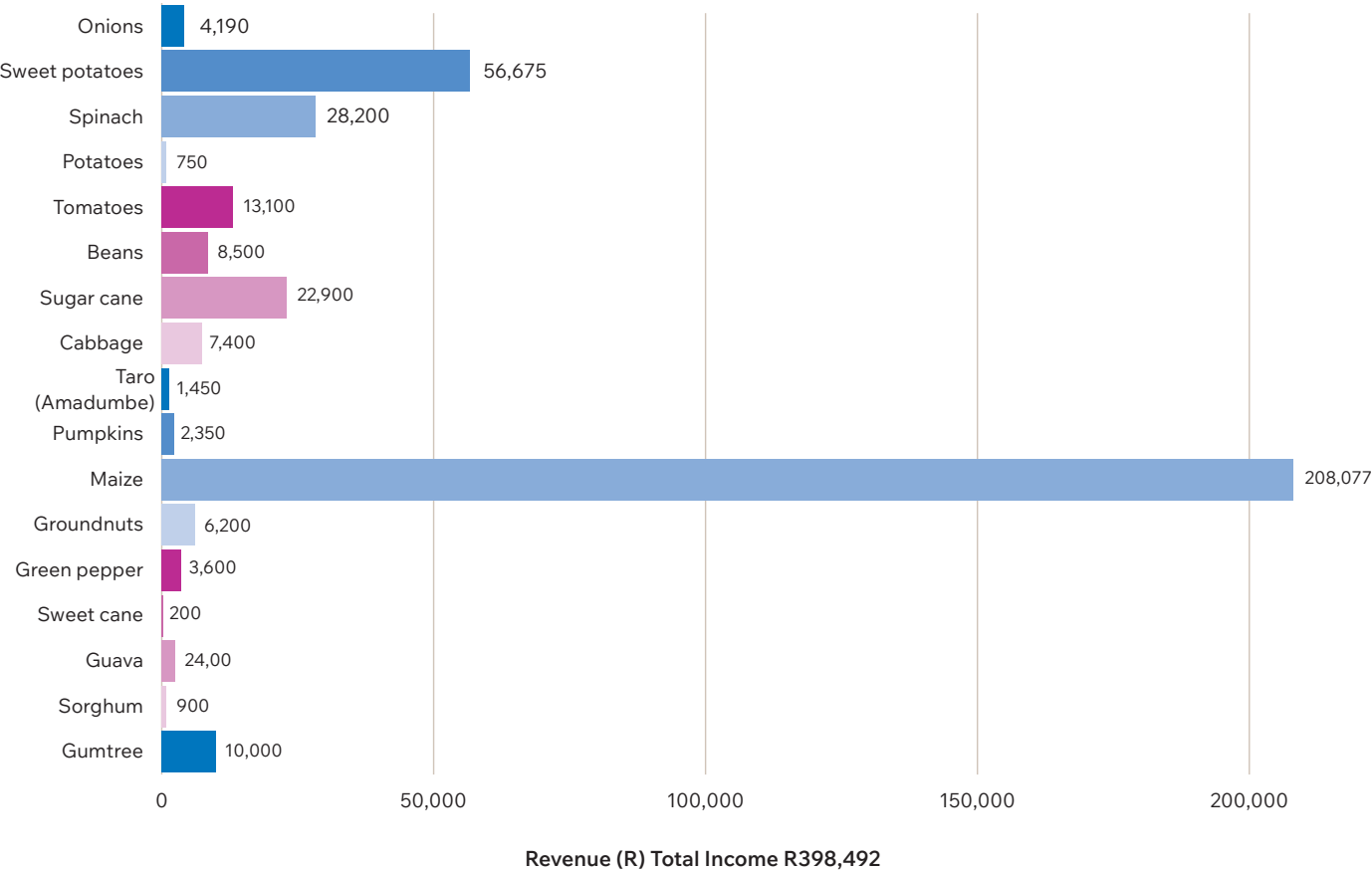
Income generated from the sale of crops and other natural resources

As illustrated in Figure 11, maize generated the highest collective income among all crops sold by respondents at the time crop sales data were collected in 2018, with total earnings amounting to R208,077. This shows the importance of maize not only as a staple food crop but also as a key source of household income. Sweet potatoes were the second highest contributor generating a collective amount of R56,675, this is consistent with their relative higher yields of 7.5 tons. With a yearly yield of 6.1 tons, spinach also contributed significantly to households' income, contributing R28,200 per year. Moreover, Somkhele's low veld and subtropical climate support the thriving of sugar cane and guava trees, enhancing their income generating potential. Resultantly, sugarcane and guava contributed significantly to the household income, earning households a collective amount of R22,900 and R24,000 respectively. Additionally, the cultivation of tomatoes occupies a critical role in replenishing household income streams, generating an annual income of R13,100.

Table 2: Crop production, before and after mining operations

Crop	Yield before mining (kilograms)	Yield after mining	Yield net loss	Loss in percentage	Number of households reporting crop yield	Average loss per household (kilograms)
Maize	76,000	2,300	73,700	97%	70	1,053
Onions	38,000	1,052	36,948	97%	19	1,945
Potatoes	3,798	760	3,038	80%	13	234
Sweet potatoes	7,500	1,400	6,100	81%	12	508
Spinach	7,547	1,755	5,792	77%	20	290
Beans	3,905	350	3,555	91%	9	395
Total	136,750	7,617	129,133	94%	–	1,142

Figure 11: Yearly income generated from cultivated crops in 2018



Non-food natural resources such as gumtree which is commonly used for timber also contribute a considerable amount to households. According to the data, the sale of gum tree timber by one particularly household generated a yearly income of R10,000. Furthermore, the sale of beans, cabbage and groundnuts were regarded as equally important in sustaining household income, generating an income of R8,500, R7,400 and R6,200 per year respectively. In contrast, crops such as onions, potatoes, taro (amadumbe), pumpkins, green pepper, sweet cane and sorghum generated lower monetary returns amounting to R4,190, R750, R1,450, R2,350, R3,600 and R900 per year respectively. The collective income generated from the sale of crops was R398,492 before the mine.

Decline in the ability to sell crops and cumulative income loss

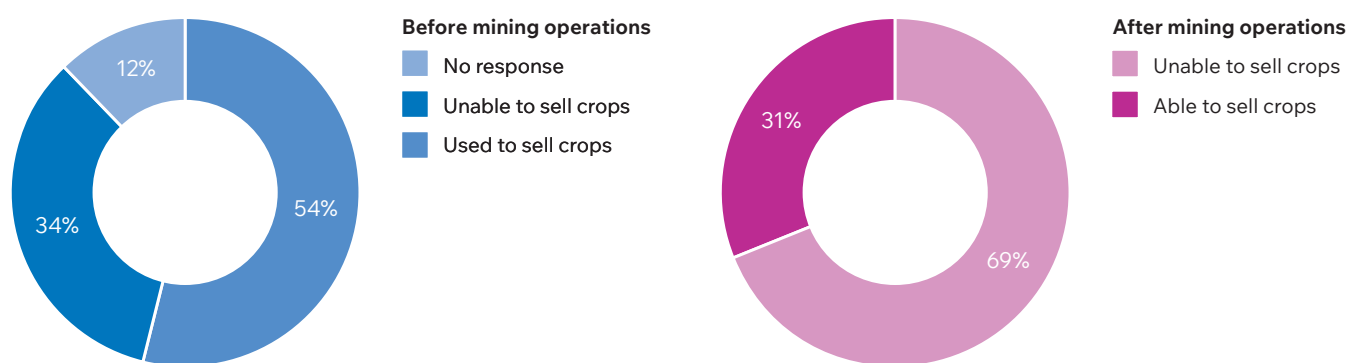
Although the collected data shows that crop production by respondents generated a collective income of R398,492 before the mine, the prolonged disruption of farming activities due to mine operations has resulted in far greater cumulative losses in the community’s capabilities to generate income from selling crops. The evidence gathered from the data indicates that the establishment of coal mining operations not only directly reduced crop yields but also diminished the income generated from agricultural production. As illustrated in Figure 12, of the 115 respondents, 62 respondents (54%) indicated that they used to sell crops prior to mining activity. In contrast, 39 respondents (34%) stated that they never sold crops

before mining commenced, while 14 respondents (12%) did not provide responses. Of the 62 that previously depended on selling crops for income only 19 respondents (31%) replied that they were still able to do so, meaning that 43 respondents’ (69%) ability to sell crops was disrupted by the mine. When asked to estimate the cumulative losses that they had incurred since the coal mine arrived, these 43 calculated that they had lost a cumulative amount of R8,168,001. Respondents who had previously sold surplus crops to their neighbours also reported a cumulative income loss of R8,940,630. If these were mutually exclusive categories, the cumulative loss in crop income from the mine opening to 2018 would be R17,108,631, or **over R17.1 million**. However, given the separate unit volumes per crop given in the surveys we estimate that to add these would involve double counting, so we will use singularly the lower R8,168,001 value, or **nearly R8.2 million**.

Conditions that contributed to the plummeting of crop revenues

Respondants identified a myriad of conditions that have directly contributed to the decline of crop productivity and sales. Chief among these were loss of land, pollution associated with mining activities, water shortages, and the prevalence of drought conditions in the are partly contributed to by excess water use on the part of the mine. These conditions have effectively contributed to the decline in crop productivity and ultimately affected households’ ability to cope with food insecurity and generate income.

Figure 12: Ability to sell crops after and before mining operations



Loss of land

Regarding landlessness caused by mining activities, respondents identified that the loss of farming land is the primary reason they discontinued crop production. For instance, when asked why they no longer cultivate and sell crops, one respondent from Household #19 who previously generated an annual income of R5,000 from crop sales explained why she ceased producing crops:

‘Tendele Mine took our land where I used to plant crops’

(Household #19 respondent)

Similar sentiments were expressed by a respondent from Household #106, indicating that the reason she abandoned farming activities is because the mine displaced her from the farms she once owned. She stated that her fields were converted into a road to facilitate the movement of mine dump trucks, lamenting, ‘they took all of my land to do their roads’. Consequently, she estimated a cumulative income loss of R150,000 linked to the dispossession of her ploughing fields. A respondent from Household #93 highlighted that displacement from his fields significantly worsened his already precarious situation since he is unemployed:

‘...they took all my ploughing fields and turned them into a mining area, and they did not even employ me’

(Household #93 respondent)

He explained that the loss of land effectively meant that his ‘livelihood was taken away’ noting that he had previously produced a yearly yield of sugarcane valued at R6,000. The respondent further expressed his frustration that despite losing his land and main source of income, the mine failed to offer him employment at its premises (Household #93, quote above).

Water scarcity and drought

Water scarcity and drought emerged as important factors identified by Somkhele community members as contributing to the disruption of crop production and sales. While the respondents noted that water scarcity

has been directly induced by extreme drought and changes in climate conditions, they also argued that the coal mining activities that rely on intense water utilisation have worsened existing water scarcity. For instance, one respondent from Household #112 stated that his decision to abandon farming was largely driven by water shortages caused by coal mining. He noted that the stream that previously irrigated his fields had been fenced off by the mining company making it inaccessible to the community. When asked whether he still produces crops for sale, he stated, ‘We have shortage of water and some of the streams have been fenced off by the mine’ highlighting how the respondents have not only been dispossessed of the land but other crucial resources such as water bodies. Similarly, a respondent from Household #65 asserted that the mining activities at Somkhele have exerted pressure on water resources, intensifying the water scarcity in a community already vulnerable to the impacts of climate change. She argued that, because of drought and mining operations Somkhele now ‘...has no water and the little that we have is becoming scarce’, negatively affecting her ability to generate income from farming. Indeed, according to the respondent, water scarcity and drought have led to substantial financial losses, estimating a reduction of R50,000 in revenues previously earned from crop sales.

Pollution and contamination of soil

The respondents further attributed the plummeting of crop production and sales to soil pollution and infertility caused by the coal dust. They argued that the emissions and dust from the coal mines have infiltrated and degraded the soil, thereby negatively affecting the growth of planted crops. For instance, a respondent from Household #84 explained that the dust and fumes emanating from the mine have contaminated the soil to the extent that crops can no longer grow. Reflecting on her experience with soil pollutants from the mine, the respondent noted that she is no longer able to harvest the two tons of maize she once produced, stating ‘The soil has been badly contaminated by the coal dust. We lost the fertile land we used to plant the crops...’. One respondent emphasised that the contamination expanded beyond soil to water bodies such as dams that are used to irrigate crops. The respondent explained that the use of contaminated water has had a detrimental effect on the plant’s growth. She noted that ‘the water we collect from the nearest dam is contaminated as a result when we use the water the crops

Figure 13: Goats support rural livelihoods in Somkhele



Goats walking along a dusty road in Mpukunyoni (Photo credit: All Rise)

die’ (Respondent, Household#90). Examining the interplay between mining, pollution, water and food security, Leonard (2022) argues that coal mining in Somkhele has led to the reduction of water quantity and quality which are crucial in supporting rural food production systems.

Ownership and loss of livestock wealth before and after mining operations

As shown in Table 3, prior to the commencement of mining operations in Somkhele, 82 respondents that reported owning cattle collectively held a herd of 1730 cattle. Following the onset of mining activities, this collective herd declined sharply to 486 cattle, indicating a loss of 1,244 cattle across these community members, reflecting a 72% loss of cattle. On average, each affected household lost approximately 15 cows. A similar pattern is evident with sheep ownership. Before mining began, 12 respondents who owned sheep collectively reported a total of 220 sheep. After mining commenced, this number was reduced to 56, resulting in a loss of 164 sheep and an average loss of 14 sheep per household. This represents a 75% decline in sheep numbers, indicating that sheep experienced the highest reduction among all livestock categories. A total of 96 respondents collectively owned 2,273 goats before mining operations began. With the expansion of mining activities, the collective goat herd declined to 826, reflecting a loss of 1,447 goats, representing a 64% loss. As such the average loss per household is 15 goats.

Likewise, poultry ownership experienced a substantial decline of 62%. Before mining, 82 households that owned chickens collectively reported 3,258 chickens. Following the commencement of mining, this number decreased to 1,242, indicating a loss of 2,016 chickens. On average, each affected household lost approximately 25 chickens. Additionally, before the mine began its operation, 5 respondents had a collective ownership of 93 pigs which were later reduced to 33 indicating a loss of 60 pigs (65% loss). On average, each household lost 12 pigs. The cumulative ownership of livestock before the coal mine operated was 7,574 which reduced to 2,643 with after mining operations indicating a significant loss of 4,931 livestock and collective loss of 65%. On average the collective loss of livestock per household is 18.

