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TOWARDS AN EQUITABLE TRANSITION TO LOW-CARBON, CLIMATE-RESILIENT ECONOMIES

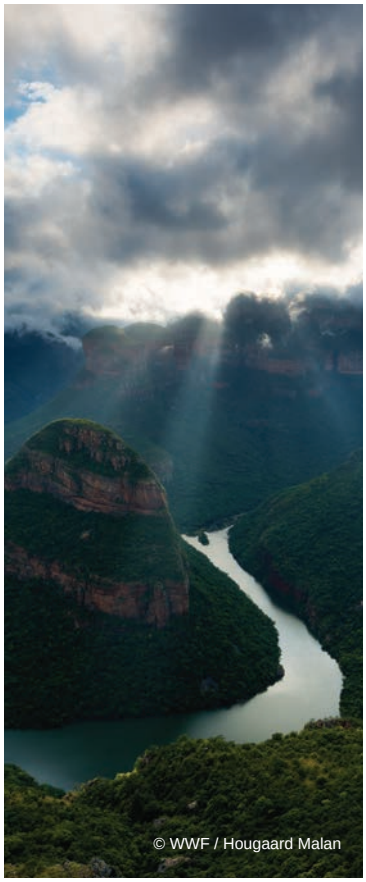
AN AGENDA FOR RESPONSIBLE MINING OF TRANSITION MINERALS IN AFRICA

This discussion paper addresses issues of economic, social and environmental sustainability in the mining and processing of transition minerals, also referred to as critical minerals or green minerals.

The idea is to avoid the past patterns of extractivism in Africa: the resource curse, rent-seeking by elites, illicit financial flows, exploitative jobs, and the displacement and disruption of local communities. In addition, we must avoid negative water, land and biodiversity impacts, which include pollution and the loss of productive land, carbon sinks, biodiversity habitats and other ecosystem services such as clean water supply. Extraction of transition minerals should not serve the interests of the Global North (the market), while Africa pays the externalities price.[1]

KEY RECOMMENDATIONS

1. Create **circular economies** for transition minerals to build out new industries and jobs, and minimise the need for destructive virgin mining.
2. Mandate **strategic land-use decision-making** at a national level to establish relative benefits of different land uses and possibly "no-go areas" for mining, prior to a mining project's conception and impact assessments.
3. Adopt and implement **legislation and action plans on work in mining**, and strengthen institutions, including enforcement agencies, relating to the eradication of child labour, human trafficking and modern slavery; and to improve worker rights, in line with the decent work guidelines of the International Labour Organization (ILO).
4. Grant prospecting permits and mining licences only if the business case for the mine indicates **sufficient funds for sustainability practices** in operations, for both rehabilitation and offsets to compensate for residual negative impacts.
5. Adopt and implement best practices for sustainability during preparation, mining and post-mining. To ensure this implementation happens, aspects of these **best practices should be translated into regulations;** otherwise, there is no guarantee they will be followed or the necessary benefits realised.
6. Establish a global framework and mechanisms for **traceability, transparency and accountability** in the mining and processing of transition minerals.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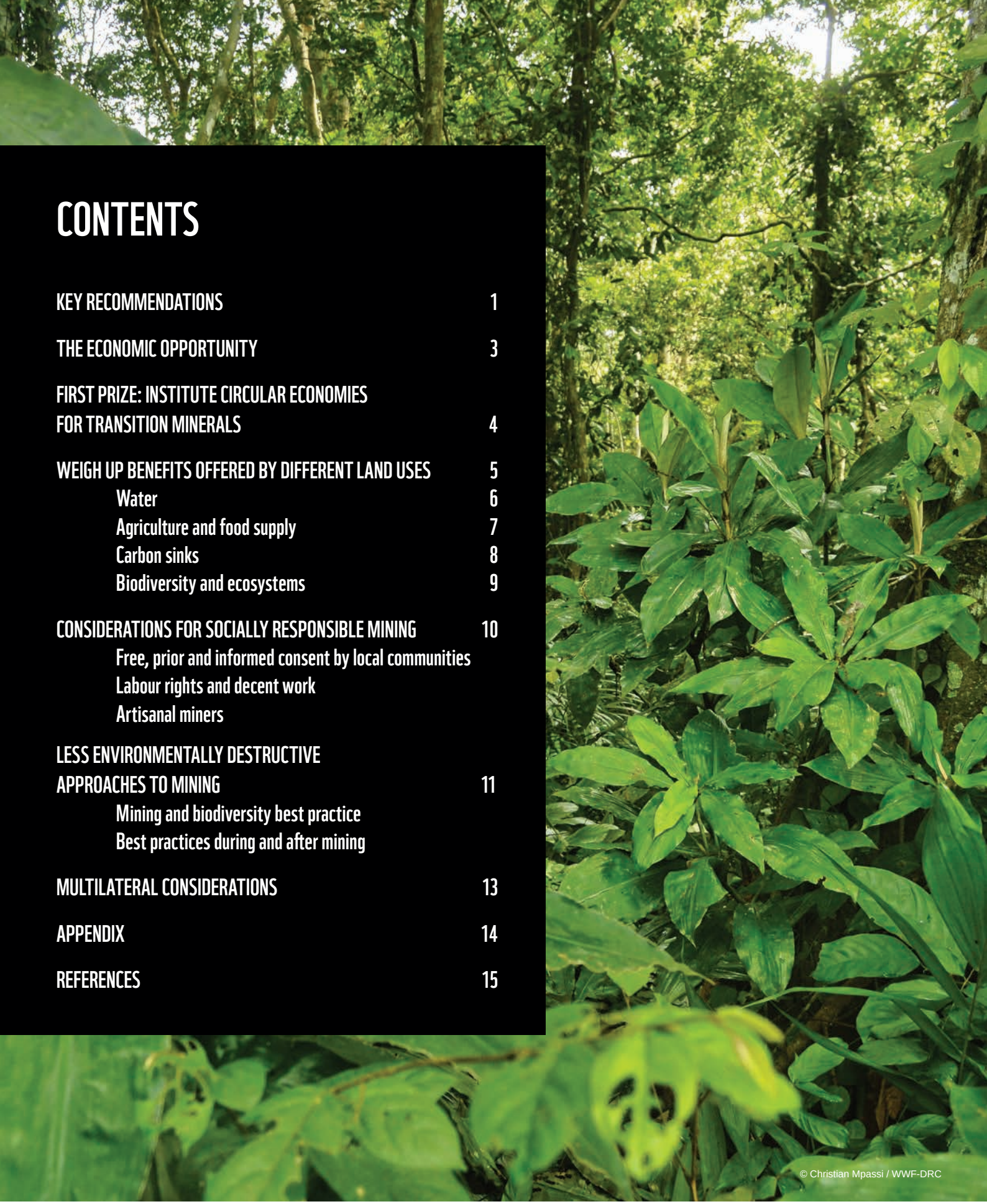

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THE ECONOMIC OPPORTUNITY

Transition minerals* are essential inputs into many clean energy technologies and associated infrastructures, like wind turbines, solar panels and electric vehicles. Exponential growth in demand for these minerals is expected between 2025 and 2050 based on business growth trajectories and countries' climate pledges.

Most transition mineral ores are found in the Global South, China and Australia. Certain African countries are already suppliers: South Africa dominates with platinum-group metals mining and reserves, and the Democratic Republic of the Congo (DRC) has significant cobalt mining and reserves, and a large share of copper. Morocco has phosphate, Guinea has bauxite, Gabon has manganese, and Mozambique has titanium and graphite.

Demand for the minerals is mainly from the Global North and China, where production is located and where large middle classes and industrial use drive consumption.

Southern Transitions, a think tank working to advance just transitions in the Global South, released a 2024 paper, *Navigating the African Opportunity Landscape for Value Chain Upgrading in the Global Scramble for Critical Minerals*, which analyses data about where transition minerals are found in Africa and which countries constitute the market. The paper also looks at challenges and opportunities for African countries to realise their economic potential and makes policy recommendations.[3]

WWF South Africa has long recognised the economic opportunity presented by transition minerals and the replacement mining jobs that would be created to assist in a just transition to a low-carbon economy.[2]

THE VALUE OF TRANSITION MINERALS FOR JOBS AND GROWTH IN AFRICA

The African Union's Green Minerals Strategy,[4] as well as many national strategies including South Africa's recent Critical Minerals and Metals Strategy [5] and various policy think tanks** emphasise the need for strategic beneficiation to capture more economic value in Africa as demand for these minerals grows.

