Investor Engagement Brief on Nature

Metals and Mining Sector

This is the second edition of the 'Sectoral Investor Engagement Briefs on Nature' series. It has been designed for use by the Finance for Biodiversity Foundation's members and investors involved in the Nature Action 100 initiative.

June 2026

Finance *for* Biodiversity Foundation

Overview

- This Investor Nature Engagement Brief on the Metals and Mining Sector forms part of a series of sector-focused briefs that have been created by the Finance for Biodiversity (FfB) Foundation and its members.
- The purpose of this unique series is to support investors engaging with companies on nature-related issues, notably with a series of questions that can serve as a starting point for investors when engaging with companies regarding their impacts and dependencies on nature, and in particular, when seeking to influence company actions and strategies to curb biodiversity loss and shift towards a nature-positive approach.
- The Metals and Mining sector has a high potential impact on nature as a result of the extractive nature of mining activities and the potential pollution resulting from the processing required to extract the metal from the mined material.
- Finance for Biodiversity's analysis shows that the sector generates over 4% of the overall impact on biodiversity from companies in the MSCI ACWI Index[1] means that this sector ranks fifth of all identified sectors with an impact on biodiversity.
- The ENCORE database[2] identifies the key potential nature impacts that the Metals and Mining sector is responsible for, with Very High potential impacts in relation to freshwater use, emissions of toxic soil and water pollutants, release of solid waste and 'disturbances' (e.g. noise, light). In addition, the sector has High potential impacts in relation to emissions of GHGs, emissions of non-GHG air pollutants, and other abiotic resource extraction. The sector scores High or Very High (on a scale from Very Low to Very High) on eight of the twelve potential impacts assessed by ENCORE, showing the extent of the potential threat to nature from the sector's activities.
- The Metals and Mining sector is also very dependent on nature for its operations, particularly ecosystems relating to water. In ENCORE, it is assessed as having a Very High dependency on the rainfall pattern regulation and water purification ecosystem services, and a High dependency on water supply, global climate regulation, water flow regulation and flood mitigation services.

1. The MSCI ACWI Index was used as the company universe, as it is a leading benchmark for many investors. The index captures large and mid-cap companies across 23 Developed Markets and 24 Emerging Markets with over two thousand constituents.
2. ENCORE (Exploring Natural Capital Opportunities, Risks and Exposure) is a free, online tool that sets out how the economy – sectors, subsectors and production processes – depends and impacts on nature.

Table of Contents

What's inside the brief

This brief is made up of four sections

The **first section** provides an overview of the sector, including how the sector specifically impacts and depends on nature, particularly in sensitive locations. It then looks at some of the most forward-looking regulations on biodiversity that are relevant for engagements in this sector. Finally, this section considers how the sector links to the objectives of the goals and targets of the Kunming-Montréal Global Biodiversity Framework which sets out an ambitious pathway to reverse biodiversity loss by 2030 and to reach the global vision of a world living in harmony with nature by 2050.

The **second section** then considers, in detail, some of the most relevant sector-specific actions that investors can expect of companies at different stages of their journey to address nature loss.