The livestock’s monetary value and loss before and after mining operations (2007–18)

Table 4 below compares the monetary value of respondents’ livestock before and after the commencement of mining operations in 2007 and at the time the data was collected in 2018. The data illustrate that the reduction in livestock ownership following the onset of mining activities resulted in significant financial losses for the respondent households. While 82 respondents reported having owned cattle before mining operations commenced, only 73 respondents assigned monetary value to the cattle owned. As indicated in Table 4, the collective monetary value assigned to cattle by the

Table 3: The number of livestock and average of livestock loss, before and after mining

Herd	Before mining operations	After mining operations	Net loss	Loss in percentage	Number of households reporting livestock ownership	Average loss per household
Cattle	1,730	486	1,244	72%	82	15
Goats	2,273	826	1,447	64%	96	15
Chickens	3,258	1,242	2,016	62%	82	25
Sheep	220	56	164	75%	12	14
Pigs	93	33	60	65%	5	12
Total loss of livestock	7,574	2,643	4,931	65%	–	18

Table 4: Livestock monetary value loss (2007–18)

Cumulative livestock value	Before mining operations	After mining operations	Net loss	Loss in percentage	Number of households that assigned monetary value	Average loss per household
Cattle	R 14,195,600	R4,376,900	R9,818,700	69%	73	R134,503
Goats	R2,694,900	R987,200	R1,707,700	63%	85	R20,090
Chickens	R187,799	R62,881	R124,918	67%	65	R1,922
Sheep	R209,220	R73,800	R135,420	65%	7	R19,345
Pigs	R152,000	R48,400	R103,600	68%	2	R51,800
Total	R17,439,519	R5,549,181	R11,890,338	68%	–	R51,251

respondents stood at R14,195,600 and after the onset of mining activities the value plummeted to R4,376,900 indicating a loss of R9,818,700 (69% loss). The average monetary loss among households that reported cattle ownership is R134,503 per household. Goats also constituted a significant asset category, with 85 of the 96 respondents owning goats reporting a collective value of R2,694,900 before mining operations commenced. The value of goats declined to R987,200 showing a R1,707,700 loss in value (63% loss) and an average loss of R20,090 per household.

While chickens were individually of lower economic value, they were widely owned across households. Before commencement of mining operations, 65 of the 82 respondents that chicken ownership reported a collective value of chickens to be R187,799. Following the onset of mining, this value declined markedly to R62,881, representing a loss of R124,918 (67% loss) and an average loss of R1,922 per household. In contrast, sheep ownership was less widespread but the total value among 7 of the 12 households that reported sheep ownership was comparatively higher, amounting to R209,220 before mining. This category also experienced significant financial losses, with the value decreasing to R73,800 after mining began, reflecting a reduction of R135,420 (65% loss) and an average loss of R19,345 per household. While the total value of pigs owned by the 5 respondents before mining activities, only 2 respondents assigned monetary value to their pigs which stood at R152,000,

the loss was comparatively high. The value dwindled to R48,400 pointing to a R103,600 loss (68% loss) with an average of R51,800 per household. Taken together, the cumulative monetary value of all livestock assets owned by respondents before the commencement of mining activities amounts to R17,439,519. However, with the onset of mining operations in Somkhele, the value of this livestock asset value declined to R5,549,181, contributing to a 68% loss of R11,890,338 (US\$731,827) and a collective average loss of R51,251 per household (US\$3141).

In contrast, the total reported financial loss incurred by respondents who owned livestock is estimated at R11,890,338 (approx \$0.73 million). As discussed later in this report, this amount substantially exceeds the total compensation of **R3,648,301** (Table 10) paid by the mine to respondents *for everything*. The findings further indicate that compensation payments were primarily directed towards relocation-related expenses and property damage, rather than compensating for the loss of livestock. Consequently, losses incurred by livestock owners were not adequately accounted for or compensated, leaving a substantial gap of **R8,242,037** between the value of livestock losses and the total compensation received for everything. In sum, the total mine compensation – for everything – only represents just 30.7% of the losses they caused to livestock alone. Taking the figure recorded for compensation for livestock alone) (R33,000, Table 10, section 4) takes this percentage much lower, but because the reason for compensation

Figure 14: Cattle: An important source of wealth in Somkhele



The decline in the number of cattle has translated to plummeting household income (Photo credit: All Rise)

payments was often not disclosed an accurate figure is hard to discern. This is also only the initial loss and does not include the loss of the future animals that the herds would have produced for their owners, had the assets been allowed to live longer (see section 3).

Factors contributing to the decline of livestock ownership and wealth

Most respondents attributed the decline of livestock in Somkhele and surrounding areas to mining operations which contributed to the loss of land, pollution, and land degradation. Respondents mentioned that large tracts of land that were previously used for grazing livestock were converted into a coal mining area. For instance, one respondent noted that in the past decade she has witnessed the disappearance of grazing land due to the ever-expanding mining exploration. For her, the expansion of the coal mine has meant that communities are pushed to the fringes of the mines where grazing space is scarce. When asked why her cattle herd declined from 27 to 7, for instance, she commented: 'The livestock do not have a place to graze due to mining operations. They have been on our grazing lands since 2006' (Household #20).

A respondent from Household #103 gave a similar account of how the encroachment of mining activities on community grazing lands has adversely affected livestock ownership and livelihoods. She noted that due to decades of mining coal in the Somkhele community, the lush grazing land that once surrounded the community has

been replaced by heaps of coal waste, forcing her to stop rearing cattle. She stated that: 'All the grazing land is gone; they are now using it as their dump' (Household #103).

Some respondents reported that losing grazing land forced them to sell their livestock prematurely, sometimes at a loss. Fearing competition for increasingly scarce grazing land, one respondent from Household #66 had to sell part of his herd. As a result, he sold his cattle at a reduced price of R5,000 per animal instead of the usual market price of R10,000. In addition, several respondents reported that pollution associated with mining activities, particularly dust emissions, had adverse effects on the grazing fields, consequently leading to the deterioration and death of their livestock. For instance, respondents from Household #91 and Household #111 indicated that the dust emitted from the coal mine usually settles on the grass where livestock browse. According to the respondent from Household #91 the cattle '...died soon after the mine started to operate next to us. The coal dust has been covering the trees and the grass; as a result, many cattle and goats failed to cope with their digestion'. Similarly, a respondent from Household #111 explained that when livestock, such as cattle, sheep, and goats, fed on grass with coal toxins, their health was compromised stating that 'my cattle died, and we found that the intestines were black after being affected by coal. Goats disappeared in the mining area, and some were stolen when the mine arrived'. Most cows and goats died from consuming grass covered with coal dust, as evidenced by traces of coal dust found in their intestines, another respondent from Household #76 narrated how their livestock began to die as soon as coal mining began in their communities: 'the livestock were damaged by the mine, although the mine compensated for the cattle. The cattle died, and they had coal in their stomachs. The goats had coal dust filled up in the stomach'. The recurrence of similar narratives across respondents further indicates that livestock mortality was perceived as a widespread consequence of mining activities rather than an isolated incident.

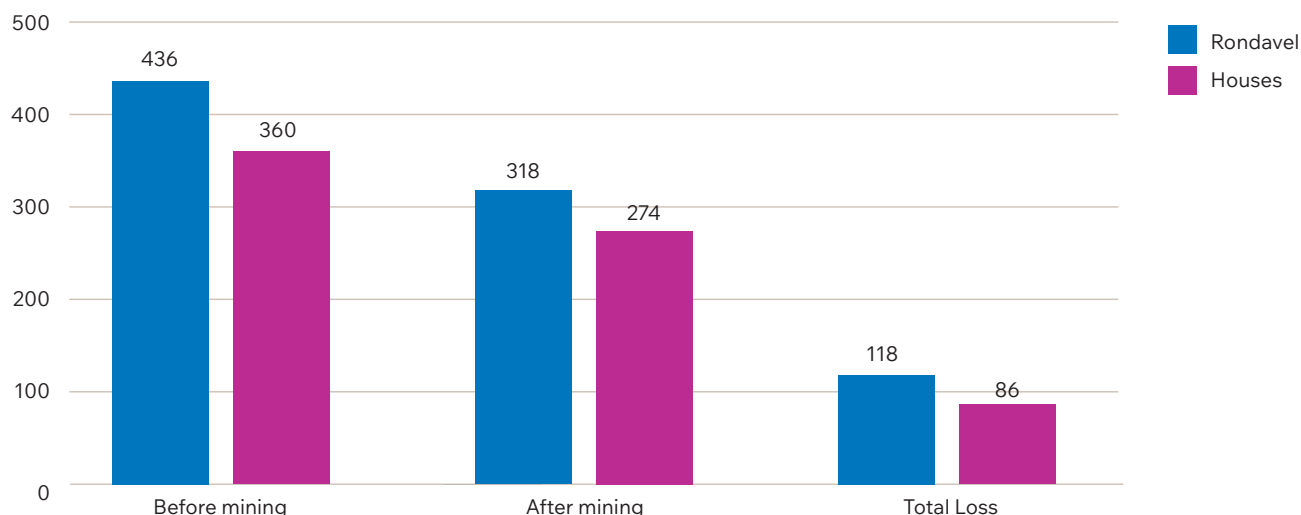
Housing and property ownership

House and property ownership is one of the important indicators used in this study to assess and quantify loss and measure loss among the community members affected by coal mining. Similar to other assets discussed in the previous section, the commencement of mining activities in Somkhele directly contributed to the loss and depreciation of houses and other properties such as kraals and storage buildings. As illustrated in Figure 15, before Tendele mine operated in Somkhele, the sampled 115 households collectively owned 436 rondavels, but the ownership declined to 318 rondavels as the mine intensified its operations, reflecting a loss of 118 rondavels. A similar trend is observed with the decline in the number of housing structures which decreased from 360 to 274 houses during mining activities, representing a loss of 86 houses. Overall, the combined number of all properties i.e. rondavels and houses declined from 796 and 592 structures, amounting to a total loss of 204 structures.

Functions and uses of structures

As illustrated in Figure 16, a total of 225 responses were recorded regarding the functions and uses of structures.

Figure 15: Property ownership, before and after mining operations



Of these, 29% indicated that properties were used as bedrooms for sleeping, while 22% reported that the properties were used as kitchens for cooking. At least 22% of the responses indicate that the properties were used as kraals for keeping animals. Approximately 15% of responses showed that structures were utilised for the storage of grains, tools, and other household items. Only a very small proportion of responses indicated alternative uses, with 1% identifying structures as garages, and just 0.44% each reporting their use as dog cabins and tuckshops.

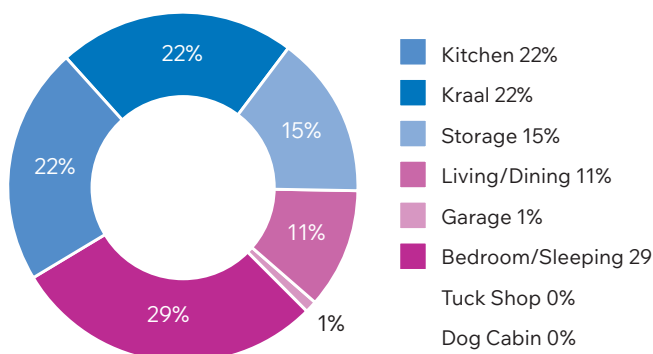
Housing dilapidation and structural damage attributable to mining activities

According to the respondents, mining activities have had a damaging impact on their properties. Respondents were asked to describe the condition of up to four structures on their properties before and after the commencement of mining operations in Somkhele. The findings indicate widespread deterioration and destruction of these structures following the onset of mining activities. The structures were categorised as Structure 1, Structure 2, Structure 3, and Structure 4, and included kitchens, bedrooms, complete houses, kraals, rondavels, and storerooms. Table 5 presents a detailed breakdown of the types and number of properties included within each of these four structural categories.

Table 5: Type of structures identified by respondents

Structure category	Type of properties identified by respondents	Total number of respondents
Structure 1	House (23), Bedroom (25), Rondavel (13), Kitchen (15), Cattle kraal (10), Living room (11), Toilet (4), Storeroom (1), Harvest structure (4)	106
Structure 2	House (19), Bedroom (15), Kitchen (17) Rondavel (19), Cattle Kraal (10), Goat kraal (2), Chicken run (1), Harvest structure (3), Storeroom (2), Living room (4)	92
Structure 3	House (16), Bedroom (14), Kitchen (4) Rondavel (8), Cattle kraal (15), Goat kraal (4), Chicken run (6), Harvest structure (10), Living room (4), Toilet (1)	82
Structure 4	House (14), Bedroom (10), Kitchen (2) Rondavel (8), Cattle kraal (9), Goat kraal (7), Chicken run (1), Harvest structure (10), Living room (4), Garage (2), Doghouse (1)	68