For many African countries, export revenues from extractive industries (including oil and gas, artisanal and small-scale mining) are critical for the balance of payments, although job impacts vary.[6]

In South Africa, the mining and minerals sectors employ more than 474 000 workers, such as in the platinum-group metals (181 000), gold (98 000) and coal (95 000) subsectors.[7]

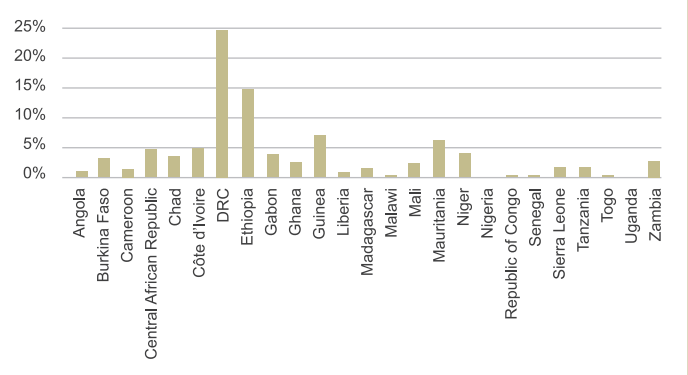

Figure 1: Estimated share of national jobs in extractive industries, including oil and gas, and artisanal mining, 2019–2022

Source: Graphs constructed using data from Extractive Industries Transparency Initiative (EITI) reports, using the latest year provided for each country on the website as at April 2025. South Africa is not a member of the EITI, which thus does not publish data for the country. [8]

Sustainability ambitions will be challenged by the mining of transition minerals, bringing increased risks for human rights abuses, food insecurity and water contestation. [9] Around 60% of transition mineral projects globally are in food-insecure jurisdictions, 53% of projects are in high water risk locations and 43% of projects are in jurisdictions where there are risks to resource governance.[10]

* Copper, cobalt, nickel, lithium, graphite, rare earth elements, platinum-group metals, fluorspar, chromium, zinc, tungsten, antimony and aluminium
** Including Atlantic Council, Carnegie Endowment for International Peace, Southern Transitions and the South African Institute of International Affairs

FIRST PRIZE: INSTITUTE CIRCULAR ECONOMIES FOR TRANSITION MINERALS

A more sustainable alternative to expansive and inherently destructive virgin mining is to create circular economies around transition minerals.

A circular economy keeps materials and products in circulation for as long as possible through practices such as designing for reuse, repair, recycling and remanufacture of products and sharing of underused assets.[11]

How the transition minerals landscape can benefit from circular economies:

- Improved primary mining operations can save on output costs of water and energy, among others.
- Recovery of minerals from mining tailings and polluted mine water. At and close to mine sites, a large opportunity exists in the remediation of tailings dams, slag heaps, stockpiles and polluted water sources. Opportunities include extracting residual metals, repurposing tailings for construction and developing new materials like techno-soils for agriculture.
- Recovery of minerals from urban mining.[12] Urban mining is the practice of recovering useful minerals from scrap metals and post-consumer waste, mostly by recycling items that would end up in landfills. This includes "downstream" products like electric vehicle (EV) batteries, renewable energy infrastructure (modular or large scale) and consumer electronic goods, which often contain circuit boards and other components with significant amounts of valuable metals. With platinum, for example, the second largest source of the mineral is now from recycling, at 25% of supply since the mid-2000s. [13]

  In Nigeria, media reports of investments at Romco Metals indicate that the recycling of around 1 500 tonnes of aluminium per month is supporting 5 000 new jobs.[15] In Morocco, Glencore's partnership with mining company Managem is testing the feasibility of producing cobalt from recycled battery materials.[16]

Examples of South Africa's emerging circular economies in transition minerals:

- Extended producer responsibility (EPR) is mandated for electronic goods placed on the market, including EV batteries, small-scale renewable energy infrastructure and consumer goods. This provides a significant opportunity for investment into end-of-life management and potential new business models (refurbishment and remanufacturing) with a number of entrepreneurs already innovating in this space. [17]
- Copper, aluminium, steel and lead are valuable, and heavily traded, scrap metals. In 2023, they had an export value of R5.2 billion altogether. Scrap markets require effective management to ensure trade is legal, and, where feasible, that scrap is used for domestic processing and not simply exported.
- Research and pilot projects on phyto-extraction using plants, electrolysis or ion exchange to reclaim transition and other minerals from tailings, slag heaps and polluted water bodies hold potential for less polluting and energy-intensive reclamation technologies. These approaches have co-benefits, for example, in addressing acid mine drainage, thereby creating clean water resources for impacted communities, local ecologies and other economic activities.[18]

Recommendation Circular economy markets can be developed through Extended Producer Responsibility regulations and enforcement, addressing illicit and criminal flows and supporting local entrepreneurs with, for example, technology transfer and commercialisation.

Avoiding mining through circular economies can fulfil a share of demand, create new industries and jobs, reduce polluting waste, clean up water bodies, and keep unmined land available to serve its water, food, livelihoods and habitat purposes.

WEIGH UP BENEFITS OFFERED BY DIFFERENT LAND USES

Before decisions to pursue mining are considered, countries would do well to have a national framework for land use which considers the options and trade-offs of different land uses, and establishes an encompassing approach to making land use decisions.

South Africa's Spatial Planning and Land Use Management Act 16 of 2013 mandates national, provincial, regional and municipal spatial development frameworks. The act says "sustainable development of land requires the integration of social, economic and environmental considerations in both forward planning and ongoing land use management to ensure that development of land serves present and future generations."[19]

The resulting National Spatial Development Framework 2050 speaks of "identifying and earmarking broad categories of high potential agricultural land for food security and agrarian reform, and environmentally-significant areas for the provision and use of essential ecosystem services" and "managing competing land uses e.g. mining, agriculture and ecotourism."[20]

The benefits of water production zones, high-yield agricultural land, carbon sinks and important biodiversity areas need to be weighed against those of mining. Pertinent information is necessary for strategic decision-making around land use choices to assess trade-offs and establish conditions under which mining is a "no go". Combining datasets and spatial tools on mining with those on land use, including agrarian use, indigenous ownership, human rights due diligence, strategic water source areas and biodiversity hotspots, can support better decision-making on optimal land use, as well as free, prior and informed consent (FPIC), stronger conditionalities and safeguards, and enhanced accountability.

Recommendation Mandatory strategic land-use decision-making tools should be introduced, which may stipulate no-go areas for mining where, on balance, the trade-offs between different land use benefits are too high. This decision-making should occur before any projects get to the environmental impact assessment stage.

The natural functioning of key water-supplying areas should not be disrupted. Africa's water towers are high-altitude areas which are the source of most major rivers. In South Africa, identified strategic water source areas provide over half of the country's surface water from just 8% of its land area.[21]

Water usage is typically high during mining, and can impact both surface water and groundwater resources. When mines are situated in water-stressed areas, they could challenge the security of the water supply for other users. Many global transition mineral projects are in high water risk locations.[23]