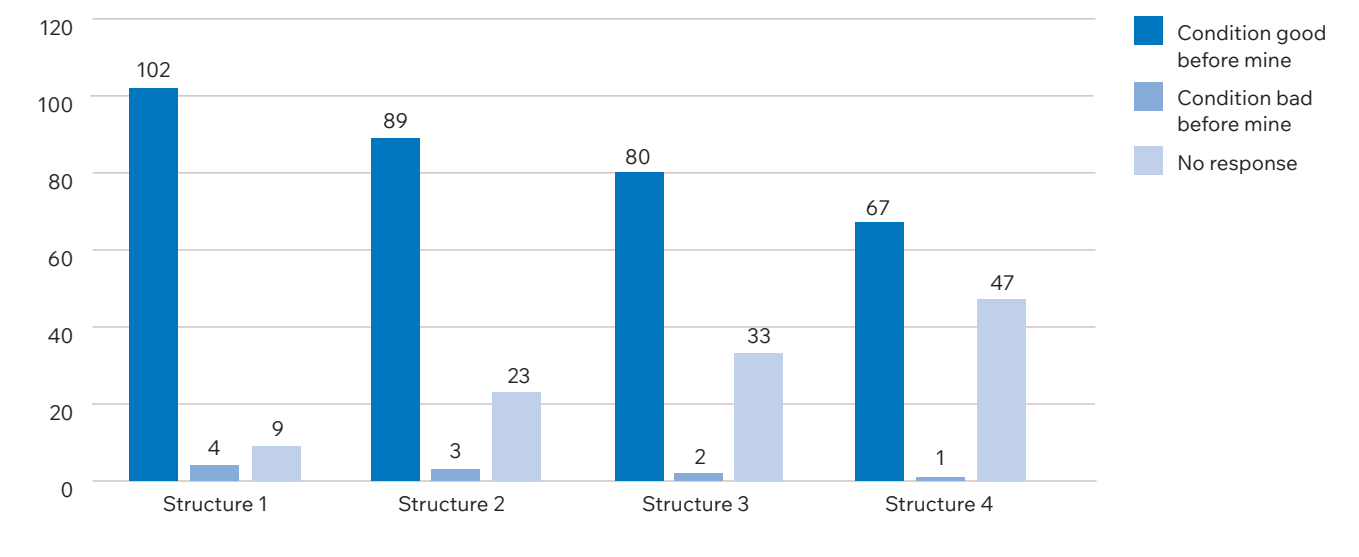
Figure 16: Functions and utility of structure



Conditions of structures before mining

As indicated in Figure 17, 106 of the 115 respondents (92.2%) provided information on the condition of the properties grouped under Structure 1 prior to the commencement of mining activities in Somkhele. Of these, 102 respondents (96.2%) reported that their structures were in good condition before the mine began its operations, indicating that the properties were generally habitable and fully functional. In contrast, 4 respondents (3.8%) reported that their structures comprising two houses, one kitchen, and one bedroom were already

Figure 17: Conditions of structure before mining operations



in a dilapidated condition before mining commenced. The remaining 9 respondents (7.8%) did not provide any information on the condition of their structures prior to mining. Similarly, under the Structure 2 category, 92 of the 115 respondents (80%) provided information on the condition of their structures before mining operations commenced, while at least 23 respondents (20%) did not provide any information about their properties. Of the respondents who did provide information, 89 (97%) indicated that their structures were in good condition before the mine began operating in Somkhele. In contrast, only 3 respondents (3%) reported that their structures were already in poor condition prior to mining. Two respondents stated that their kitchens had existing cracks, while one respondent reported that a bedroom had collapsed walls before the commencement of mining activities. Similarly, within the Structure 3 category, 82 of the 115 respondents provided information on the condition of their properties prior to the commencement of mining activities, while 33 respondents did not offer any information on this issue. Of the 82 respondents who responded, 80 (98%) stated that their structures were in good condition and fully habitable before mining began. In contrast, only 2 respondents (2%) reported that their properties were already in poor condition prior to mining. One respondent indicated that the walls of the living room had already collapsed, while the other stated that the house was already dilapidated before the mine commenced operations.

For the Structure 4 category, Figure 17 shows that 68 of the 115 respondents reported on the condition of their structures before the mine commenced operations. Of these, 67 respondents (99%) stated that their structures were in good condition prior to mining, while only 1 respondent (1%) reported that the garage had already collapsed before mining began. The remaining 47 respondents (40.9%) did not provide information on the condition of their structures prior to the commencement of coal mining in Somkhele.

Condition of structures after mining

As illustrated in Figure 18, of the respondents who commented on the condition of their properties under the Structure 1 category following the commencement of mining operations, 92 respondents (80%) reported that their structures had deteriorated, developed cracks, partially collapsed, or had become unsafe for habitation (for example see Figure 19). Respondents largely attributed this deterioration to blasting associated with mining activities. Additionally, 3 respondents (2.6%) indicated that the condition of their properties, which had already been poor before the mine commenced operations, remained unchanged after mining began. In contrast, 4 respondents (3.5%) reported that their properties including kraals, bedrooms, and houses remained in good condition and had not been affected by mining-related blasting. The remaining 16 respondents (14%) did not provide any information on the condition of their properties following the commencement of coal mining.

Regarding respondents in the Structure 2 category, 83 respondents (72.2%) indicated that the condition of their structures deteriorated with the intensification of mining activities. Most respondents reported that their properties developed cracks in the walls and windows, while some structures partially collapsed under the strain of tremors caused by blasting. Only 6 respondents (5.2%) stated that the condition of their properties remained good both before and after mining operations, indicating that they had not experienced any cracking or collapse of walls. Similarly, 2 respondents (1.7%) reported that the poor condition of their houses remained unchanged, as the structures had already been in a deteriorated state prior to the commencement of mining activities. In addition, 24 respondents (20.9%) did not provide any information regarding the condition of their structures following the onset of mining operations.

For the Structure 3 and Structure 4 categories, 70 respondents (61%) and 65 respondents (57%), respectively, reported that their properties had deteriorated following

Figure 18: Structures' conditions after mining operations

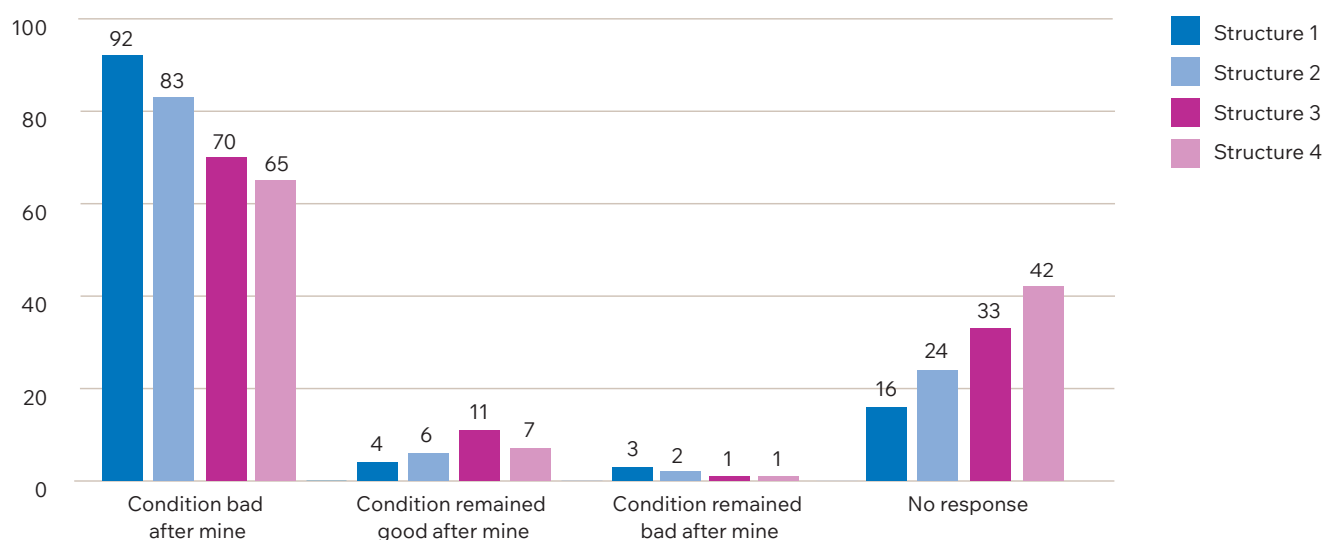


Figure 19: A damaged and cracked housing structure



The visible cracks in this building are a result of the mine blasting, the towering heap of coal extracts can be seen in the background (Photo credit: All Rise)

the commencement of mining activities, citing collapsed structures, cracked walls, broken windows, and, in some cases, the destruction of kraals due to blast-induced tremors. Conversely, a small proportion of respondents indicated that their properties remained in good condition despite the mining activities, comprising 11 respondents (9.6%) in the Structure 3 category and 7 respondents (6.1%) in the Structure 4 category. Furthermore, one respondent (0.9%) in each of the Structure 3 and Structure 4 categories reported that the poor condition of the property had remained unchanged, as it had already been in a deteriorated state prior to the commencement of mining activities. Additionally, 33 respondents (29%) in the Structure 3 category and 42 (37%) of the respondents did not provide any information concerning the condition of the properties after the onset of mining activities.

Grave ownership, relocation, access and compensation

The data shows that a total of 578 graves were recorded by respondents. As shown in Figure 20, of the 115 respondents who participated in the study, 97 respondents (84%) indicated that they had graves in the community. In contrast, only 11 respondents (10 %) indicated that they did not have any relatives buried in the community, while seven respondents (6%) did not respond to the question. Regarding the impact coal mining had on grave relocations, Figure 21, indicates that 16 respondents reported that the graves have been moved from the homesteads to communal cemeteries (14%). At least 9 respondents (8%) reported that they did not have to relocate their graves, suggesting fewer grave movements among the surveyed population. A substantial proportion of 90 respondents (78%) did not respond to whether they had relocated their graves due to coal mining at Somkhele.

The high level of no response may be attributed to the sensitivity surrounding discussions on graves and reburial rites among and within traditional Zulu communities. Only a small number of respondents (14%) reported that graves were moved suggesting that fewer respondents were impacted by grave relocations. It is worth noting that the high rate of non-response may have contributed to underreporting by households that might have had their graves moved from their homesteads to communal grave sites.

Coal mining in Somkhele has also adversely affected respondents' access to family grave sites. The data as presented in Figure 22 shows that out of 115 respondents, 46 respondents (40%) highlighted that they are still able to access their family graves. In contrast, 13 respondents (11%) indicated that they no longer have access due to relocations. Notably, nearly half of the respondents (56 respondents, 49%) did not respond to the question. As already stated, the high non-response rate may have been contributed by the sensitivity surrounding grave access after the relocation process.

Figure 20: Respondents' grave ownership

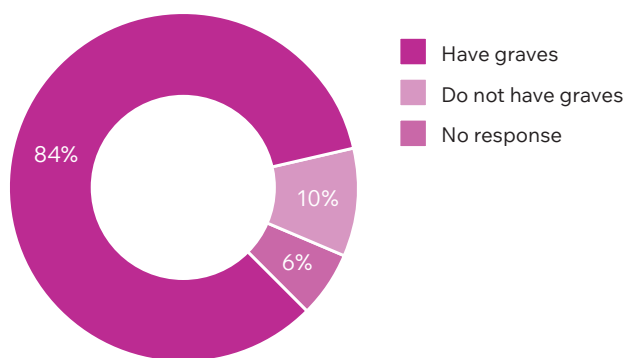


Figure 21: Grave relocations

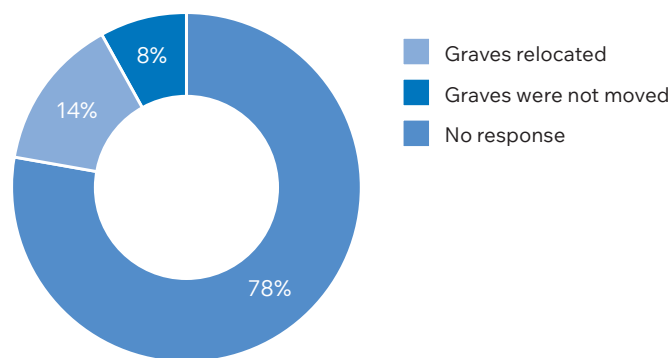


Figure 22: Respondents' access to graves

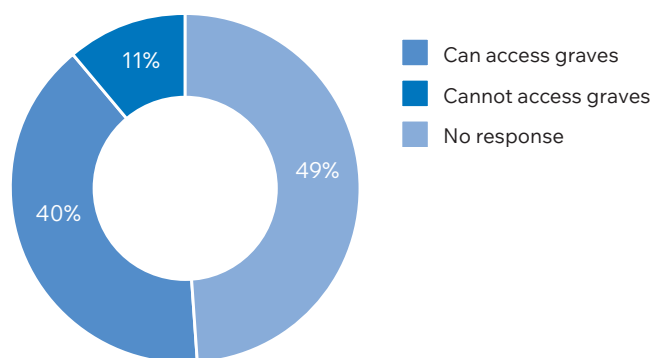
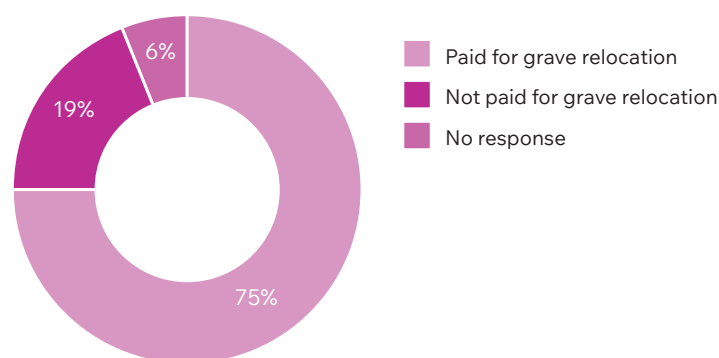


Figure 23: Compensation for graves



As illustrated in Figure 23, of the 16 households that moved their graves to the communal cemetery, 12 of the respondents (75%) confirmed that they did receive compensation from the mining company. However, three respondents stated that the families did not receive any compensation, while one respondent did not provide a response. Of the 12 respondents who reported having received compensation, only 10 households disclosed the amounts they received, which collectively amounted to R82,500. It is reported that the compensation was meant to support families to conduct the necessary cultural rituals such as slaughtering of livestock, consulting spiritual leaders and the transportation of remains.

In this study graves occupied an important place in the community's spiritual and ancestral realm. For most respondents graves are regarded as sacred spaces that serve not only as burial sites but also as portals for communicating with ancestors. However, the respondents felt that the relocation of graves was conducted in an undignified manner, which they believed angered their ancestors. For instance, a respondent from Household #113 recounted how the relocation of her deceased family members was carried out without due respect for cultural customs and Zulu spiritual practices. Expressing dissatisfaction with the process, the respondent explained: 'they were not exhumed in a dignified manner even the person who was to come with caskets came very late. It was raining, the deceased caused that rain...'. For her, the rain symbolised ancestral displeasure and was interpreted as a sign that the ancestors were protesting the dispossession and displacement of their final resting places to make way

for coal mining activities. She believed that the disturbance of graves without proper cultural and spiritual observance could bring misfortune or a bad omen upon the family.

A respondent from Household #86 stated that the encroachment of the mine onto burial sites disturbed the peace of the deceased. She explained that a newly constructed road, which now experiences heavy movement of mining trucks, was built too close to the graves. Although the mine had promised to erect a fence around the graves, nothing had been done, resulting in damage to some of the burial sites. Similarly, a respondent from Household #48 noted that mining blasting activities and the coal dumps have adversely affected the graves, with some developing cracks and becoming 'not as hard and visibly appealing as before'.

In South Africa, as elsewhere, compensation for harm caused by industrial and mining activities is near exclusively framed as only a material loss in land, houses and livelihood. As a result, its conceptualisation rarely captures intangible losses such as ancestral connections and spirituality disruptions that comes with land dispossessions (Skosana, 2021). According to Skosana (2021:2) grave relocations in communities dislodged by coal mining represents another important form of dispossession where communities are deprived of '... the physical means through which the living access the spiritual realm'. She goes on to argue that grave relocations lead to spiritual insecurity, a condition in '...which the living are anxious about their standing with ancestors, as well as the disturbance of the social fabric' (ibid).

Figure 24: No resting place: disruptions even in death!



Community graves situated close to a mine dump (Photo credit: All Rise)

Disrupted access to indigenous plant species

The encroachment of mining activities onto rural lands of Somkhele was perceived by respondents as disrupting cultural and spiritual connections with the ecological spaces such as forests. Respondents viewed the expansion of mining activities as contributing to the disappearance of some of the indigenous plant species that had for generations been used to cure illnesses, connect with ancestors, safeguard homesteads from evil spirits and promote physical wellbeing. Table 6 illustrates some of the plant species that respondents indicated that they have become unavailable and inaccessible due to mining activities. Most of the respondents noted that plants which had long formed part of their everyday lives such as aloe have become inaccessible because the mine operations have fenced off areas where these plants naturally grow. Sisal in isiZulu is widely used for a variety of home remedies (see Figure 25), including skin care, treating influenza, cleansing the stomach and managing blood pressure. Respondents also identified several other indigenous medicinal plants whose accessibility has been restricted by coal dumps. These medicinal plants include lemon bush (umsuzwane), forest mahogany (umkhuhlu), and ginger bush (iboza) which are traditionally used to cure illnesses such as bloated stomach, sinuses, and persistent coughs. Consequently, the loss of access to these traditional herb plants may compel community members

to rely on expensive pharmaceutical medicine, placing additional strain on already limited household incomes.

Respondents further highlighted that the decline of indigenous plants, coupled with restricted access to them due to the mine's occupation of the land has disrupted important cultural and ritual practices. For instance, one respondent explained that since the mine arrived in 2007, he has witnessed the dwindling of the helichrysum plant (impepho), which Zulu communities burn as incense when connecting with ancestors in the spiritual realm. The burning of impepho plays an important role in seeking protection from ancestors and connecting the worlds of the living with that of the non-living. Respondents therefore associated the decimation of the helichrysum plant with a growing sense of disconnection from the ancestral world and the erosion of cultural practices. Moreover, the findings indicate that some of the indigenous plants and trees are an important source of nutrients and play a critical role in helping communities cope with food insecurities. Respondents noted that before the arrival of the mine, they had easy access to traditional fruits such as sour plum (amathunduluka), figs (umkhiwane), wild medlar (amaviyo), and amarula (amaganu) among others. These fruits are rich sources of vitamins and carbohydrates contributing to household nutritional levels.

Table 6: Indigenous plants, herbs and fruits: use and availability, before and after mining

Traditional herb, plant or tree	Use	Availability before (B) and after (A) Mining
Aloe (<i>Inhlaba</i>)	Skin care routine; cures flu; cleanses the stomach and liver; manages blood pressure	B (available); A (still accessible)
Lemon Bush (<i>Umsuzwane</i>)	Cures flu and fever; colon cleansing	B (available); A (no longer available because the mine took the land)
Ginger Bush (<i>Iboza</i>)	Cough relief; stomach cleansing	B (available); A (no longer available)
Mexican Tea (<i>Nsukumbili</i>)	Heals sores and wounds	B (available); A (still available)
Forest Mahogany (<i>Umkhuhlu</i>)	Treats stomach pain	B (available); A (not available)
Sausage Tree (<i>Umvongothi</i>)	Protects from lightning	B (available); A (now endangered)
Mountain Bitter Tea (<i>Uhlunguhlungu</i>)	Cooking	B (available); A (not available)
Weeping Boer-bean (<i>Umgxamu</i>)	Medicinal purposes	B (available); A (not available)
Timboti (<i>Umthombothi</i>)	Herbs for treating fever	B (available); A (not available)
Ox-eye Daisy (<i>Impila</i>)	Chases away bad spirits; protection	B (available); A (not available)
Helichrysum (<i>Impepho</i>)	Spiritual connection with ancestors	B (available); A (not available)
False Thorn (<i>Unyazangoma</i>)	Medicinal purposes	B (available); A (not available)
Bushveld Saffron (<i>Ingwavuma</i>)	Tanning	B (available); A (not available)
Sour Plum (<i>Umthunduluka</i>)	Fruits; cleanses the body system	B (available); A (not available)
Common Dombeya (<i>Unhliziyonkulu</i>)	Colon cleansing	B (available); A (still available)

Figure 25: A sisal plant emerging through a thicket of shrubs

A sisal plant's fibre is used to make mats, baskets and cattle whips (Photo credit: All Rise)

Figure 26: Wild fruits in Somkhele



*Some of the wild fruits that are a rich source of nutrients
(Photo credit: All Rise)*

Water access in the context of mining in Somkhele

The restriction to natural resources has not only been experienced in relation to indigenous plants but also extends to water bodies such as rivers and streams. The study brings to the fore how extractive coal mining, with its heavy dependency on freshwater resources to wash off impurities of raw coal, has disrupted the community's hydro-ecological system. As illustrated in Figure 27, before the onset of mining operations in Somkhele, a significant proportion of households depended on rivers to meet their domestic and agricultural needs. A total of 70 respondents (61% of the sample) reported that they relied on rivers for household consumption and farming purposes. Respondents explained that before Tendele Mine expanded its operations they accessed water from the uMfolozi, Sijombolo, Nkolokotho, Khwayibhide, and Ngodane rivers. However, access to some of the rivers, particularly Umfolozi, became restricted once the mine began utilising them for its operation. From Figure 27, it can be discerned that upon commencement of mining activities the number of households that relied on rivers sharply declined from 70 (60%) to 13 (13%) confirming how the mine pushed the community out of the hydro-ecological system.

Similarly, the proportion of households that could access other water bodies such as streams also declined after mining assumed its operation. For instance, before mining operations, four respondents (3.4%) indicated that they

relied on nearby streams. However, the findings reveal no households currently have access to these streams, as they have since been cordoned off by the mine. All four respondents who previously depended on the surrounding streams indicated that access has now become restricted. According to the Department of Water and Sanitation communique released in 2017, Tendele Mine was granted a water use license in 2014, authorising the extraction of huge quantities of water of up to 750,000 cubic metres per annum (750 million litres) from the uMfolozi river for its coal mining operations. This is equivalent to about 103 twenty-thousand-litre truckloads per day, access to which is lost by other users. Communities located downstream are particularly vulnerable to intensified water scarcity because of dewatering processes and reduced flow of water in the river system.

Furthermore, the findings suggest that the displacement of households from rivers and streams by the mine, has left many with limited alternatives other than relying on tap water. Indeed, the proportion of households relying on taps increased significantly with the coming of the mine, with 22 respondents reporting that they are now using taps for accessing water, although some respondents explained that these communal taps (see Figure 28) are sometimes far away from where they stay, thus increasing distance when accessing water.

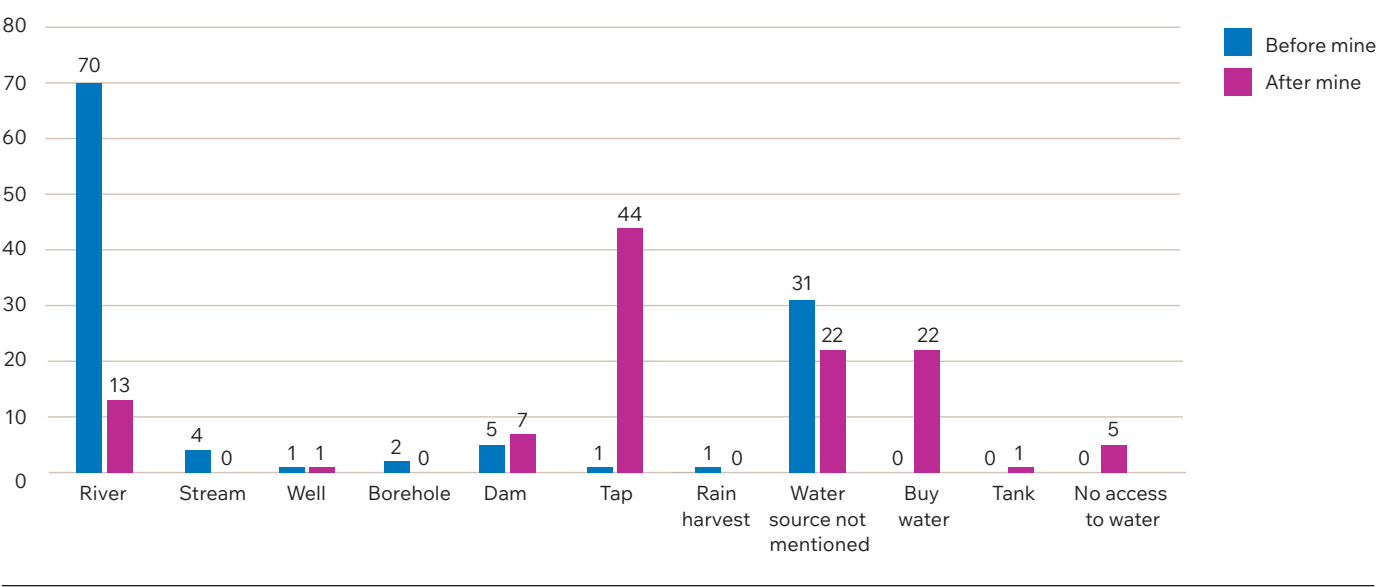
Additionally, a smaller proportion of households mentioned that they utilised boreholes and wells before and after mining operations commenced. Only one respondent (0.9%) and two respondents (1.7%) highlighted that they relied on a well and borehole respectively, with the proportion of households using a well remaining unchanged after the mine. In contrast, no household reported using the borehole after the mine. A significant number of respondents did not share information on how they sourced their water before and after mining activities. Moreover, a considerable number of respondents relied on dams as a source of water. Before the commencement of mining operations, five respondents (4.3%) indicated that they depended on dam water. This number increased to seven (6%) after mining activities began, suggesting access to dam water use was not entirely disrupted.

The decline in accessing rivers and streams has in turn contributed to an increase in the number of households purchasing water for domestic use, which has increased living costs for households. In effect, the water that the mine enjoys for no cost – via the water license – has been taken from the households and surrounding environment, with costs transferred to households as they are forced to replace that access. Indeed, as illustrated in Figure 27, before the commencement of mining activities no single household was buying water. However, following the establishment of coal mining in Somkhele, 44 respondents (38%) reported that they had begun purchasing water. Thus, it is important to look at the total costs or monetary losses that households of Somkhele have incurred by not having access to water bodies such as rivers and streams.

Bearing the cost of water insecurities

In calculating the true cost of water insecurity in Somkhele, the study examined the cumulative amount of money that households have spent on purchasing water after being displaced from accessing water from rivers and other

Figure 27: Water sources access, before and after mining operations



natural water sources. Furthermore, it also calculates the amount of money that was used to avoid the long-distance households must travel to access water. Table 7 below shows that the costs incurred specifically due to households losing access to river water and consequently relying on alternative sources such as paid water delivery

and storage tanks amounted to R14,638. In contrast, respondents who incurred costs because they lived far from the water source recorded comparatively higher expenditure of R31,750. Combined the total financial burden associated with water insecurity by respondents amounted to R46,388 (US\$ 2,801).

Figure 28: A community tap in Mpukunyoni



A community tap like this one is an important source of water for households that no longer have access to water bodies such as rivers and streams (Photo credit: All Rise)

Table 7: Financial resources directed towards accessing water

Cost type	Description	Amount in South African Rand
Money incurred by not having access to the river	Costs incurred specifically because households have lost access to the river due to contamination, and displacement (alternative water, Jojo tanks, etc)	R14,638
Money from avoiding distance to water	Costs incurred because households live far from a water source (buying water, paying for delivery, Jojo tanks, etc)	R31,750
Total		R46,388

These findings are consistent with those of Hargreaves (2016) who argued that the water grabs by Tendele Mine have eroded the capacity of households in Somkhele to resist poverty as money meant to support household income and food outcomes is diverted towards purchasing water. She further noted that Somkhele residents were paying an average of R500 for 5,000 litres of water delivered by the municipality trucks. If the mine were forced to pay for its water usage (the 750 million it is allowed under license) at this price this would cost the mine R75 million per year, which is effectively what it owes the community for the water it has taken at the price the community would have to pay to replace it. Moreover, according to Hargreaves (2016) the selling of water to distressed communities such as Somkhele constituted a direct violation of the government's Free Basic Water (FBW) policy which guarantees 6,000 litres of free water to indigent households.

The crisis of polluted water sources

Coal extractive mining is among the largest emitters of toxins contributing significantly to the pollution of both surface and groundwater. According to Leonard (2022), since the commencement of mining activities, mining companies have contributed to the pollution of the uMfolozi River system. For example, the Zululand Anthracite Colliery reportedly released an estimated 1.5 million litres of toxic liquid coal waste into the river following the collapse of a waste slurry dam. As previously discussed in earlier sections of this report, water contamination caused by coal dust has compelled Somkhele residents to find alternative ways of accessing clean water, often requiring households to divert financial resources that could otherwise be used for other aspects of human development.

Respondents from Household #92 and Household #94 were among the many residents of Somkhele who reported experiencing contamination of the uMfolozi river and its tributaries. They explained that during periods of rainfall, toxins and chemicals contained in large coal dumps are washed into rivers and streams, while some seeps to the ground increasing incidences of waterborne diseases. A respondent from Household #94 summarised the severity of the water crisis in Somkhele:

‘Every water source is contaminated with coal dust, even if you practice rainwater harvesting, the moment the water runs down your roof and enters the tank it is already contaminated’

(Household #94 respondent).