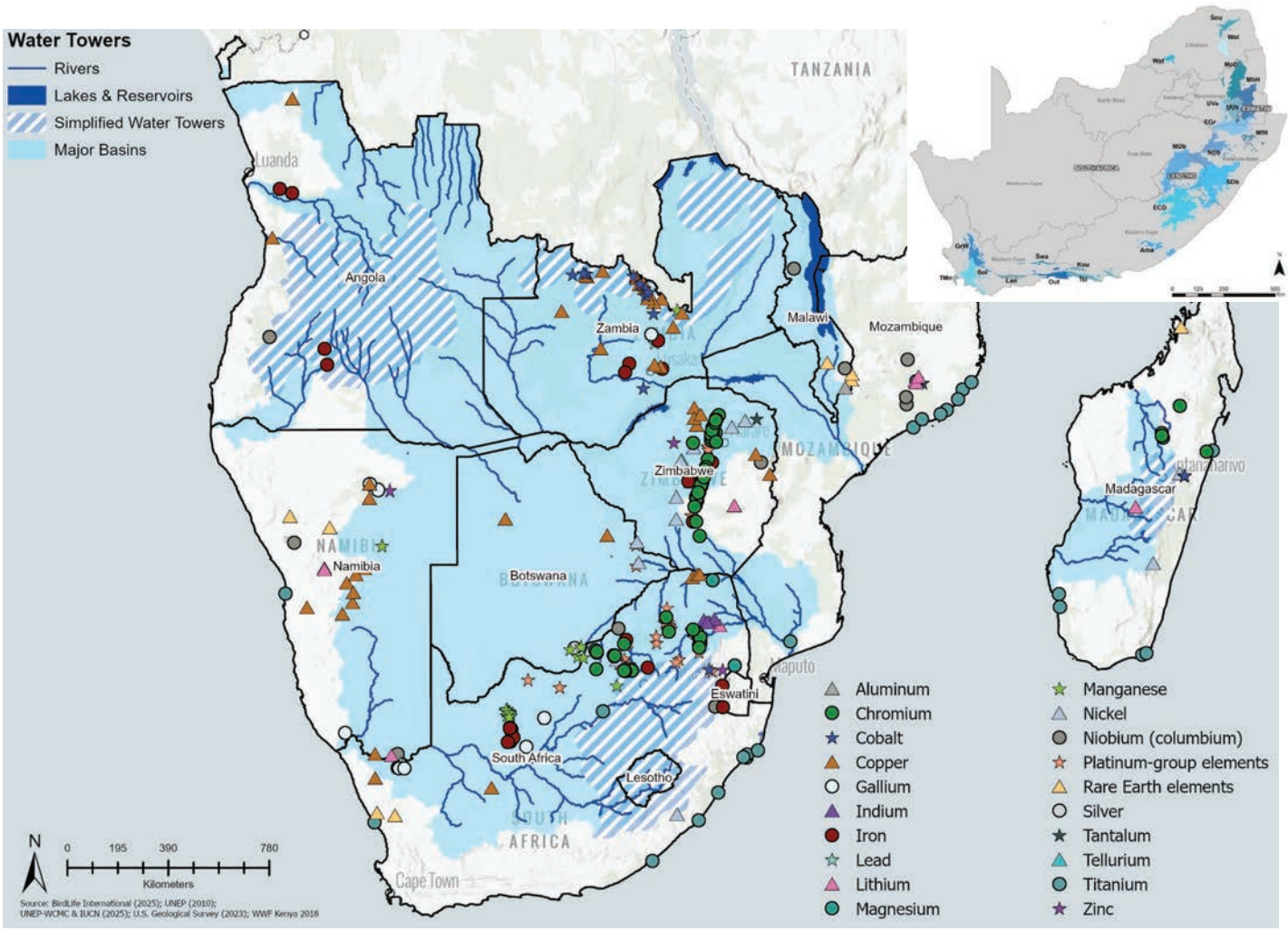

Figure 2: Water towers in southern Africa and the overlap with transition mineral resources **(Top left inset:** South Africa's strategic water source areas)

Source: WWF, 2025 [22]

Copper and lithium have particularly high water requirements, with lithium presenting the highest water risks, as many of the global resources of this mineral are found in areas of medium to very high-water risk.[24]

In Chile, 80% of copper production takes place in locations with high water stress, increasing competition with local people for this critical resource.[25] At the Ewoyaa Lithium Project in Ghana, for example, the raw water requirement for the project is significant and may disrupt the water cycle, and impact available water for domestic, irrigation and other purposes.[26]

Aquatic ecosystems are also often impacted by mining. Post-mining negative impacts can increase, leading to long-lived acid mine drainage, polluted groundwater and biologically degraded rivers. In the Witwatersrand area in South Africa, acid mine drainage continues to leach heavy metals into freshwater systems decades after mine closures.[27] In other regions, wetlands have been drained or fragmented, riparian vegetation stripped and hydrological flows permanently altered. This undermines the capacity of rivers to support biodiversity, regulate floods or provide clean water for local communities and into built water supply infrastructure.[28]

In certain contexts, agricultural development can be better for local, direct benefits than mining, as it is more effective at reducing poverty, food insecurity and malnutrition.[29] Mining may also have negative impacts on agriculture. In Mozambique, for example, soil contaminants reduced maize yields in the inland Moatize district.[30] In one part of Kenya, gemstone mining has led to a loss of agricultural lands.[31] In Zambia, certain agricultural products were found to have high levels of metals in them, from farming operations close to copper and cobalt mines.[32]

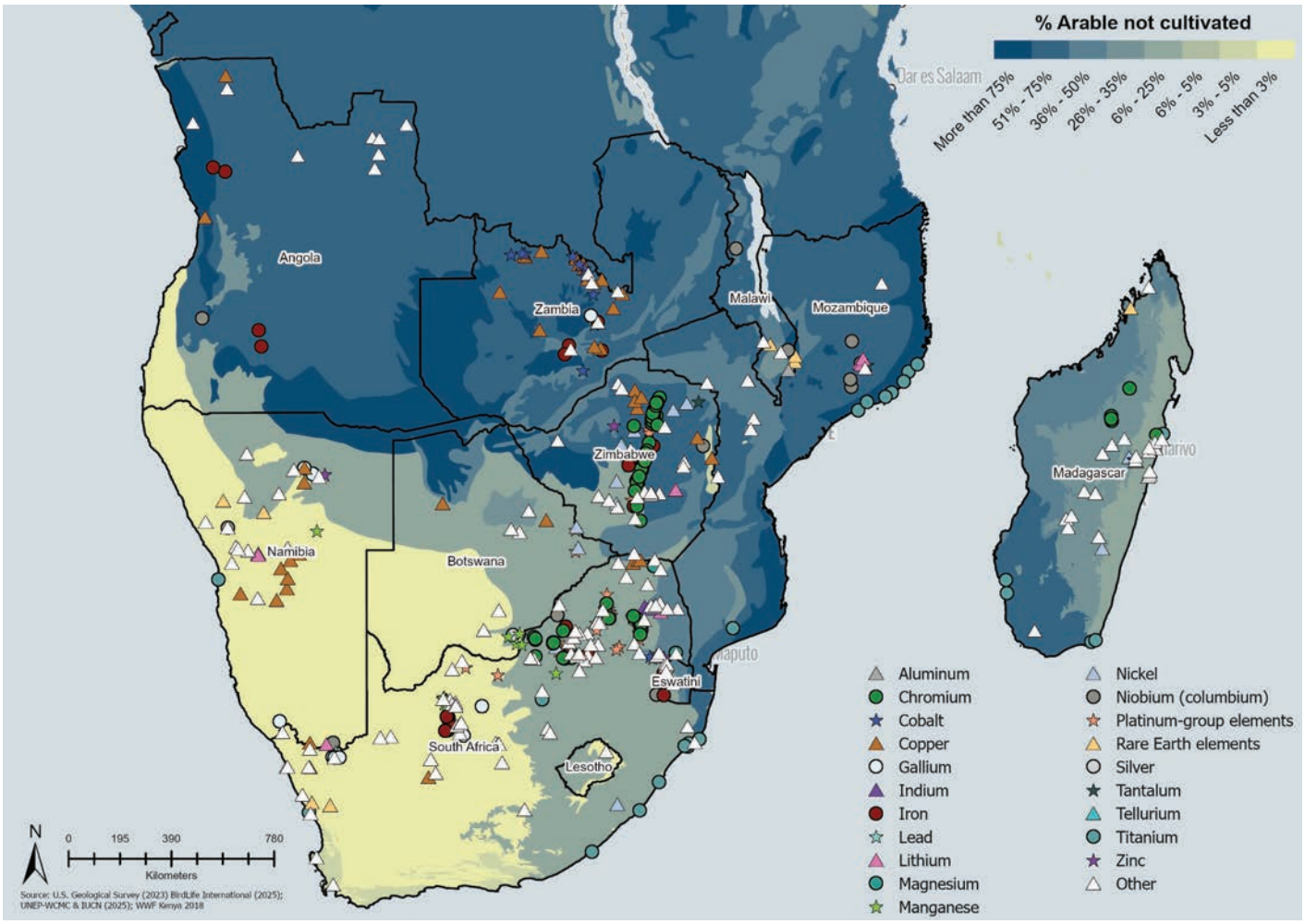

Figure 3: Arable land overlap with transition mineral resources

Source: WWF, 2025 [33]

CARBON SINKS

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Vegetation and soil provide carbon sinks, which are essential to reabsorb human-produced greenhouse gas emissions that are driving climate change. The global goal of reaching net-zero carbon dioxide emissions by mid-century relies heavily on maintaining land and ocean sinks. South Africa has mapped its national carbon sinks, being soil organic carbon, woody biomass, herbaceous biomass and above-ground biomass litter.[35] Global vegetation and soil carbon maps indicate high carbon sink areas (which generally co-occur with high biodiversity areas). Figure 4 shows only the soil carbon component. Mining developments in these carbon sink areas should be avoided.