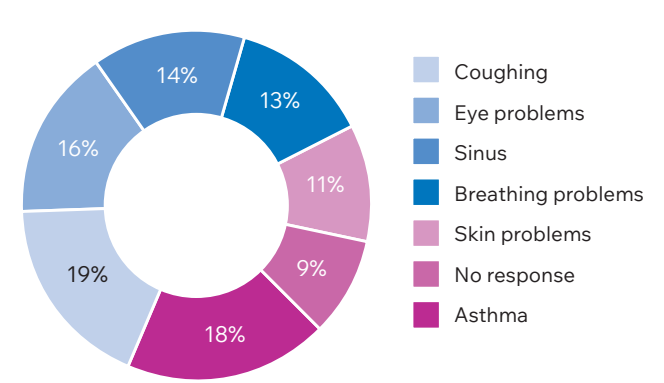
Some of the complaints relating to environmental pollution are discussed in greater detail in later sections of this report.

Household health outcomes after the commencement of mining

The results show that coal mining in Somkhele has negatively affected the community's health outcomes. As is common in many mining communities, people living near coal mine operations tend to be susceptible to respiratory illnesses and other health complications associated with dust and air pollution such as persistent coughing, eye, skin and breathing problems. As illustrated in Figure 29 conditions such as asthma, coughing, eye and skin problems became increasingly common following the establishment of coal mining operations in Somkhele. Although the costs of the ill-health caused by the mine are not yet available, we can deduce that they would be substantial. We must also bear in mind the additional hidden health costs, where communities cannot afford to be treated such that morbidity and mortality occur. For example, a report by Greenpeace and CMEA calculated that the economic cost of delaying coal phase out at coal fired power plants nationally by 10 years is an additional R721 billion in economic damages, including in health costs and the corresponding losses in productivity. This figure accounts for an estimated, extra 136,000 premature deaths (over a 95,000 baseline of an earlier coal phase out), extensive emergency room visits, lifelong lung disease, and an extra 1,340 deaths (over a baseline of 970) of children under 5, caused by the delayed decommissioning of coal plants (Nesan et al, 2026).

The Greenpeace/CMEA estimate is based primarily on the health and economic consequences of continued coal combustion at power stations, whereas harm around Tendele is by dust and particulate pollution from open-cast coal mining and mine dust exposure. The magnitude and pathways of harm differ, although evidence from South Africa and internationally shows that communities living near open-cast coal mines experience elevated exposure to particulate matter generated by blasting, drilling, haul roads and overburden removal. These emissions are associated with increased risks of respiratory illness, chronic obstructive pulmonary disease, asthma exacerbation, cardiovascular disease and adverse child health outcomes (Naidoo, 2023), with a direct evidential link between open-cast mining and airborne particulate exposure (Ghose, 2010; Khumalo, 2022). The Somkhele area has been the subject of several health and community impact assessments that identify dust exposure as a major community concern, alongside reported effects on respiratory health, livelihoods, wellbeing and mental health (Myeni, 2022; Carnie, 2022; Fourie and van Niekerk, 2024). There is currently little research that directly quantifies

Figure 29: Households experiencing health problem



the health effects of coal-mine dust exposure at Somkhele in the way the Greenpeace and CMEA study quantifies coal-combustion impacts. Overall, we can conclude that the R721 billion figure of health costs by burning coal is in addition to a related figure for coal mining, with similar particulates and effects: mine expansion is connected to downstream coal combustion impacts.

In the case of Somkhele, the data indicates that out of the 270 responses collected from 115 households regarding health outcomes in the context of mining, as shown in Figure 29, a significant proportion of responses (51 respondents) (19%) reported a high incidence of persistent coughing among family members since coal mine operations began in Somkhele. The findings further reveal that individuals between the ages of 50-80 years were the most affected. Moreover, extensive coal mining activities in Somkhele have been associated with an increase in cases of asthma, with 50 household responses (18%) reporting that family members with no history of respiratory conditions began experiencing asthmatic attacks after the establishment of the mine. Similarly, the findings show that deteriorating health conditions, including increased cases of asthma and tuberculosis cases were particularly prevalent among family members within the 50-80 age group, suggesting that older populations are more likely to bear the health burdens associated with extractive coal mining.

The high incidences of sinus, eye and breathing problems among the households further indicate how coal mine activities can undermine the health and wellbeing of rural communities. The findings show that 42 responses (16%) reported that household family members have experienced eye related diseases associated with exposure to fine coal dust particles and fumes which can destroy the surface of the eyes. Additionally, 38 responses (14%) pointed to an increase in cases of sinus related complications caused by the inhalation of coal dust originating from coal dumps located adjacent to Somkhele’s homesteads. Furthermore, the data revealed that 35 responses (13%) reported that an increase in asthma and tuberculosis incidences was consistent with some family members having difficulties in breathing since air quality has since decreased with high concentrations of dust in the area. A relatively smaller proportion of 21 responses (11%) indicated that since the arrival of the mining company, some family members have developed skin problems such as rash, irritations and eczema.

Approximately 23 households (9%) did not provide any information related to their health conditions before and after mining operations.

Denoon-Stevens and du Toit (2022) argue that intensive coal mining has imposed a significant health burden on rural communities living on the fringes of coalfields. Similarly, Cortes-Ramirez et al. (2018) note that populations residing near coal mines often experience compromised immune systems, making them more susceptible to pulmonary, respiratory, and cardiovascular diseases.

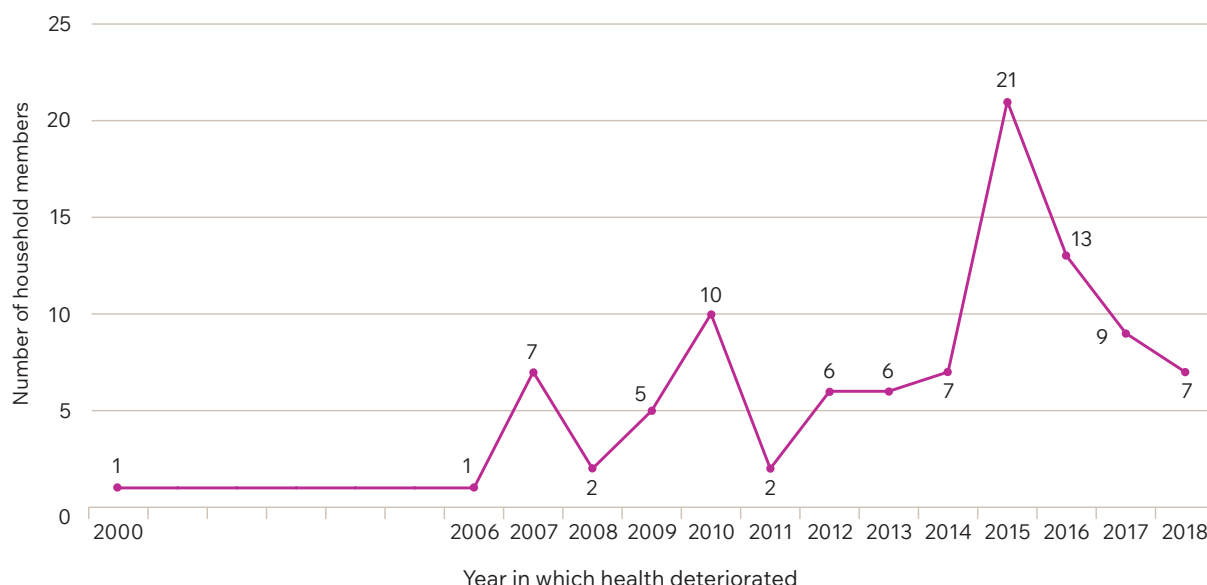
Health complications reported (2007–18)

To establish the correlation between coal mining activity and an increase in health- related complications, the study tracked reported health outcomes over time, comparing the periods before and after the commencement of Tendele Mine mining operations. The analysis draws on responses of 61 out of the 115 sampled households that documented the years in which members began experiencing declining health conditions, commonly characterised by asthma, coughing, skin and eye problems.

Tendele Mine started operating in the Somkhele area in 2007. As illustrated in Figure 30, while the first reported incidence of mine related health complications dates back to 2006, reports of deteriorating health among household members began to increase significantly from 2007 and onwards. For instance, in 2007 alone seven individuals across the sample reported contracting illnesses associated with coal mine activities. The years of 2008 and 2009 show a decline of household members contracting illnesses with two and five family members respectively reported to have developed health complications during this period. This decline may be attributed to the slowing down in mining activities caused by global economic recession which disrupted the extractive industries. In 2010 there was a slight surge in the number of households reporting a decline in health conditions, with 10 individuals reported to have contracted illnesses related to coal mining. While Figure 30 shows that there was a dip in reported coal-related health complications in 2011, the period from 2012–14 reflects a relatively steady number of individuals experiencing deteriorating health conditions linked to mining activities.

Notably, the year 2015 recorded the highest number of reported cases of illnesses related to coal dust emissions. A total of 21 individuals were reported to have developed health complications. Interestingly, this spike coincided with Tendele’s historic production output of 1.3 million tonnes of anthracite coal in 2015 (see Petmin, 2016). This suggests a positive correlation between increased coal production and rising incidences of coal related diseases in mining communities. There is a steady decline of reported incidences of mine related health illnesses during the year 2016, 2017, and 2018 with 13, 9 and 7 individuals reporting acquiring a disease related to mining activities.

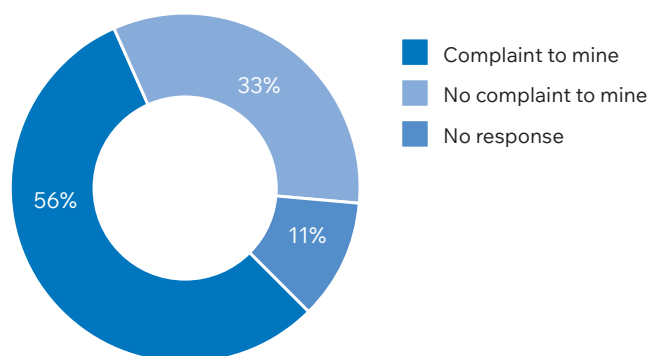
Figure 30: Respondents' health complications (2000–18)



Complaints lodged to Tendele mining company

In examining the extent to which the mining company has damaged and disrupted the community's livelihoods, properties and natural resources, the respondents expressed dissatisfaction directed at the mine. The data reveals that a significant number of residents have at one point lodged a complaint with the mining company. As displayed in Figure 31 of the 115 sampled households, 64 respondents (56%) indicated that they have lodged their dissatisfaction with the mine regarding its harmful impacts on the community. In contrast, 38 of the respondents (33%) noted that they have never submitted any complaints to the mining company, while 13 respondents (11%) did not respond to the question. When the complaints are analysed, through the gender lens, female respondents lodged more complaints than their male counterparts, with 33 complaints coming from female respondents and 31 emanating from male respondents.

Figure 31: Respondents that lodged complaints with the mining company



Nature of complaints lodged against the mining company

The complaints characterise the deep crisis of extractive mining in rural communities, particularly in relation to the dismantling of rural economies and ecologies. Moreover, rural communities living adjacent to coal mines are compelled to endure exposure to health threatening conditions. These complaints mirror the lived experiences of dispossession, asset losses, ecological degradation and disintegration of poverty prevention strategies. Respondents expressed dissatisfaction in the way mining operations a) destroyed properties b) forced households to reduce livestock herds c) compromised health and wellbeing d) damaged agro-ecological resources, forced relocations, and caused air and noise pollution.

‘...our houses are cracked. The rondavel fell down; the other house has cracks. Six rooms have cracks above the windows and doors. The houses are 6 metres away from the mine’

(Household #82 respondent)

Collapse of houses and other properties

The findings indicate that about 41 complaints (36 %) were on how Tendele's mining operations have led to the cracking and collapsing of housing structures and kraals. For instance, a respondent from Household #29 described how the constant blasting in the mines led to the cracking of his seven houses. He expressed that ‘...because of the noise 7 houses are now cracked’. For a respondent living in Household #51, much of the destruction of houses has been caused by stones that are thrown out from the mine during blasting. He stated that ‘...the stones that come to our house’ destroy windows and can inflict bodily harm. Another respondent from Household #82, who resides just six metres from the mine, complained about how all the

houses in her compound had fallen apart because of the tremors caused by blasting.

These accounts reflect how extractive mining violates the community's right to decent and safe housing, thus limiting them in their access to other social and economic rights.

Decimation of animal production

As demonstrated in the previous sections of this report, mining in Somkhele has negatively impacted on animal production, with a noticeable reduction in the livestock herd sizes. Respondents indicated that the dust and toxins coming from the coal mine compromised the health condition of cattle, goats, sheep and chickens. Although the proportion was relatively small, approximately 12 respondents (10 %) reported that they had lodged complaints with the mining company concerning the deaths of livestock caused by dust and heavy truck activity. A respondent from Household #42 mentioned that all her goats have died due to browsing leaves covered with coal dust. Similarly, when asked what compelled her to lodge a complaint, a respondent from Household #89 responded that she went to complain to the mine '...when they killed my goats with three kids'.

Decline in good health outcomes

The decline in health conditions and the outbreak of respiratory diseases were among the complaints raised by community members. The results indicate that 17 respondents (15%) stated that they raised their concerns with the mining company on the deteriorating household health outcomes since the arrival of the mine. These respondents noted that the pollution from the coal mine has caused health conditions such as asthma, sinus complications, skin problems and persistent coughing. For example, a respondent from Household #57 explained that she approached the mining company to complain about her husband's asthma and cough which had worsened since the mine intensified its operation. When questioned about her grievances, she stated '...I complained about my husband's health, I reported his ill health to the Mine, they directed me to the Department of Labour, and I did not get any help from the mine'. Similar grievances were shared by a respondent from Household #74, who stated that both he and his wife had developed asthma and breathing problems since the mine was opened. Describing his experience, he remarked, 'I have complained about our sickness to the mine. I even showed them my clinic note'.