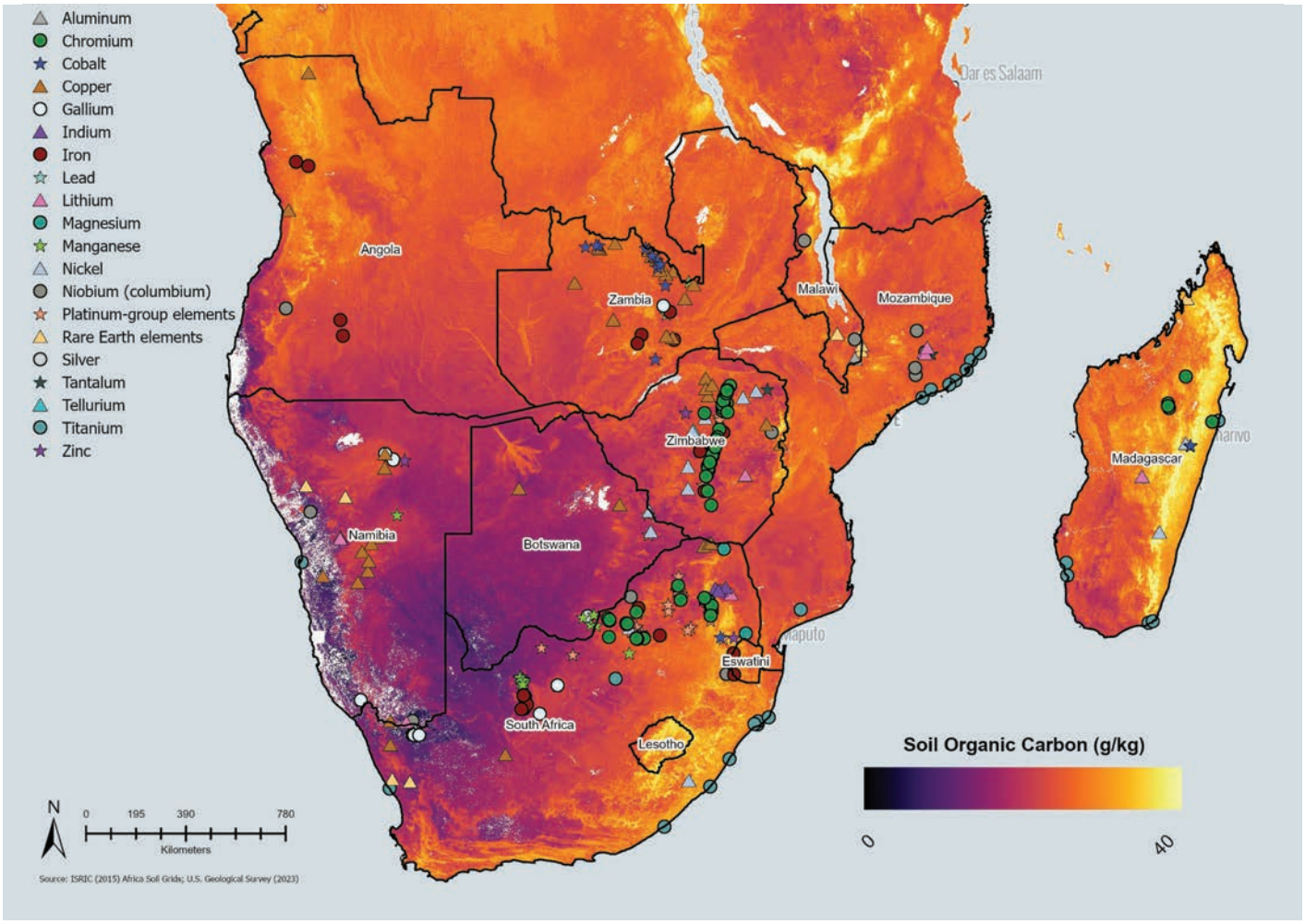

Figure 4: Soil organic carbon overlap with transition mineral resources

Source: WWF, 2025 [34]

Soil disruption and deforestation from mining impact the ability of these sinks to remove carbon from the air, plus this releases carbon stored in soils, plants and natural systems. Indirect effects due to the expansion of infrastructure and habitation around mines also exacerbate this impact significantly. This both accelerates climate change and reduces the potential for natural systems to buffer and mitigate its impacts.

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BIODIVERSITY AND ECOSYSTEMS

Biodiversity has significant value to local communities and economies on a day-to-day basis. Many communities depend directly upon local biodiversity for food, medicines and fuel. Ensuring the sustainable utilisation of this biodiversity can increase local benefits, in part through the development of industries that benefit biodiversity or are compatible with biodiversity. This includes nature-based tourism, which is already a major industry in many parts of Africa, creating local employment, income and export earnings.

In July 2025, the International Court of Justice pronounced an Opinion Advisory that says protecting nature isn't optional – it is legally required. Protecting forests, wetlands, oceans and other ecosystems is now part of what countries are legally required to do under international law. In short, countries must avoid harming ecosystems. This means including conservation when planning climate policies, acting early so damage doesn't become permanent and working with other countries to protect biodiversity and nature's services.

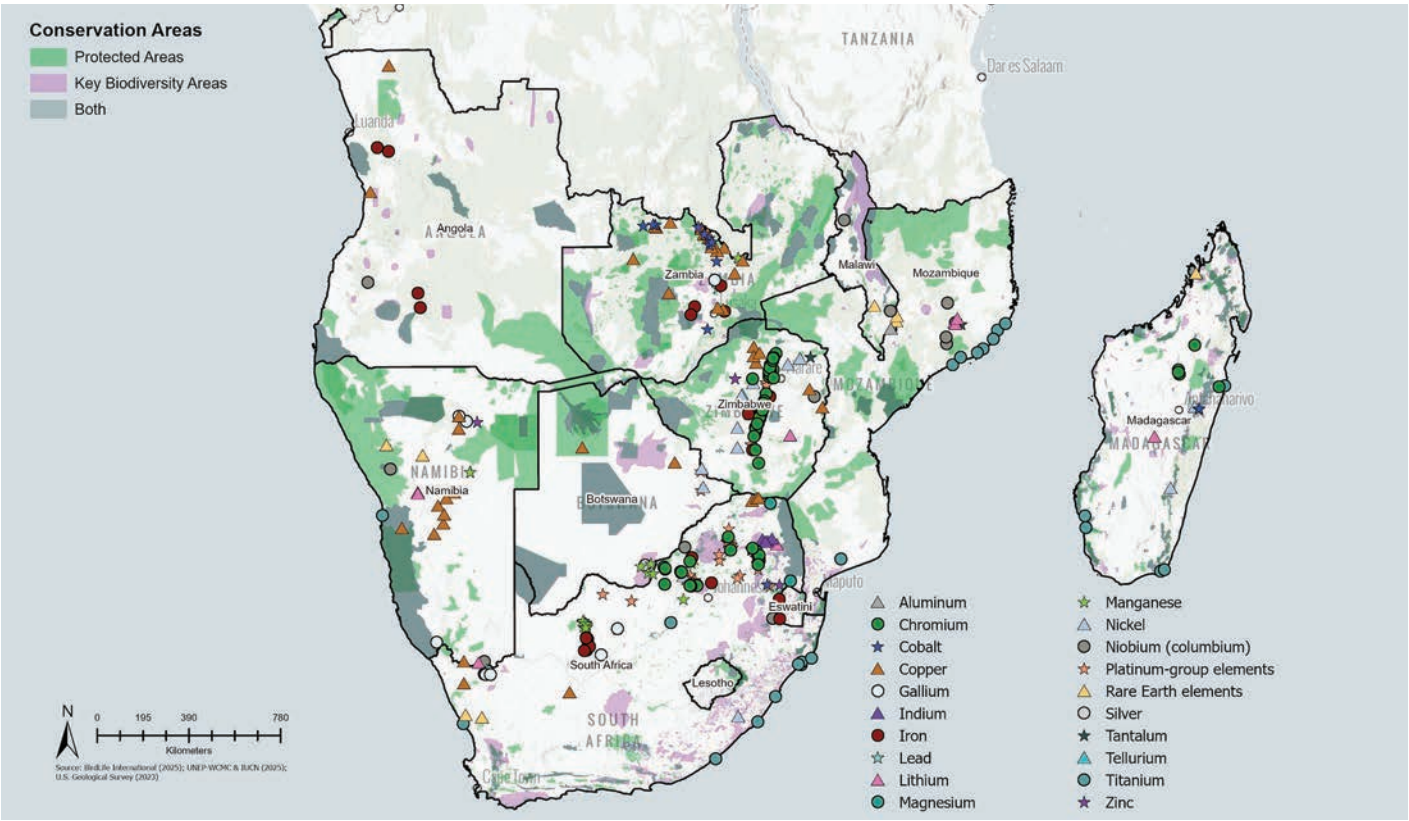


Figure 5: Critical biodiversity habitats in southern Africa and the overlap with transition mineral resources

Source: WWF, 2025 [36]

While protecting nature is now legally required, most of the world's most vulnerable biodiversity is not under strict legal protection and is potentially exposed to mining development and other human land uses.[37]

Deforestation impacts from mining over the past 20 years are highly concentrated, with almost 84% of total direct mining-related deforestation taking place in only 10 countries and 63% occurring since 2010.[38] The increase in the extraction of transition minerals will bring new challenges.

For example:[39]

- Bauxite-linked deforestation accounts for 8% of direct mining-related deforestation. It occurs mostly in: Australia (50%), Brazil (16%), Ghana (15%) and Indonesia (14%).
- Iron ore and copper account for 7% and 4% of direct mining-related deforestation, respectively.
- Together, manganese, nickel, zinc, silver, platinum, cobalt, palladium, lead, U308 and molybdenum contribute 11% of direct mining-related deforestation.

Once informed decisions have been made about land uses and trade-offs, and areas designated for mining, the processes to permit prospecting and mining, mining operations, and post-mining closure and rehabilitation must ensure social responsibility and environmental sustainability.

CONSIDERATIONS FOR SOCIALLY RESPONSIBLE MINING

While it is critical to assess and address negative environmental impacts, social aspects are as vital to ensure inclusive decision-making and equitable access to natural resources.

FREE, PRIOR AND INFORMED CONSENT BY LOCAL COMMUNITIES

It is estimated that 69% of transition minerals mining projects are on or near land that qualifies as Indigenous peoples' or peasant land (that is, agrarian land), with Africa having the highest proportion (33%) of projects located on or near both Indigenous peoples' and peasant land. In one instance in Zimbabwe, it is alleged that community members near a lithium mine were offered US$1 900 to relocate or face eviction without compensation. Communities near a lithium project in Ghana have experienced negative agricultural and food security impacts, as well as limited financial compensation.[40]

In April 2024, 87 Indigenous Peoples' representatives from 35 countries across seven regions issued a declaration containing a clear call for companies to "fairly negotiate and implement equitable benefit-sharing mechanisms, including co-ownership and co-equity models, that respect Indigenous Peoples' rights and contributions and ensure respect to their free, prior and informed consent (FPIC)."[41] While compensation and benefit-sharing mechanisms are necessary, these must follow FPIC as described in the ILO's Indigenous and Tribal peoples Convention, 1989 (No. 169).[42]

Local and Indigenous communities must be supported as custodians of the land with FPIC, along with equitable benefit-sharing and protection of human rights. Their access to economic resources and options, as well as land tenure, among other resources and levers, must be supported. Revised legislation may be needed, given the unique characteristics of the rapidly evolving transition minerals sector and the inadequacy of existing environmental legislation in certain countries.

Recommendation Countries should adopt and apply at a national level the recommendations of the United Nations (UN) Secretary General's High-level Expert Advisory Group on Critical Energy Transition Minerals on regulations and other levers to expedite meaningful and substantive inclusion and protection of affected local communities (see Appendix).

LABOUR RIGHTS AND DECENT WORK

A range of labour rights violations are associated with the mining of transition minerals, with 39 allegations impacting workers in 2023, including occupational health and safety risks, child labour, violations of the right to unionise or freedom of association, and unfair wages.[43]

Recommendation Countries should fully implement the African Union's Ten-Year Action Plan to Eradicate Child Labour, Forced Labour, Human Trafficking and Modern Slavery (2020–2030) and any other national legislation to address these issues and their linkages, in certain instances, with mining.

Recommendation All jobs created in circular economy industries, transition minerals mining and related value chains should be decent work as conceived by the ILO.[44]

ARTISANAL MINERS

Artisanal and small-scale mining is prevalent across Africa. For example, it is estimated that up to 5 000 artisanal miners in Zimbabwe are pursuing lithium ore extraction, with clashes between artisanal and formal mining operations leading to injuries and death.[45] Artisanal mining is particularly prevalent in the DRC where the International Peace Initiative's open data and mapping of artisanal mining projects[46] is an example of several global, regional and national initiatives aimed at better understanding and supporting formalisation of the industry. Protecting workers, improving productivity, reducing environmental impacts and increasing domestic revenues are critical for this to happen. A participatory approach is required to build trust and support behaviour change.[47]

Recommendation Artisanal mining should be formalised to protect workers and improve sustainability outcomes, including through the participatory design of programmes with workers and affected communities.

LESS ENVIRONMENTALLY DESTRUCTIVE APPROACHES TO MINING

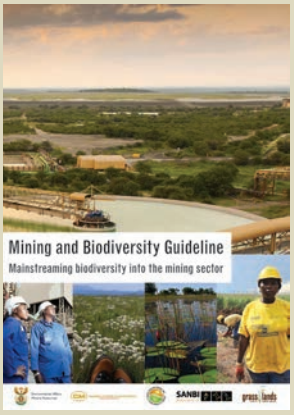
Recommendation Prospecting permits and mining licences should not be granted if the business case for the mine does not indicate sufficient funds for rehabilitation and offsets to compensate for residual negative impacts.

Planning for and pursuing prospecting and mining, mine closure and post-mining rehabilitation should follow best practice with regards to environmental responsibility. There are many guidelines available, as shown below.

MINING AND BIODIVERSITY BEST PRACTICE

In South Africa, a non-binding Mining and Biodiversity Guideline was published in 2013, which has broader relevance to other countries and regions. It is accompanied by a set of biodiversity information and tools for enhanced data for decision-making. The purpose of the guideline is to integrate relevant biodiversity information into decision-making about where to mine and how best to avoid, minimise or remedy impacts on biodiversity to support sustainable development.

A 2014 WWF report revealed an alarmingly high level of non-adherence – approximately a third – to the key biodiversity principles of the guideline. This confirmed what was already being experienced in practice, namely "that certain environmental assessment practitioners and/or mining houses are apparently disregarding critically important environmental information in the completion of their coal mining or prospecting applications". The report indicated that increased use of the guideline document requires the professionalisation of environmental assessment practitioner associations, capacity building of environmental assessment practitioners and the adoption of the mining and biodiversity guidelines as mandatory tools for decision-making.



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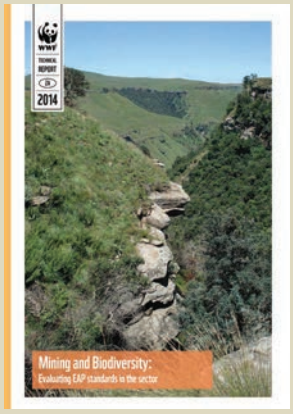

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OFFSETS

"Offsets are the final option in the mitigation hierarchy – biodiversity offsets must only be considered once all the foregoing steps in the mitigation hierarchy have been considered to their full and feasible extent. The mitigation hierarchy dictates that the degradation and loss of biodiversity must be avoided, or where impacts cannot altogether be avoided, they should be minimised and the area adversely impacted by the relevant activity should be rehabilitated. When, after taking the aforementioned mitigation measures, there are likely to be residual negative impacts on biodiversity of medium to high significance, they must be offset."

Source: South Africa's National Biodiversity Offset Guideline

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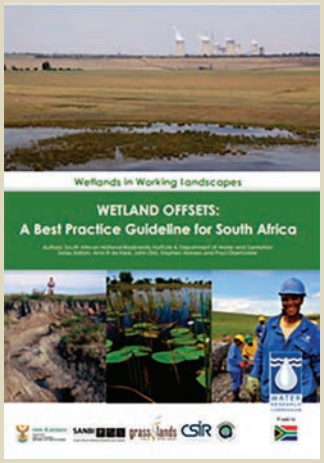

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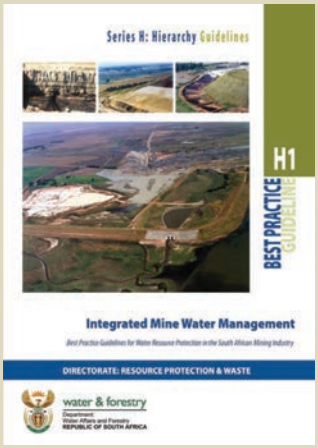
BEST PRACTICES DURING AND AFTER MINING

Recommendation Aspects of these best-practice guidelines should be translated into regulations to ensure their implementation; otherwise, there is no guarantee that they will be followed and sustainability benefits realised.

Recommendation Build institutions, increase penalties and improve enforcement capabilities through introducing new measures, such as stricter sanctions and specialised training for governments to enforce regulations.

DURING MINING: EXAMPLES OF GUIDELINES RELATING TO WATER



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BEST PRACTICE GUIDELINES dealing with aspects of DWAF's water management HIERARCHY are prefaced with the letter H. The topics that are covered in these guidelines include:

- H1. Integrated Mine Water Management
- H2. Pollution Prevention and Minimisation of Impacts
- H3. Water Reuse And Reclamation
- H4. Water Treatment

BEST PRACTICE GUIDELINES dealing with GENERAL water management strategies, techniques and tools, which could be applied cross-sectoral and always prefaced by the letter G. The topics that are covered in these guidelines include:

- G1. Storm Water Management
- G2. Water and Salt Balances
- G3. Water Monitoring Systems
- G4. Impact Prediction
- G5. Water Management Aspects for Mine Closure

BEST PRACTICE GUIDELINES dealing with specific mining ACTIVITIES or ASPECTS and always prefaced by the letter A. These guidelines address the prevention and management of impacts from:

- A1. Small-scale Mining
- A2. Water Management for Mine Residue Deposits
- A3. Water Management in Hydrometallurgical Plants
- A4. Pollution Control Dams
- A5. Water Management for Surface Mines
- A6. Water Management for Underground Mines

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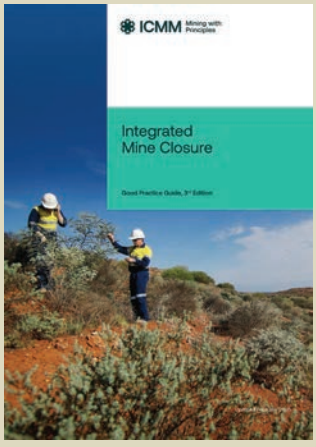
Recommendation Corporate sustainability and traceability must be enhanced, as currently, decisions on approaches to assessing and addressing impacts are too often at the discretion of a mining company. Mining firms must develop and participate in credible traceability systems. Such systems can use data that tracks the mineral from its origin, along its path to market, and across different entities in the supply chain.