Contamination of air and noise pollution

The findings also reflect that a significant number of households expressed their dissatisfaction with high levels of air and noise pollution caused by everyday mining operations. Accordingly, about 28 respondents (24%) complained of how dust coming from the mine has polluted the land, grass and water bodies such that livestock have been killed from grazing and drinking from rivers. Respondents linked air pollution to the prevalence of respiratory complications such as tuberculosis, asthma, and breathing problems. Some respondents complained about how the dust pollution was accompanied by noise caused by the blasting which makes the place unpleasant to inhabit. One respondent from Household #12 stated that he visited the mine to complain about the noise and the dust pollution but was met with violence that left his car burnt. A respondent from Household #16 added that the coal dust gets worse during the blasting which is usually done without notice.

'...I complained about the dust and noise, the mine burnt my car, and they chased us away when we gathered against the mine'

(Household #12 respondent)

No compensation support for relocations

Some respondents complained that the mine never compensated them for relocation, collapsed houses and relocation of graves. A proportion of 10 respondents (9%) complained about not getting compensated for the relocations and losses in assets. Furthermore, they expressed dissatisfaction in the manner the relocation of graves was conducted. Indeed, in some cases, the relocation of graves led to situations where households could not identify if the person being reburied is their family member. A respondent from Household #85 who stated that his family's graves were relocated to Bekabezayo cemetery gave this account, stating that: 'we cannot differentiate the graves, and we cannot perform traditional rituals on the graves'. This indicates that the relocation process was not fully supported by the mining company.

3. Projecting loss of livestock and crop produce over time

The study uses a deterministic herd growth model to predict the growth of the herd over a period of 20 years, had the original animals not been lost. It projects and estimates the cumulative value of livestock losses over periods of 10, 15, and 20 years starting from the period the data was collected in 2018 to 2038. The deterministic herd growth model, influenced by the pioneering work of Brascamp (1978) on herd structure and population dynamics, estimates changes in livestock populations over time under fixed demographic and management parameters. The model assumes that key biological and management variables, including fertility, mortality, and offtake rates, remain constant throughout the projection period (see Amer et al., 2016). Based on these predetermined parameters, it provides a simplified framework for forecasting herd growth, which we used in this study.

These projections relied on existing literature on the fertility of Nguni livestock (calving, kidding, and lambing rates), as well as mortality and offtake rates, to estimate the future herd size and the economic value of livestock assets that would have accrued in the absence of mining-related losses (see Figures 32, 33 and 34 respectively). The model generates the following herd growth equation:

$$N_{t+1} = [N_t + \text{surviving births}_t] \times (1 - \text{OR})$$

with mortality treated according to the species-specific assumptions set out below, where:

N_t = herd size at the beginning of year t
 N_{t+1} = herd size at the end of the following year
OR = annual offtake rate
 g = species-specific annual herd-growth factor
 $N_{t+5} = N_t(g)^5$ for each five-year projection interval

This formulation combines reproduction/new births, mortality and offtake into a species-specific annual growth factor. The unrounded annual factor is then compounded over successive five-year intervals to estimate the livestock population that would have existed in the absence of mining-related losses. We then compounded the annual factor to calculate the herd size after five, ten, fifteen and twenty years:

$$N(t+n) = N(t) \times g^n$$

where g is the species-specific annual herd factor

In this method we first calculate the surviving births and then apply the mortality and offtake rates to the full post-birth herd. We use the full annual factor in each calculation and only round the final herd totals.

This projection gives us probable herd growth, which then enables an assessment of asset values beyond the

traditional 'one-off' compensation period and illustrates how livestock holdings would have accumulated over time had losses associated with mining activities not occurred. This is a more accurate assessment of loss as it includes the loss and damage suffered to the household's livelihood as it would have accumulated over time. Methodologically, it is also commensurate with the way that an asset manager would value the household, if it were treated as an ongoing commercial concern, which it arguably would be in a deracialised economic paradigm. In this method the setting of a future time to measure to – 10, 20 or 30 years etc – will always be short of an intergenerational analysis which could assume that the ecological assets of land, soil and water belong to the community over several generations, or even in perpetuity. This method moves beyond static compensation (replacement cost / one-off loss), which chronically undervalues what has been lost, toward dynamic accumulation loss (the foregone growth path of assets over time).

This method is widely used by finance and legal professionals, banks and asset managers and would include the Discounted Cash Flow (DCF) approach. In the DCF approach an economic valuation is made based on the future expected derivative income from the assets in question – cow, land, crop etc. While here we are mirroring DCF in a counterfactual ("but-for") going-concern valuation, this does not make the losses suffered any less real. Instead, it surfaces what the mine would have had to have paid to purchase these resources at a free market value. In standard DCF practice, the timeline (forecast horizon) is not arbitrary, but follows a fairly well-established structure. For agricultural and ecological assets, a 10–20-year horizon is entirely defensible and orthodox, especially given herd growth dynamics.

After that horizon, a DCF model of terminal value (continuation beyond the horizon) would assume either perpetual continuation (Gordon growth model), or steady-state asset level, where the household enterprise system continues after the modelled window. In this case, this value has been lost. In fact, the method here is a type of truncated DCF, as it stops at a finite horizon and does not explicitly include a terminal value. It is thus calculated at less than a true DCF for commercial purposes, which would include a proxy for terminal value, normally calculated as $\text{Terminal Value} = \text{Final Year Income} \times (1+g)/(r-g)$ where g = long-run growth (low, e.g. 1–3%) and r = discount rate. Our method, however, does have the benefit over standard DCF calculations, that it does not collapse the remaining huge intergenerational value of the livelihood system into a terminal value, as doing so, in current financial practice, actually obscures the scale and temporal depth of loss. In sum, by mirroring a finite horizon DCF we are surfacing the medium-term derivative incomes from assets – over 10 to 20 years – that have effectively been dispossessed from these farmers by Tendele's choice of derisory one-off payments.

By extending the analysis into future periods, the projection provides an indication of the foregone economic value of livestock assets resulting from Tendele mining disruptions.

Projecting the future herd growth of cattle

As already mentioned in the preceding section, the collective cattle loss suffered by the 115 households who participated in the study from 2007 to 2018 is 1244. Most if not all the cows bred by the respondents, are from the Nguni breed. The Nguni cattle belong to the Sanga cattle lineage group, and are native to South Africa, and other neighbouring countries such as Swaziland and Zimbabwe (Kunene et al, 2022). Their resistance to heat and tick diseases make the Nguni cattle favourable to rear in dry lowveld areas of northern KwaZulu-Natal. Moreover, when compared to other breeds, Nguni cattle tend to have a higher calving rate and shorter calving intervals (see Dionisio and Syrstad, 1990). The calving rate can be defined as the number of calves born per number of cows offered to a bull, while the calving interval is the interval (in days) between successive calvings for an individual cow, reflecting the timing of reproduction and fertility. According to a study of the reproductive rates and fertility of 179 Nguni cattle (Maciel et al., 2013) the average Nguni cattle calving rate (CR) is 90% while the average calving interval (CI) was 422 days. Similarly, a study conducted by Sambo et al (2023) on 30 Nguni heifers in Limpopo communal areas reveals that the herd's CR was 89%.

Due to its resistance to drought, diseases and ticks, Nguni cattle have relatively lower mortality rates (MR) compared to other cattle breeds, ranging from 13% to 18% (see Bester et al., 2003; Mmbengwa et al., 2013; Muchenje et al., 2008; Tada et al., 2013; Nowers et al., 2013). According to Musemwa et al (2010) there is low offtake rate in the communal cattle production systems. They note that the Nguni cattle market offtake rate, which is usually measured by sales, slaughter, and cultural exchanges such as lobola, ranges between 5% to 10%. For this study, the highest percentages reported in the literature are used to project the cumulative number and value of the respondents' collective cattle herd. As such a 90% calving rate (CR), 18% mortality rate (MR), and 10% annual offtake rate are applied in the projections. To produce more realistic estimates, it is assumed that 50% of the herd consists of breeding cows. Herd growth projections are calculated at 5-year intervals over the study period.

Cattle herd growth calculations (2018–38)

The equation for estimating the herd growth of cattle is as follows:

$$H_{t+1} = [H_t + (H_t \times B \times CR)] \times (1 - MR) \times (1 - OR)$$

- H_t = cattle herd size at the beginning of year t
- H_{t+1} = cattle herd size at the end of the following year
- B = proportion of breeding cows (0.50)
- CR = calving rate (0.90)
- MR = mortality rate applied to the post-birth herd (0.18)
- OR = annual offtake rate applied to the post-birth herd (0.10)

5-year calculation

- a) Annual growth factor = $[1 + (0.50 \times 0.90)] \times 0.82 \times 0.90$
- b) = 1.0701 (7.01% annual herd growth)
- c) $H_5 = 1,244(1.0701)^5 = 1,745.59$
- d) $H_5 \approx 1,746$ cattle

10-year calculation

- a) $H_{10} = 1,244(1.0701)^{10}$
- b) = 2,449.42
- c) The unrounded annual factor is used throughout
- d) $H_{10} \approx 2,449$ cattle

15-year calculation

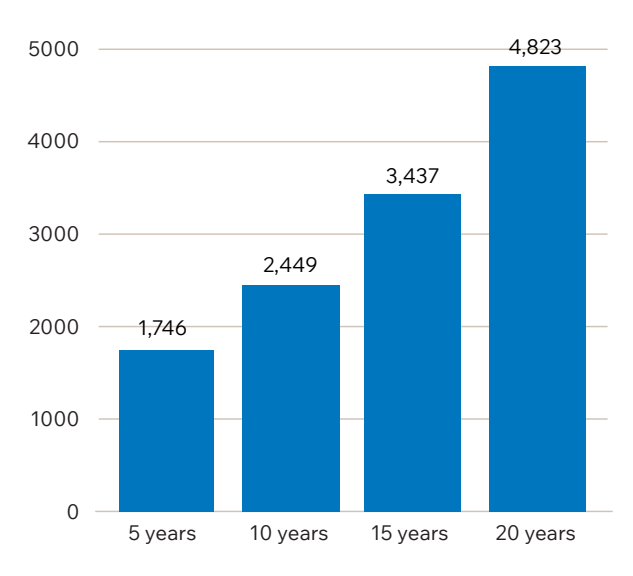
- a) $H_{15} = 1,244(1.0701)^{15}$
- b) = 3,437.05
- c) The unrounded annual factor is used throughout
- d) $H_{15} \approx 3,437$ cattle

20-year calculation

- a) $H_{20} = 1,244(1.0701)^{20}$
- b) = 4,822.89
- c) The unrounded annual factor is used throughout
- d) $H_{20} \approx 4,823$ cattle

Figure 32 shows that, had the respondents not lost 1,244 cattle because of mining activities, the herd would have increased to approximately 1,746 cattle after 5 years, 2,449 after 10 years, 3,437 after 15 years and 4,823 after 20 years. This represents an extra 3,579 cattle from the baseline of 1244 (that were lost).

Figure 32: Projected cattle herd growth (2018–38)



The projected herd growth of goats

While the production of indigenous goats is largely neglected, Gwaze et al. (2009) argue that their ability to adapt to local conditions and reproduce at a faster rate than cattle make them an important resource for poverty reduction and wealth creation. In rural Zulu communities, goats serve purposes beyond sustaining livelihoods, as they also play a significant role in cultural practices and festivities. A study by Kraai et al. (2022) on the reproductive performance of indigenous Nguni goats in KwaZulu-Natal found that these goats exhibit relatively high fertility, with breeding does achieving a kidding rate of up to 80%. The study monitored 17 communal goat herds and reported that kidding success reached 80%. Despite its high fertility performance, the Nguni goat has a high kid mortality rate. Several studies conducted in rural Eastern Cape and KwaZulu-Natal show that most Nguni goat herds experience an annual kid mortality rate of 46% (Webb and Mamabolo,

2004, Slayi et al., 2022). Factors such as lack of access to veterinary services, uncontrolled transmission of parasitic diseases, poor hygiene and climate induced drought have been identified as the leading drivers of high mortality rates in communal goats across South Africa (Slayi et al., 2022, Segakoeng, 2026). Moreover, constraints in accessing markets for communal households to sell goats has meant that rural areas across Africa and indeed South Africa experience low off-takes. Accordingly, goat off-take rates in most Southern Africa's rural communities average 7.3%. For consistency, the highest percentages reported in the literature are used to project the cumulative number and value of the respondents' collective goat herd. Resultantly, an 80% kidding rate (KR), 46% kid mortality rate (MR), and 7% annual offtake rate are applied in the projections. To produce more realistic estimates, it is assumed that 50% of the herd consists of breeding does. Herd growth projections are calculated at 5-year intervals over the study period. To project goat herd size growth, we use the same equation applied to cattle herd growth predictions. Unlike the cattle herd growth projection, where the mortality rate is calculated on the entire herd, the deterministic herd growth projection for goats restricts the mortality rate to newly born kids, since the highest mortality rates are predominantly observed among kids (see Webb and Mamabolo, 2004; Slayi et al., 2022; Segakoeng, 2026).