MINE CLOSURE



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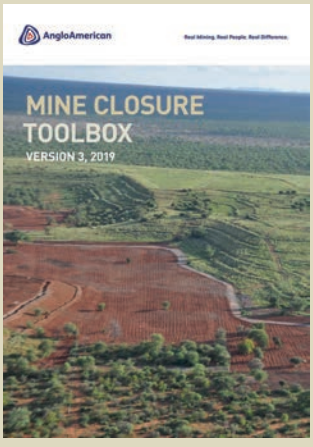

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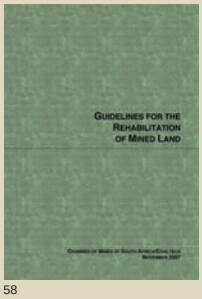
POST-MINING REHABILITATION



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Recommendation Long-term biological monitoring is critical, as rehabilitation often focuses on landform reshaping, ignoring the restoration of ecosystem functions.

Recommendation For aquatic systems, tools such as passive water treatment using constructed wetlands, microbial filters and biochar are cost-effective, nature-based approaches gaining traction. Their uptake should be supported.[57]

MULTILATERAL CONSIDERATIONS

Countries can cooperate to manage land and water use trade-offs in Africa and to leverage optimal benefits from transition minerals mining.

The African Union's new Green Minerals Observatory, the African Mining Legislation Atlas and the Extractive Industries Transparency Initiative are some potential enablers of improved outcomes in Africa.

Some proposals:

- Enhance the capacity of regional, continental and global institutions to improve cross-border data sharing and planning, as well as mine permitting, consultation and consent practices. This requires a fundamental shift in the approach of many institutions.
- Ensure clear, transparent and consistent permitting and approval processes exist for major project developments.[61] In time, cross-border data sharing, ecological zoning and participatory decision-making may be able to support the rivers, wetlands and communities, and could be explored as added dimensions in a mining licence.
- Co-ordinate national traceability systems by tracking minerals from origin, along the path to market and across different entities in the supply chain, to dovetail with the international recommendation that a global traceability, transparency and accountability framework be put in place (see Appendix).
- Invest in a continental framework for aquatic ecosystem safeguards and restoration, supported by performance bonds, catchment-level planning and community engagement, to avoid the environmental injustices of the past. Catchment Management Agencies, although under-resourced and inconsistently established in South Africa, offer a mandated model for participatory water governance and improved oversight with possible application elsewhere and across borders.
- BRICS countries, the African Union, Southern African Development Community (SADC) or other south-south platforms could address the market in a co-ordinated manner, harnessing different countries' advantages in mineral resources and potential for beneficiation. Such co-operation could yield greater negotiation clout and economies of scale than countries acting individually. The South African Institute of International Affairs' Futures of Critical Minerals series of publications offers interesting analyses and ideas for the SADC.[62]
- Major demand countries could set the standard by requiring that countries supplying transition minerals follow social and environmental sustainability requirements.

Building international cooperation between Global South countries can help to cement a fairer and more sustainable deal for the future of transition minerals mining. Similarly, it will be necessary to align the interests of those countries that require the minerals and the corporate and other interests that operate in this space, with the needs of resource-endowed countries. This is not a simple task. It can, however, be enabled by stronger regulations and institutions, effective decision-making tools and accountability measures[63], including those outlined above. Fair finance must underpin this. African countries are losing between USD$470 million and USD$730 million per year in corporate income tax on average from multinational enterprise tax avoidance.[64]

G20
SOUTH AFRICA 2025

South Africa, under the auspices of the G20, and together with other G20 members, can redefine what sustainable growth looks like: not just in megatonnes of minerals extracted and export earnings, but in terms of water secured, livelihoods sustained, human rights upheld and ecosystems maintained or restored.

APPENDIX

UNITED NATIONS SECRETARY GENERAL'S PANEL'S PRINCIPLES AND ACTIONABLE RECOMMENDATIONS ON CRITICAL ENERGY TRANSITION MINERALS

GUIDING PRINCIPLES ON CRITICAL ENERGY TRANSITION MINERALS

The United Nations Secretary General's Panel on Critical Energy Transition Minerals proposes seven voluntary Guiding Principles, building on existing norms, commitments and legal obligations outlined in United Nations texts:

PRINCIPLE 1
Human rights must be at the core of all mineral value chains.

PRINCIPLE 2
The integrity of the planet, its environment and biodiversity must be safeguarded.

PRINCIPLE 3
Justice and equity must underpin mineral value chains.

PRINCIPLE 4
Development must be fostered through benefit sharing, value addition and economic diversification.

PRINCIPLE 5
Investments, finance and trade must be responsible and fair.

PRINCIPLE 6
Transparency, accountability and anti-corruption measures are necessary to ensure good governance.

PRINCIPLE 7
Multilateral and international cooperation must underpin global action and promote peace and security.

ACTIONABLE RECOMMENDATIONS

To embed and maintain these Guiding Principles across critical energy transition mineral value chains, the Panel has made a number of actionable recommendations that leverage the United Nations in the creation of key bodies and processes. These include the establishment of:

A High-Level Expert Advisory Group to accelerate greater benefit-sharing, value addition and economic diversification in critical energy transition minerals value chains as well as responsible and fair trade, investment, finance, and taxation.

A global traceability, transparency and accountability framework along the entire mineral value chain – from mining to recycling – to strengthen due diligence, facilitate corporate accountability and build a global market for critical energy transition minerals, though the framework should not be used as a unilateral trade barrier.

A Global Mining Legacy Fund to build trust and address legacy issues as a result of derelict, ownerless or abandoned mines, and strengthen financial assurance mechanisms for mine closure and rehabilitation.

An initiative that empowers artisanal and small-scale miners to become agents of transformation to foster development, environmental stewardship and human rights.

Equitable targets and timelines for the implementation of material efficiency and circularity approaches across the entire life cycle of critical energy transition minerals.

Source: UN Secretary General's Panel on Critical Energy Transition Minerals, 2024[65]

REFERENCES

1. Paraphrasing a comment made by Dr Claude Kabemba, CEO of the Southern Africa Resource Watch, during an online meeting 'Critical Minerals: A Deep Dive into Supply Chains, Geopolitics, and Future Technologies' on 5/5/2025
2. Gulati, M., Naudé, L. 2018. A Low-Carbon Sunrise for the Mining Industry. Cape Town: WWF South Africa. Accessed 11/7/25 at https://wwfafrica.awsassets.panda.org/downloads/wwf_2018_low_carbon_sunrise_for_mining_industry.pdf?25521/A-low-carbon-sunrise-for-the-mining-industry. Upadhyaya, P., Naudé, L. 2018. Planning for employment effects of climate change in the mining sector. Cape Town: WWF South Africa. Accessed 12/7/25 at https://wwfafrica.awsassets.panda.org/downloads/wwf_2018_planning_for_employment_effects_of_cc_in_mining_sector.pdf
3. Montmasson-Clair, G., Hermanus, L., Dane, A. 2024. Navigating the African Opportunity Landscape for Value Chain Upgrading in the Global Scramble for Critical Minerals: Delineating the opportunity landscape. Southern Transitions, Cape Town. Accessed 25 April 2025 at https://www.southerntransitions.org/s/ST_2024_Paper_Critical_Minerals_Africa_Opportunty_Landscape.pdf
4. African Union. 2024. Africa's Green Minerals Strategy. https://au.int/sites/default/files/documents/44539-doc-AGMS_Final_doc.pdf
5. Government of South Africa, 2025. Critical Minerals and Metals Strategy. Accessed 15 May 2025 at https://www.gov.za/sites/default/files/gcis_document/202505/critical-minerals-and-metals-strategy-south-africa-2025.pdf
6. Extractive Industries Transparency Initiative, 2025. Https://eiti.org/our-mission
7. Minerals Council South Africa, 2024. 2023 Comprehensive facts and figures. Accessed 25 April 2025: https://www.mineralscouncil.org.za/all-categories?Catid=18&id=2310%3Acomprehensive-facts-and-figures-2024&task=download.send&utm
8. https://eiti.org/countries
9. Owen, J.R., Kemp, D., Lechner, A.M. et al. Energy transition minerals and their intersection with land-connected peoples. Nat Sustain 6, 203–211 (2023). Https://doi.org/10.1038/s41893-022-00994-6
10. Owen, J.R., Kemp, D., Lechner, A.M. et al. (2023). Authors used the S&P Capital IQ Pro database (formerly S&P Global Market Intelligence), November 2021 and covered investments committed towards either defining the orebody or mining development.
11. Schroder, P. (2020). Promoting a Just Transition to an Inclusive Circular Economy. London: Chatham House
12. Moyo T, Sadan Z, Lötter A, Petersen J. Barriers to recycling e-waste within a changing legal environment in South Africa. S Afr J Sci. 2022;118(Special issue: Waste as a Resource), Art. #12564. https://doi. org/10.17159/sajs.2022/12564
13. Montmasson-Clair, G.; Hermanus, L and Dane, A. 2024. Navigating the African Opportunity Landscape for value chain upgrading in the global scramble for critical minerals: delineating the opportunity landscape. Southern Transitions
14. Lèbre, E., Corder, G. and Golev, A. (2017). The Role of the Mining Industry in a Circular Economy. J. Ind. Ecol., 21(3): 662-672.
15. Dewast, 2022. In Nigeria, finding value in waste recycling. Physorg. Accessed 25 April 2025: Https://phys.org/news/2022-09-nigeria-recycling.html
16. Glencore, 2022. Glencore & Managem set up partnership for Moroccan production of cobalt from recycled battery materials. Accessed 25 April 2025: https://www.glencore.com/media-and-insights/news/glencore-and-managem-set-up-partnership
17. For example, https://www.batteryrecycling.co.za/
18. Glenna Thomas, Craig Sheridan, Peter E. Holm, A critical review of phytoremediation for acid mine drainage-impacted environments, Science of The Total Environment,Volume 811,2022,152230,ISSN 0048-9697,https://doi.org/10.1016/j.scitotenv.2021.152230. (https://www.sciencedirect.com/science/article/pii/S004896972107306X). See also https://www.wits.ac.za/acids-2-value/
19. National Department of Rural Development and Land Reform. 2013. South Africa's Spatial Planning and Land Use Management Act 16 of 2013. Republic of South Africa, Pretoria. Accessed 27 June 2025 at https://www.gov.za/sites/default/files/gcis_document/201409/367305-8act16of20.pdf.
20. National Department of Rural Development and Land Reform. 2022. National Spatial Development Framework 2050. Republic of South Africa, Pretoria. Accessed 27 June 2025 at https://www.gov.za/sites/default/files/gcis_document/202302/47999gen1594.pdf, with Summary at https://sacplan.org.za/wp-content/uploads/Booklet-NSDF.pdf
21. Le Maitre, D., Walsdorff, A., Cape, L., Seyler, H., Audouin, M., Smith-Adao, L., & Witthüser, K. (2018). Strategic Water Source Areas: management framework and implementation guidelines for planners and managers. Water Research Commission, Pretoria, South Africa.
22. Southern Africa map produced by WWF South Africa, using: Water: UNEP. 2010. Africa Water Atlas. Division of Early Warning and Assessment (DEWA), United Nations Environment Programme (UNEP). Nairobi, Kenya. https://www.hydrology.nl/images/docs/alg/2016.03.06_africa_water_atlas.pdf WWF Kenya. 2018. Water Towers Africa. Accessed 2/5/2025 at https://www.arcgis.com/home/item.html?id=6cdbb46561ff453fac9f067bf247222e. South Africa Strategic Water Source Areas map from Stats SA. 2023. Safeguarding every drop: Profiling South Africa's Strategic Water Source Areas. National Department of Statistics. Pretoria, South Africa. Accessed 30/6/2025 at https://www.statssa.gov.za/?p=16223. Minerals: U.S. Geological Survey (USGS) World Minerals Exploration (WMED; unpublished data). Laurence Bird (USGS), Amanda Brioche (USGS), and Abraham J. Padilla (USGS) reviewed this data for location accuracy. This feature class was compiled by Abraham J. Padilla. Unless otherwise noted, all other data attributes remain unchanged from WMED compilation. BucknellGIS (2023). AFR Mineral Deposits shp (2023) accessed 2/5/2025 at https://services2.arcgis.com/xsh7pVZv42relbEf/arcgis/rest/services/AFR_Mineral_Deposits_shp/FeatureServer/0 027719_AeresHogeschool. AFR Mineral Exploration shp accessed 2/5/2025 at https://services2.arcgis.com/rtefou6JFIxFvYTf/arcgis/rest/services/AFR_Mineral_Exploration_shp/FeatureServer/0.
23. Owen, J.R., Kemp, D., Lechner, A.M. et al. Energy transition minerals and their intersection with land-connected peoples. Nat Sustain 6, 203–211 (2023). Https://doi.org/10.1038/s41893-022-00994-6
24. Lakshman, S, 2024. More Critical Minerals Mining Could Strain Water Supplies in Stressed Regions. World Resources Institute. Online at https://www.wri.org/insights/critical-minerals-mining-water-impacts#:~:text=Current%20processes%20for%20extracting%20lithium,an%20already%20water%2Dscarce%20region.
25. IEA (2021), The Role of Critical Minerals in Clean Energy Transitions, IEA, Paris https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions.
26. James Boafo, Jacob Obodai, Eric Stemn, Philip Nti Nkrumah. 2024. The race for critical minerals in Africa: A blessing or another resource curse? Resources Policy, Volume 93, 2024,105046, ISSN 0301-4207,https://doi.org/10.1016/j.resourpol.2024.105046.
27. Mccarthy, T. S. (2011). The impact of acid mine drainage in South Africa. South African Journal of Science, 107(5), 1-7.
28. Ochieng, G. M., Seanego, E. S., & Nkwonta, O. I. (2010). Impacts of mining on water resources in South Africa: A review. Scientific Research and Essays, 5(22), 3351-3357.
29. Wandile Sihlobo, 2025. https://theconversation.com/south-africa-as-g20-leader-can-take-action-on-africas-food-supply-4-ways-to-make-a-difference-253678
30. Chandamela, M. 2023. "Before the mining companies arrived, we produced a lot... Not anymore": the impact of coal mining on agricultural production in communities surrounding the mines in Moatize. OBSERVADOR RURAL No. 138 August 2023. Accessed 16 May 2025: https://omrmz.org/wp-content/uploads/2023/08/OR-138-Eng.pdf
31. Mwakesi, M. et al (2021). Impact of mining on environment: A case study of Taita Taveta County, Kenya. African Journal of Environmental Science and Technology, 5(12), 1040-1054. Accessed 16 May 2025: https://academicjournals.org/journal/AJEST/article-full-text-pdf/D63BE5466927
32. Nakanwagi, S. 2024. Critical minerals, Sustainability and the Energy Transition in the Global South: A Justice Perspective. Hart: London.
33. Map produced by WWF South Africa, using: Percent Arable and Not Yet Cultivated by Terrestrial Ecoregion (Data Basin Dataset). Hoekstra, J. M., J. L. Molnar, M. Jennings, C. Revenga, M. D. Spalding, T. M. Boucher, J. C. Robertson, T. J. Heibel, with K. Ellison. 2010. The Atlas of Global Conservation: Changes, Challenges, and Opportunities to Make a Difference. Ed. J. L. Molnar. Berkeley: University of California Press. Accessed 2/5/2025 at https://databasin.org/datasets/31bee9c5cd524ce4836f3d58a7b9b0d0/. For sources of mineral resources mapping, see endnote 22 'Minerals'.
34. Map produced by WWF South Africa, using: Soil surface carbon (0-20cm) modelled for Africa. Source: iSDA open soil analysis dataset. 2023. Accessed 12/5/2025 at DOI 10.17605/OSF.IO/A69R5. For sources of mineral resources mapping, see endnote 22 'Minerals'.
35. Department of Environment, Forestry and Fisheries. 2020. South African National Terrestrial Carbon Sinks Assessment 2020. Pretoria, South Africa: Department of Environment, Forestry and Fisheries. Available: https://drive.google.com/file/d/11fULYRsygridhJFMCbeNUSxbSp4wF_yJ/view?usp=sharing.
36. Map produced by WWF South Africa, using: Key Biodiversity Areas BirdLife International (2025). The World Database of Key Biodiversity Areas. Developed by the KBA Partnership: BirdLife International, International Union for the Conservation of Nature, Amphibian Survival Alliance, Conservation International, Critical Ecosystem Partnership Fund, Global Environment Facility, Re:wild, NatureServe, Rainforest Trust, Royal Society for the Protection of Birds, Wildlife Conservation Society and World Wildlife Fund. Accessed 2/5/2025 at www.keybiodiversityareas.org. Protected Areas UNEP-WCMC and IUCN. Protected Planet: The World Database on Protected Areas, [May 2025 of version downloaded], Cambridge, UK: UNEP-WCMC and IUCN. Accessed 2/5/2025 at https://www.protectedplanet.net/en/thematic-areas/wdpa?tab=WDPA. For sources of mineral resources mapping, see endnote 22 'Minerals'.