Goat herd growth calculations (2018–38)

The deterministic herd growth equation for estimating the herd growth of lost goats is as follows:

$G_{t+1} = [G_t + (G_t \times 0.50 \times KR \times (1 - KM))] \times (1 - OT)$, where:

G_t = goat herd size at the beginning of year t

G_{t+1} = goat herd size at the end of the following year

KR = kidding rate (0.80)

KM = kid mortality rate applied to newborn kids (0.46)

OT = annual offtake rate applied to the post-birth herd (0.07)

Using $G(n) = 1,447 \times (1.13088)^n$, gives goat herd projections of 2,676 after 5 years, 4,950 after 10 years, 9,156 after 15 years and 16,936 after 20 years. The calculations are:

5-year calculation

a) Surviving kids per animal = $0.50 \times 0.80 \times (1 - 0.46) = 0.216$

b) $gG = (1 + 0.216) \times (1 - 0.07) = 1.13088$

c) Annual goat herd growth rate = 13.088%

d) $G_5 = 1,447(1.13088)^5 = 2,676.40$

e) $G_5 \approx 2,676$ goats

10-year calculation

a) $G_{10} = 1,447(1.13088)^{10}$

b) = 4,950.33

c) The unrounded annual factor is used throughout.

d) Projected herd after 10 years

e) $G_{10} \approx 4,950$ goats

15-year calculation

a) $G_{15} = 1,447(1.13088)^{15}$

b) = 9,156.22

c) The unrounded annual factor is used throughout.

d) Projected herd after 15 years

e) $G_{15} \approx 9,156$ goats

20-year calculation

a) $G_{20} = 1,447(1.13088)^{20}$

b) = 16,935.54

c) The unrounded annual factor is used throughout.

d) Projected herd after 20 years

e) $G_{20} \approx 16,936$ goats

Figure 33: Projected goat herd growth (2018–38)

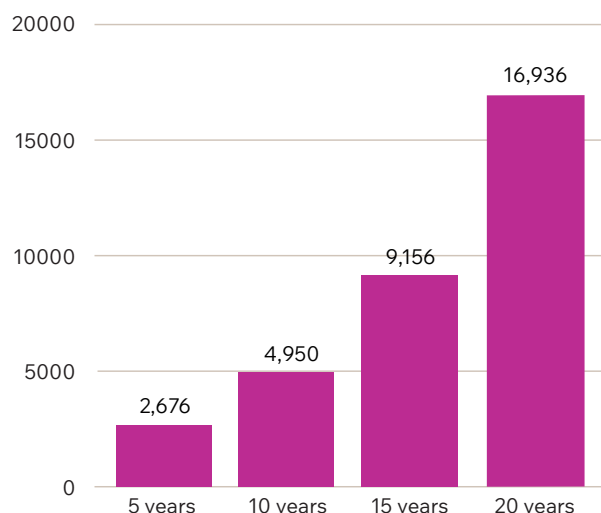


Figure 33 shows a projected sustained increase in goat herd size over the 20-year projection period (2018–38). The calculation applies kid mortality only to newborn kids but applies the annual offtake rate to the post-birth herd. Had the respondents not lost 1,447 goats, the herd would have increased to approximately 2,676 goats after 5 years, 4,950 after 10 years, 9,156 after 15 years and 16,936 after 20 years. This represents an increase of 15,489 extra goats projected from the original 1,447 to the potential 16,936 twenty years later. These findings demonstrate how mining activities prevented respondents from benefiting from the growth potential of their goat herds.

The projected herd growth of sheep

When compared to other livestock such as cattle and goats, the number of sheep owned by Somkhele households is significantly lower. In rural KwaZulu-Natal, the breed most kept by smallholder farmers is the Zulu sheep, which belongs to the Nguni sheep genus (Zyl & Dugmore, 2015). The Zulu sheep is well adapted to harsh climatic conditions, including drought, and can thrive in environments characterised by low forage availability and limited grazing land, making it an ecologically sustainable livestock option (Kunene et al., 2011).

Zulu sheep are kept by rural communities primarily as a source of food and household income, but they also play an important role in cultural practices, including lobolo (bride price) and payments in traditional dispute resolution courts. In terms of reproductive efficiency, the Zulu sheep is regarded as having a comparatively high lambing rate relative to other indigenous and locally adapted breeds. Ngcobo et al.'s (2022) comparative study of reproductive performance among Zulu, Damara, Namaqua Afrikaner, and Bapedi sheep breeds found that the Zulu sheep exhibited significantly higher conception and lambing

rates than the other breeds examined. The study reported a lambing rate of 89% for Zulu sheep, compared to 88% for Bapedi, 60% for Damara, and 44% for Namaqua Afrikaner sheep. While indigenous Zulu sheep are resistant to drought and forage scarcity, they experience relatively higher mortality rates, particularly among lambs. Patterns of high mortality rate among lambs farmed in South Africa's communal areas ranges from 31% to 42% (Ngcobo et al., 2015; Mthi et al., 2020).

Like most communal livestock, sheep production systems in rural areas have low off-take rates with Mmbengwa et al (2015) stating that the average off-take rates of indigenous sheep in communal South Africa ranges from 5% to 10%. Similarly, as done on goats, the deterministic herd growth projection for sheep uses the mortality rate of newly born lambs, since they also experience high mortality rates. Drawing on this evidence, sheep herd growth projections in this study are calculated using a lambing rate of 88%, mortality rate of 42%, offtake rates of 10% over five-year intervals. To produce more realistic estimates, it is assumed that breeding sheep constitute 50% of the total herd.

Sheep herd growth calculations (2018–38)

The equation for estimating the herd growth of lost sheep is as follows:

$S_{t+1} = [S_t + (S_t \times 0.50 \times LR \times (1 - LM))] \times (1 - OT)$, where:

S_t = sheep herd size at the beginning of year t

S_{t+1} = sheep herd size at the end of the following year

LR = lambing rate (0.88)

LM = lamb mortality rate applied to newborn lambs (0.42)

OT = annual offtake rate applied to the post-birth herd (0.10)

The sheep assumptions used are 50% breeding females, an 88% lambing rate, 42% lamb mortality and 10% annual offtake.

Surviving lambs per animal = $0.50 \times 0.88 \times (1 - 0.42) = 0.2552$

$g(S) = (1 + 0.2552) \times (1 - 0.10) = 1.2552 \times 0.90 = 1.12968$

Annual sheep growth = $1.12968 - 1 = 12.968\%$

Using $S(n) = 164 \times (1.12968)^n$ gives a projection of 302 sheep after 5 years, 555 at ten years, 1,021 at 15 years, and 1,879 at 20 years. Separately, the calculations are:

5-year calculation

a) Surviving lambs per animal = $0.50 \times 0.88 \times (1 - 0.42) = 0.2552$

b) $gS = (1 + 0.2552) \times (1 - 0.10) = 1.12968$

c) Annual sheep herd growth rate = 12.968%

d) $S_5 = 164(1.12968)^5 = 301.73$

e) $S_5 \approx 302$ sheep

10-year calculation

a) $S_{10} = 164(1.12968)^{10}$

b) = 555.13

c) The unrounded annual factor is used throughout.

d) Projected herd after 10 years

e) $S_{10} \approx 555$ sheep

15-year calculation

a) $S_{15} = 164(1.12968)^{15}$

b) = 1,021.35

c) The unrounded annual factor is used throughout.

d) Projected herd after 15 years

e) $S_{15} \approx 1,021$ sheep

20-year calculation

a) $S_{20} = 164(1.12968)^{20}$

b) = 1,879.11

c) The unrounded annual factor is used throughout.

d) Projected herd after 20 years

e) $S_{20} \approx 1,879$ sheep

Figure 34: Projected sheep herd growth (2018–38)

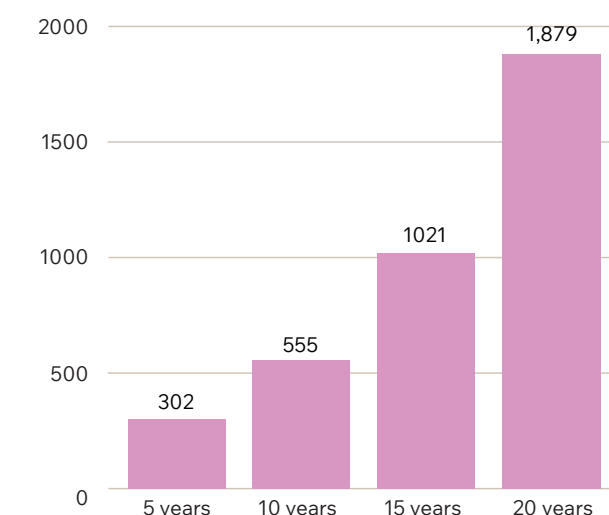


Figure 34 presents the sheep projection. Had the respondents not lost 164 sheep, the herd would have increased to approximately 302 sheep after 5 years, 555 after 10 years, 1,021 after 15 years and 1,879 after 20 years, an extra 1,715 animals. The calculation applies lamb mortality only to newborn lambs but applies the annual offtake rate to the post-birth herd. In the absence of mining-related livestock losses, the respondents' sheep herds had the potential to increase substantially over time, thereby enhancing household livestock assets, food security, and income-generating opportunities.

This means that in total, the combined herd loss after twenty years could be:

4,823 cattle + 16,936 goats + 1,879 sheep = 23,638 animals

Projected financial value of livestock over 20 years

To illustrate the longer-term asset losses incurred by rural households in Somkhele, the study projects herd size and market value at five-year intervals from 2018 to 2038. Table 8 reports the projected stock value at each interval; it is not a sum of annual cash flows. At the 20-year endpoint, the corrected combined herd is 23,638 animals and its projected market value, using constant 2018 prices, is estimated at **R73,625,730**.

Table 8: Projected financial value of livestock at five-year intervals (2018–38)

Interval	Cattle value	Goat value	Sheep value	Total value
5 years	R16,464,780	R3,746,400	R712,720	R20,923,900
10 years	R23,094,070	R6,930,000	R1,309,800	R31,333,870
15 years	R32,410,910	R12,818,400	R2,409,560	R47,638,870
20 years	R45,480,890	R23,710,400	R4,434,440	R73,625,730

The projected values were calculated by multiplying the rounded herd size at each interval by the average 2018 market price reported by respondents: R9,430 per cow, R1,400 per goat and R2,360 per sheep (without weighting with any inflationary projection) as shown in Table 8. For example, the projected cattle value after five years is $1,746 \times R9,430 = R16,464,780$. This gives a twenty-year projected livestock stock value of R73,625,730: **R45,480,890 + R23,710,400 + R4,434,440 = R73,625,730.**

Table 8 indicates that cattle account for the largest projected asset value at the 20-year endpoint, where the initial loss of 1,244 cattle could have generated 4,823 cattle by 2038, valued at R45,480.890. This is followed by goats, in which 1,447 of lost herd could potentially have grown to 16,936 goats valued at R23,710,400 by 2038, and 164 lost sheep could have become 1,879 sheep valued at R4,434,440. The combined projected livestock value, and potential lost earnings, at the 20-year endpoint is R73,625,730.

Projecting the households' financial loss of maize production

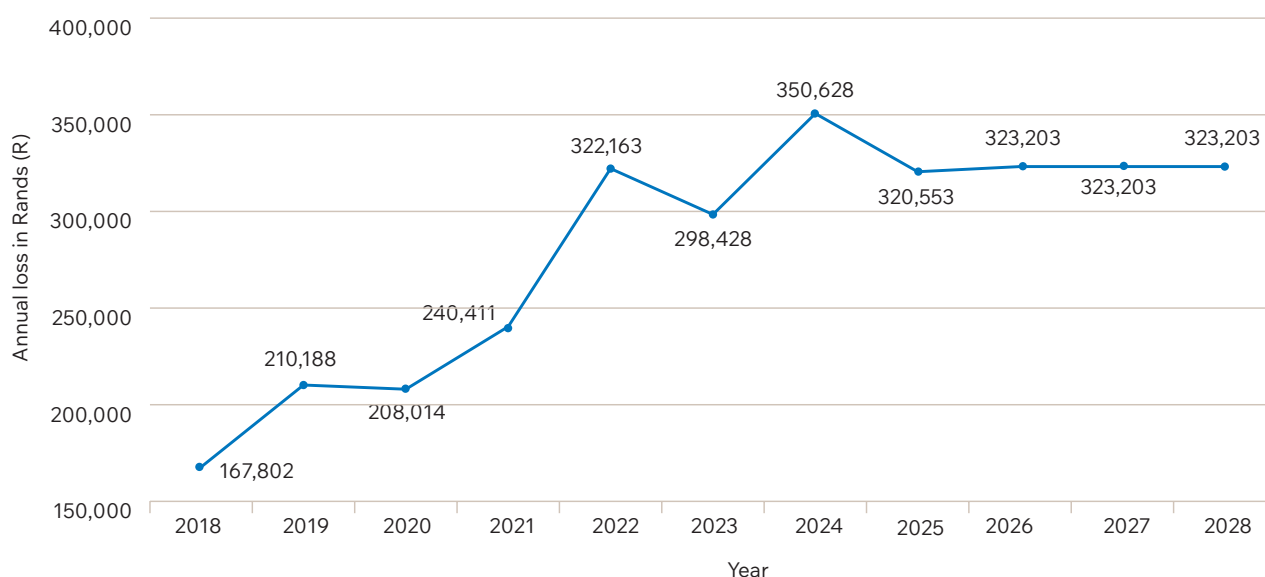
The study further projected the financial losses incurred because respondents lost an annual maize yield of 73.7 tonnes, the yield recorded in the period just before the mine began. Maize was selected because it accounted for the largest crop-yield loss recorded in the study. The projections were based on maize price data for the

2018–28 horizon provided by the South African Grain Information Service accessed on 24 December 2025 (see Table 9 and Figure 35 below).

Table 9: Maize price and projected revenue loss for 73.7 tonnes (2018–28)

Year	Avg Price (R/ton)	Totals (R/ton)
2018	2,276.83	167,802.37
2019	2,851.94	210,187.98
2020	2,823.26	208,074.26
2021	3,262.02	240,410.87
2022	4,371.28	322,163.34
2023	4,049.22	298,427.51
2024	4,757.51	350,628.49
2025	4,349.43	320,552.99
2026	4,385.38	323,202.51
2027	4,385.38	323,202.51
2028	4,385.38	323,202.51
Total (2019–28)		2,920,053
Total (11 years)		3,087,855

*Unit projections from South African Grain Information Services
(Accessed 24 December 2025)*

Figure 35: Projected annual revenue loss for 73.7 tonnes of maize (2018–28)



Baby goats taking shelter in a house in Mpukunyoni (Photo credit: All Rise)

The annual financial loss is calculated by multiplying 73.7 tonnes by the average maize price for each year. For 2018, $73.7 \times R2,276.83 = R167,802.37$. The 2018–28 horizon contains 11 annual observations, and the cumulative total reported below sums all 11 values. The projection remains conservative because some households experienced losses before the 2018 survey.

As illustrated in Figure 35, the projected annual maize loss rises from R167,802 in 2018 to R322,163 in 2022, declines

to R298,428 in 2023, and reaches a peak of R350,628 in 2024. From 2025 to 2028, the annual loss remains close to R323,000. Overall, the cumulative projected financial losses across the 11 annual observations sum to **R3,087,855.33**, or R167,802 in 2018 (base year) and then **R2,920,053** for the next 10 projected years. This represents a substantial uncompensated loss of both income and food security.

4. Measuring the compensation gap

One of the objectives of our study was to conduct a comparative analysis of the asset-based livelihood losses and damages identified in this study with the actual payments made by the mining company to some affected households included in the surveys. The results of this comparative analysis are recorded in this section, although many more households were affected in a wider radius from the mine than we can capture here. To facilitate this comparison, the study analysed historical compensation claims and settlement records alongside the estimated actual losses incurred by the surveyed households over the period between the commencement of mining operations and the household surveys in relation to the time elapsed between the opening of the mine and the surveys conducted in 2018. No further compensation was paid to these households after that date. This analysis evaluates the extent to which the compensation provided reflects the actual social, economic, and livelihood losses, as more accurately measured by our methodology, experienced by the affected communities.

According to the findings, as shown in Figure 36, of the 115 sampled households affected by mine activities, relocations, and loss of land and housing structures, only 25 (22%) received compensation from the mine. In contrast, about 67 respondents (58%) highlighted that they never received any compensation from the mine, while 24 respondents (20%) did not provide any information regarding their compensation. These findings indicate that the majority of the households suffered losses in assets, income earnings, livelihoods and properties that did not receive compensation from the mine. The findings further indicate that the mine failed to fulfil its commitments and promises to compensate affected households for loss and damage, even in the direct and immediate period after the opening of the mine in the form of one-off payments, let alone in respect of our longer time frame which includes expected but foregone income streams.

Figure 36: Number of compensated respondents

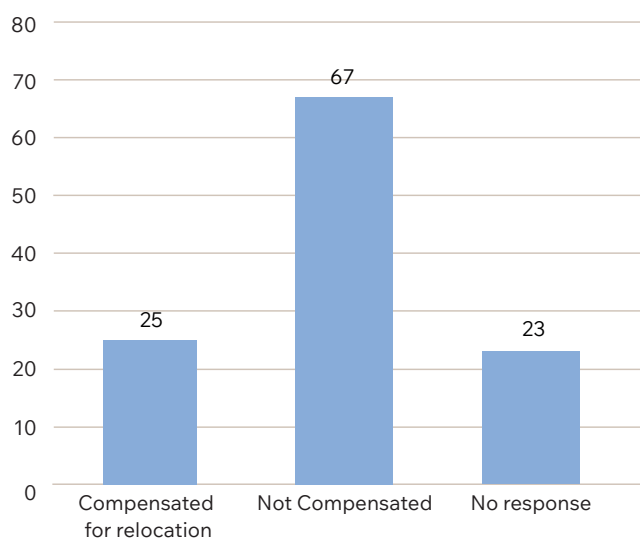


Table 10: Financial compensation paid to respondents

Household	What was compensated for	How much was paid
Household 4	Destroyed house(s)	537,300
Household 5	Relocation	510,300
Household 10	2 ploughing fields	5,000
Household 15	Relocation	220,000
Household 16	Not disclosed	Amount not disclosed
Household 17	Not disclosed	Amount not disclosed
Household 30	Destroyed house(s)	343,201
Household 34	Destroyed house(s)	200,000
Household 37	Not disclosed	Amount not disclosed
Household 47	Relocation	387,000
Household 52	Not disclosed	Amount not disclosed
Household 55	Destroyed house(s)	600,000
Household 57	Relocation	162,000
Household 60	Destroyed house(s)	300,000
Household 61	Not disclosed	Amount not disclosed
Household 84	Not disclosed	4,000
Household 85	Relocation	250,000
Household 86	Land	4,000
Household 87	Cow	10,000
Household 93	Ploughing fields	10,000
Household 100	1 goat and 1 cow	12,000
Household 104	2 goats and 1 cow	11,000
Household 30	Relocation of graves	8,500
Household 37	Relocation of graves	8,500
Household 5	Relocation of graves	10,000
Household 15	Relocation of graves	8,500
Household 47	Relocation of graves	8,500
Household 52	Relocation of graves	8,500
Household 70	Relocation of graves	6,000
Household 85	Relocation of graves	6,000
Household 100	Relocation of grave	12,000
Household 113	Relocation of grave	6,000
Total		R3,648,301

The monetary value of compensation paid to households by Tendele Mine

Households that received monetary payments from the mine highlighted that the compensation was mainly directed towards grave relocations, destroyed houses, losses of livestock and land. Table 10 above provides a breakdown of compensation paid for the various disruptions and losses that were caused by mining activities in the near term. The findings show that the mine paid a total of R1,980,501 to households whose houses were damaged and destroyed by mine blasting. Additionally, R1,529,300 was paid towards relocating households including graves. Furthermore, R33,000 was paid to compensate households whose goats and cows were killed by coal trucks travelling to and from the mine, while R15,000 was paid to two households that lost their ploughing fields. One household also reported receiving a compensation of R6,000, although the purpose of the payment was not disclosed, while five households did not disclose the amount they received as compensation. Overall, the collective reported compensation that was paid to the 115 sampled household amounted to **R3,648,301** (see Table 10).

Comparative analysis of actual loss and actual payments made

The preceding sections of this report have provided estimates of monetary losses suffered by affected households of Somkhele to 2018, who lost their crops, livestock and access to natural resources such as rivers and streams. For instance, the findings indicate that the loss of livestock due to lack of grazing land, pollution and some being trapped in the coal shaft cost community members a collective monetary value of R11,890,338. Moreover, this report suggests that the loss of cultivating land and disruptions of crop production meant that the community incurred an immediate loss of R398,492 in income from crops immediately the mine opened, and then R8,168,001 up to 2018 (reported cumulatively to 2018). Additionally, the report recorded that financial costs incurred by community members that were restricted to accessing water resources because of mining activities amounted to R46,388. The overall cumulative financial losses amounted to R80,704,727 (see Table 11).

Table 11: Total household financial loss (immediate)

Type of collective loss	Collective amount loss in South African Rand
Livestock	R11,890,338
Crops	R8,168,001
Restricted access to water (buying water)	R46,388
Land loss (estimate)	R60,600,000
Total estimated loss	R80,704,727

When analysed against the recorded compensation of **R3 648 301** paid to some of the 115 sampled households, compared to the estimated loss of **R80,704,727** incurred by Somkhele households, the compensation provided by Tendele Mine appears clearly inadequate, falling short by **R77,056,426**. At the lowest estimate (given that we have some households who did not disclose) this means **that the mine paid just 4.73% of the immediate losses (and none of the longer-term losses)**. The study, therefore, finds that the actual cost of loss and damage experienced by households is significantly higher than the once-off compensation payments made by the mine. The disparity between the actual loss and the compensation paid becomes even more pronounced when losses are projected over longer periods using our assets-based livelihoods approach. For instance, when the projected financial losses associated with livestock and crop production discussed in the previous section are combined, they amount to a further **R76,545,783**. Adding these to the valuation, and the mine has only paid just over 2% (0.023), **leaving 97.68% of these losses uncompensated**.

Table 12: Total of realised and projected losses 2007–38

Component	Amount
Land loss in 2018	60,600,000
Crop-income loss 2007 to 2018	8,168,001
Immediate livestock loss to 2018	11,890,338
Restricted access to water (buying water) to 2018	46,388
Projected maize loss (2019–38)	2,920,053
Projected livestock stock value	73,625,730
Corrected aggregate quantified loss	157,250,510

When calculated accurately the economic effects of this coal mine are clearly negative, depriving a rural community of their future, while effectively transferring resources to the private owners of Tendele mine. Even if the fiscal contribution of the mine is factored in, it remains an unconscionable and irrational extraction of value from the many to the few. In our analysis, the harm to wider ecological systems and animals (downstream, for example at the southern part of the iSimangaliso wetland park through mine run-off pollution) is still not included, and nor are the costs of eventual rehabilitation, psychological and cultural harm, or carbon emissions from the burning of the coal, experienced as transboundary pollution in a much wider geography (although an estimate of the latter is included here as an afterword). In short, to continue coal mining is clearly not in the interests of the proximate community, who are owed significant compensation and rehabilitation, or to the wider economy of South Africa. The costs of the incalculable social and cultural harm are beyond the scope of this analysis but remain the most significant moral crime inflicted to Somkhele.

Afterword: Climate damage done by Tendele Coal's Scope 3 CO₂-equivalent emissions since 2007

Patrick Bond, University of Johannesburg, 19 January 2026

This report has focussed on the loss and damage caused to the proximate community by the operations of Tendele Coal Mining (Pty) Ltd. But in addition to this and generating loss and damage into the future in a much wider geography, are the costs associated with climate change, caused by the burning of coal. How much climate damage has Tendele Coal mine in Somkhele done to current and future generations? The estimate below, based on the best data available, is that these climate-related damages have already cost, to various people, \$39 billion, which is the effect of associated ('Scope 3') emissions from 2007–25. An amount of over \$24.8 billion was confirmed as damage from reliable estimates of 2007–17 outputs; while output figures from subsequent years to 2025 have been modelled against the best data and assumptions we have (to make the remaining \$14.2).

Data from Petmin reports are available to estimate the amount (volume) of coal mined for the years 2007–17. That, in turn, gives confidence in estimating the resulting CO₂ emissions, and the associated damage. For 2018–25, four developments make estimating the output difficult:

- Petmin, the owner of Tendele, delisted from the JSE because it was purchased by Capitalworks, a private equity fund that does not have a responsible emissions disclosure policy. This halted its public reporting;
- Covid-19 lowered 202021 output;
- litigation halted the attempt at a new site of extraction in 2022–24 just as existing coal resources were depleting, causing a production pause;
- since mid-2025 there has apparently been a pause due to changes in demand.

Table 13: Estimated annual coal output at Somkhele Mine (2007–17)

Year	Metallurgical (t)	Thermal (t)	Emissions (t)
2007	250,302	0	650,785
2008	480,000	0	1,248,000
2009	500,000	0	1,300,000
2010	512,000	0	1,331,200
2011	524,006	0	1,362,416
2012	637,220	0	1,656,772
2013	823,509	159,808	2,508,682
2014	1,125,089	244,298	3,487,117
2015	1,335,233	368,413	4,318,956
2016	1,236,433	349,405	4,018,357
2017	1,149,883	436,756	3,994,235

To assess overall damage during 2007–17, we begin by recording all available (public-record) estimates for Tendele's output in metric tonnes ('t'). But there are two types of coal, and the resulting emissions tonnage can be arrived at with sensitivity to the mix of metallurgical coal, with CO₂ emissions of 2.6 tonnes, per tonne of coal consumed; and thermal coal, with CO₂ emissions of 2.3 tonnes per tonne of coal consumed.

We multiply by the estimated annual coal output in each category from Tendele's Somkhele mines (recorded in annual reports), to arrive at the annual Scope 3 emissions.

What damage was done by these emissions?

The 'Social Cost of Carbon' (SCC) is the damage done in US\$, projecting forward to 2100, caused by a single tonne of CO₂ emissions. The years 2007–17 allow reasonable annual estimates for:

- the appropriate SCC in constant US\$, adjusted for 2.3% annual inflation (i.e., US\$ devaluation), and the SCC's rising damage rate, starting at \$716/tonne in 2007 and reaching the \$1,584/tonne level for 2025 according to economists (Bilal and Kanzig, 2025; see also Bilal and Kanzig, 2026);
- the CO₂ emissions (metric tonnes) in column 3; and
- the \$ damage in column 4.

Bilal and Kanzig generate their social cost of carbon figures by applying a counterfactual world growth model:

"We show that since 1960, climate change caused a gradual reduction in the annual world growth rate that reaches one third of baseline by 2019. Because climate change is also permanent, its effects keep accumulating over time. According to our counterfactual, world GDP per capita would be more than 20% higher today had no warming occurred between 1960 and 2019... We obtain a SCC of \$1,584 per ton." (2025, 1)

This departs from the usual damage-function approach to SCC, as instead of modelling climate damages as a percentage of GDP tied to temperature increases, they construct a counterfactual growth path for the global economy. Using this method, in 2007, the start-up year, the SCC for Tendele was \$466 million, rising to \$4.4 billion for the year 2017. The aggregate climate damage done by Tendele for 2007–17 is \$24,854,869,087.

There are a number of established assumptions that underpin these figures, which for pressure of space cannot be further discussed here. Suffice to say that for the 11 years we have accurate figures for coal tonnage produced in Tendele Coal's Somkhele mine, **over \$24.85 billion** in damage can be inferred due to the resulting CO₂ emissions. In early 2025 Rand terms (R17.6/\$), that

Table 14: The aggregate climate damage at Somkhele Mine (2007–17)

Year	SCC(\$)	Emissions (t)	Damage (\$)
2007	716	650,785	465,962,060
2008	748	1,248,000	933,504,000
2009	781	1,300,000	1,015,300,000
2010	815	1,331,200	1,084,928,000
2011	851	1,362,416	1,159,416,016
2012	889	1,656,772	1,472,870,308
2013	928	2,508,682	2,328,056,896
2014	969	3,487,117	3,379,016,373
2015	1,012	4,318,956	4,370,783,472
2016	1,056	4,018,357	4,243,384,992
2017	1,102	3,994,235	4,401,646,970
Total			24,854,869,087

aggregate cost is nearly **R437 billion (or R39.7 billion/year)** for 2007–17). This figure represents the aggregated losses to all persons and infrastructure, from the transboundary air pollution, and global warming effects of burning coal.

If we assume that the average 2018–19 annual mining output was 1.5 million tonnes, keeping the late 2010s pace, but that the 2020–25 annual output might have averaged closer to 300,000 tonnes due to the factors noted above, then an additional 4.8 million tonnes was produced, creating 11.5 million tonnes of CO₂ emissions, at a time emissions costs were escalating (from \$1,102/tonne in 2017 to \$1,584/tonne in 2025). Damage would be in the range of \$14 billion (approximately **R250 billion**), for 2018–25, if these are roughly correct estimates of output. Together, for the life of the mine from 2007–25, with these very rough assumptions for 2018–25, we can estimate an historic damage amount in the order of **R687 billion** (R437 plus R250), or **\$39 billion**. This applies to the impact of coal combustion in thermal power plants and metallurgical smelting, and to the entire world. But changing climatic conditions in northern KwaZulu-Natal, partly contributed to by this mine, also have severe associated costs in the increasing frequency of droughts (such as from 2014–16) and extreme weather events (Ndlovu & Demlie, 2020). Local communities remember that in the 2014–16 drought, Tendele Mine drained local surface and table water without adequate licensing, even as they lost access to water (AIDC, 2018).

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Meeting in Mpukunyoni (Photo credit: All Rise)



View of Tendele Mine from a homestead in Mpukonyoni (Photo credit: All Rise)