37. Lèbre, É., Stringer, M., Svobodova, K. Et al. The social and environmental complexities of extracting energy transition metals. Nat Commun 11, 4823 (2020). Https://doi.org/10.1038/s41467-020-18661-9.
38. Kramer, M., Kind-Rieper, T., Munayer, R., Giljum, S., Masselink, R., Ackern, P. van, Maus, V., Luckeneder, S., et al. 2023. Extracted Forests. Unearthing the role of mining-related deforestation as a global driver of deforestation. Berlin, Germany: WWF. Available: https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/Wald/WWF-Studie-Extracted-Forests.pdf [2024, April 16].
39. Moritz Kramer (WWF Germany), Tobias Kind-Rieper (WWF Germany), Raquel Munayer (adelphi), Stefan Giljum (WU), Rens Masselink (Satelligence), Pia van Ackern (adelphi), Victor Maus (WU), Sebastian Luckeneder (WU), Nikolas Kuschnig (WU), Felipe Costa (WWF Germany), Lukas Rüttinger (adelphi). 2023. Extracted forests unearthing the role of mining-related deforestation as a driver of global deforestation. WWF. Accessed 24 April: https://wwfint.awsassets.panda.org/downloads/wwf_studie_extracted_forests_1_1.pdf
40. James Boafo, Jacob Obodai, Eric Stemn, Philip Nti Nkrumah. 2024. The race for critical minerals in Africa: A blessing or another resource curse? Resources Policy, Volume 93, 2024,105046, ISSN 0301-4207,https://doi.org/10.1016/j.resourpol.2024.105046.
41. Business and Human Rights Resource Centre, 2024. Transition Minerals Tracker, 2024 Analysis. May 2024. Accessed 25 May 2025 at https://www.business-humanrights.org/en/from-us/briefings/transition-minerals-tracker-2024-global-analysis/
42. Ibid
43. Ibid
44. ILO Declaration on Fundamental Principles and Rights at Work. Accessed 24 June 2025 at https://www.ilo.org/about-ilo/mission-and-impact-ilo/ilo-declaration-fundamental-principles-and-rights-work#:~:text=freedom%20of%20association%20and%20the,of%20employment%20and%20occupation%3B%20and
45. James Boafo, Jacob Obodai, Eric Stemn, Philip Nti Nkrumah. 2024. The race for critical minerals in Africa: A blessing or another resource curse? Resources Policy, Volume 93, 2024,105046, ISSN 0301-4207,https://doi.org/10.1016/j.resourpol.2024.105046.
46. International Peace Initiative, 2025. Artisanal mining in DR Congo - IPIS Open Data Dashboard. Accessed 25 April 2025 here: https://ipisresearch-dashboard.shinyapps.io/open_data_app/
47. World Bank, 2024. Achieving sustainable and inclusive artisanal and small-scale mining (ASM): a renewed framework for World Bank engagement. Accessed 16 May 2025: https://www.delvedatabase.org/resources/achieving-sustainable-and-inclusive-artisanal-and-small-scale-mining-asm-a-renewed-framework-for-world-bank-engagement
48. Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, and South African National Biodiversity Institute. 2013. Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector. Pretoria: Department of Environmental Affairs. Accessed 11/7/25 at https://www.wits.ac.za/media/wits-university/faculties-and-schools/commerce-law-and-management/research-entities/cals/documents/Mining%20and%20Biodiversity%20Guidlines%202013.pdf
49. Shene-Verdoorn, C.A., Ncube, N. 2014. Mining and Biodiversity: Evaluating Environmental Assessment Practitioner standards in the sector. Cape Town: WWF-SA. Accessed 12/5/2025 at https://wwfafrica.awsassets.panda.org/downloads/mining_report_03_sept_2014_spreads.pdf?11921/mining-and-biodiversity
50. Department of Forestry, Fisheries and the Environment. 2023. National Biodiversity Offset Guideline First Edition issued under section 24J of the National Environmental Management Act. Pretoria: Department of Forestry, Fisheries and the Environment. Accessed 11/7/2025 at https://www.dffe.gov.za/sites/default/files/legislation/2023-09/nema_nationalbiodiversityoffsetguideline_g48841gon3569.pdf
51. Macfarlane, D., Holness, S.D., Von Hase, A., Brownlie, S., Dini, J.A., Kilian, V., Department of Water and Sanitation, South African National Biodiversity Institute. 2016. Wetland Offsets: A Best Practice Guideline for South Africa. Pretoria: Water Research Commission. Accessed 10/7/25 at https://www.researchgate.net/profile/John-Dini-2/publication/308724848_Wetland_Offsets_A_Best_Practice_Guideline_for_South_Africa/links/57ed271608aea5476b45ec2f/Wetland-Offsets-A-Best-Practice-Guideline-for-South-Africa.pdf?_tp=eyJjb250ZXhoIjp7ImZpcnNoUGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIn19
52. Department of Water Affairs and Forestry. 2008. Best Practice Guideline H1: Integrated Mine Water Management. Pretoria: Department of Water Affairs and Forestry. Accessed 10/7/25 at https://www.mineralscouncil.org.za/component/jdownloads/?task=download.send&id=359&catid=26&m=0&Itemid=250
53. Department of Water Affairs and Forestry. 2006. Best Practice Guideline G1 Storm Water Management. Pretoria: Department of Water Affairs and Forestry. Accessed 10/7/25 at https://www.mineralscouncil.org.za/component/jdownloads/?task=download.send&id=345&catid=26&m=0. Department of Water Affairs and Forestry. 2006. Best Practice Guideline G2 Water and Salt Balances. Pretoria: Department of Water Affairs and Forestry. Accessed 10/7/25 at https://www.mineralscouncil.org.za/component/jdownloads/?task=download.send&id=352&catid=26&m=0. Department of Water Affairs and Forestry. 2007. Best Practice Guideline G3 Water Monitoring Systems. Pretoria: Department of Water Affairs and Forestry. Accessed 10/7/25 at https://www.mineralscouncil.org.za/component/jdownloads/?task=download.send&id=358&catid=26&m=0&Itemid=250
54. International Council on Mining and Metals. 2025. Integrated mine closure: good practice guide (3rd edition). ICMM.London, United Kingdom. https://www.icmm.com/website/publications/pdfs/environmental-stewardship/2025/guidance_mine-closure_update.pdf?cb=95109
55. Anglo American. 2019. Mine Closure Toolbox. Anglo American plc. Johannesburg, South Africa. Accessed 2/7/2025 at https://www.angloamerican.com/~/media/Files/A/Anglo-American-Group/PLC/sustainability/mine-closure-toolbox-version-3-2019.pdf
56. Asia-Pacific Economic Cooperation Mining Task Force. 2018. Mine Closure Checklist for Governments. Singapore: Asia-Pacific Economic Cooperation Secretariat. Accessed 10/7/25 at https://www.apec.org/docs/default-source/Publications/2018/3/Mine-Closure-Checklist-for-Governments/218_MTF_Mine-Closure_Checklist-for-Governments.pdf
57. Lei, K., Pan, H., Lin, C. 2016. A landscape approach towards ecological restoration and sustainable development of mining areas. Ecological Engineering, 90, 320-325.
58. Tanner, P. 2007. Guidelines for the Rehabilitation of Mined Land. Johannesburg: Chamber of Mines of South Africa, Coaltech Research Association. Accessed 10/7/25 at https://www.mineralscouncil.org.za/component/jdownloads/?task=download.send&id=349&catid=26&m=0
59. Land Rehabilitation Society of Southern Africa, Coaltech, Minerals Council of South Africa. 2018. Land Rehabilitation Guidelines for Surface Coal Mines. Accessed 2/7/2025 at https://www.larssa.co.za/sites/default/files/LaRSSA-Rehab-Guideline-FINAL-v1-August-2019.pdf
60. Water Research Commission. 2025. Guidelines for rehabilitating mined land to irrigable standard. Water Research Commission. Pretoria, South Africa. Accessed 2/7/2025 at https://wrc.org.za/?mdocs-file=66051
61. Lèbre, É., Stringer, M., Svobodova, K. Et al. The social and environmental complexities of extracting energy transition metals. Nat Commun 11, 4823 (2020). Https://doi.org/10.1038/s41467-020-18661-9.
62. Cloete, D., Jentel, L., Neapo Wolf, N., Mzinyati., L., Benkenstein, A., Joseph, A. 2023. Special Report 1 Exploring Critical Minerals in SADC: Country Barriers and Enablers. Special Report 2 Navigating the SADC Critical Minerals Transition: Towards Preferred Futures. Special Report 3 Re-imagining the Critical Minerals Ecosystem in SADC: Building Anticipatory Governance. Special Report 4 Systemic Innovations Toward the SADC Draft Critical Minerals Strategic Framework. Available at https://saiia.org.za/series/futures-critical-minerals/
63. For more on this, see Usman Z. and Csanadi, A. How to Advance U.S.-Africa Critical Minerals Partnerships in Mining and Geological Sciences. Carnegie Endowment for International Peace. April 2025.
64. Albertin, G, et.c al., 2021. Tax avoidance in Sub-Saharan Africa's mining sector. International Monetary Fund. Accessed 16 May 2025: https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2021/09/27/Tax-Avoidance-in-Sub-Saharan-Africas-Mining-Sector-464850
65. UN Secretary-General's Panel on Critical Energy Transition Minerals. 2024. Resourcing the Energy Transition Principles to Guide Critical Energy Transition Minerals Towards Equity and Justice. New York City: United Nations. Accessed 12/7/25 at https://www.un.org/sites/un2.un.org/files/report_sg_panel_on_critical_energy_transition_minerals_11_sept_2024.pdf

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