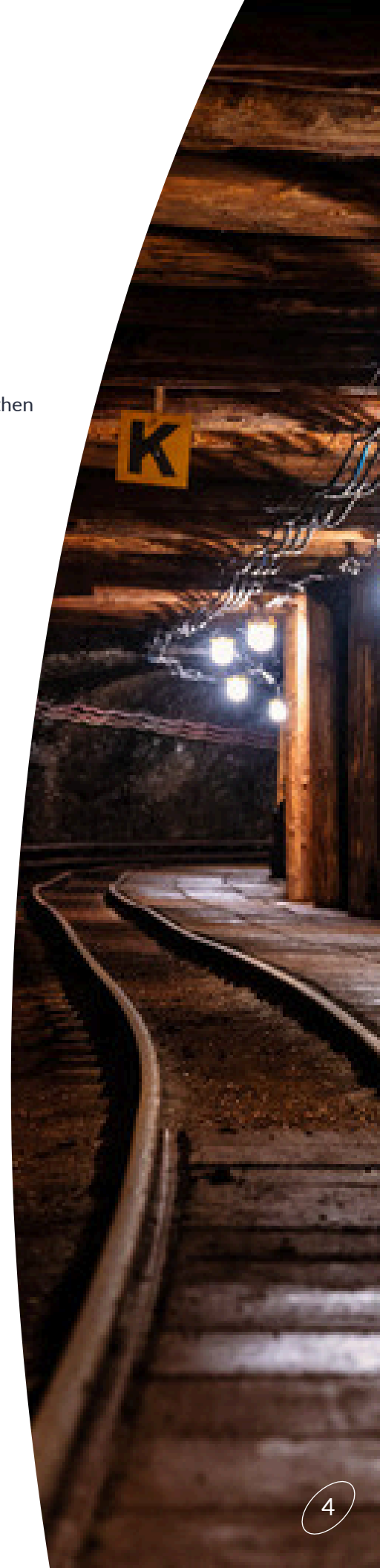
The **third section** lays out a series of questions that can serve as a starting point to build relationships between investors and the companies they are engaging on nature.

The **fourth section** provides a curated set of useful supporting tools that can be used to assist the engagement process.

Each of these sections can be referred to separately. Investors with greater sector expertise may wish to refer directly to Part III and use Parts I, II, and IV for reference.

This brief has been developed in alignment with the sectoral guides published by the Taskforce on Nature-related Financial Disclosures (TNFD) and the partnership between Business for Nature (BfN), the World Economic Forum (WEF) and the World Business Council for Sustainable Development (WBCSD) as well as sectoral reports from Planet Tracker. This brief has been written by investors for investors.

The FfB Foundation has also produced a more general Guide on Engagement with Companies for financial institutions that are looking for ways to engage with companies on biodiversity across multiple sectors.



Part I

Connections between the Metals and Mining Sector and Nature

Introduction

The activities of mining companies include the discovery, excavation and processing of metals, minerals and other geological resources that are needed in the economy. Products include metals, minerals, coal, precious and semi-precious gemstones, and inorganic building and road materials. This Sector Brief focuses on companies in the Metals and Mining sector and so excludes activities relating to mining for coal and construction materials.[3]

The sustainable transformation of the Metals and Mining sector is vital for nature. Mining causes direct habitat loss and fragmentation, generates large volumes of waste and tailings, can alter hydrology, and can release pollutants to air, water and soil. Mining activities are frequently located in biodiversity-rich regions, and pressure to allow new mines is likely to increase as demand for transition minerals increases. There is a real risk that the net-zero transition could accelerate nature loss unless circularity, demand reduction, better spatial planning and stronger safeguards are built into the sector's development model.

Scope of this Sector Brief

Figure 1 illustrates the value chain of the Metals and Mining sector proposed by the Taskforce on Nature-Related Financial Disclosures (TNFD).[4] Companies will need to map out their full value chain[5] to have a clear view of the impacts on nature caused, or contributed to, by a business and its supply chain as well as the dependencies of the business on nature.[6]

The key phases of a mine's life cycle are:

- Exploration and feasibility (geological surveying, mapping)
- Mine planning (modelling the ore reserve, mine layout, scheduling)
- Mine development (construction of mining infrastructure)
- Mine operation (extraction of ore, waste management)
- Mine closure (decommissioning, dismantling)

3. Refer to Appendix 3 for more details on how the coverage of this Sector Brief aligns with the different economic classification systems
4. TNFD is a market-led, science-based and government-backed initiative providing organisations with the tools to act on evolving nature-related issues.
5. A value chain goes beyond the selling of goods and products by offering value throughout the customer journey, from marketing to after-sales support. The supply chain focuses on sourcing materials and delivering goods to the customer.
6. https://tnfd.global/about/why-nature-matters/

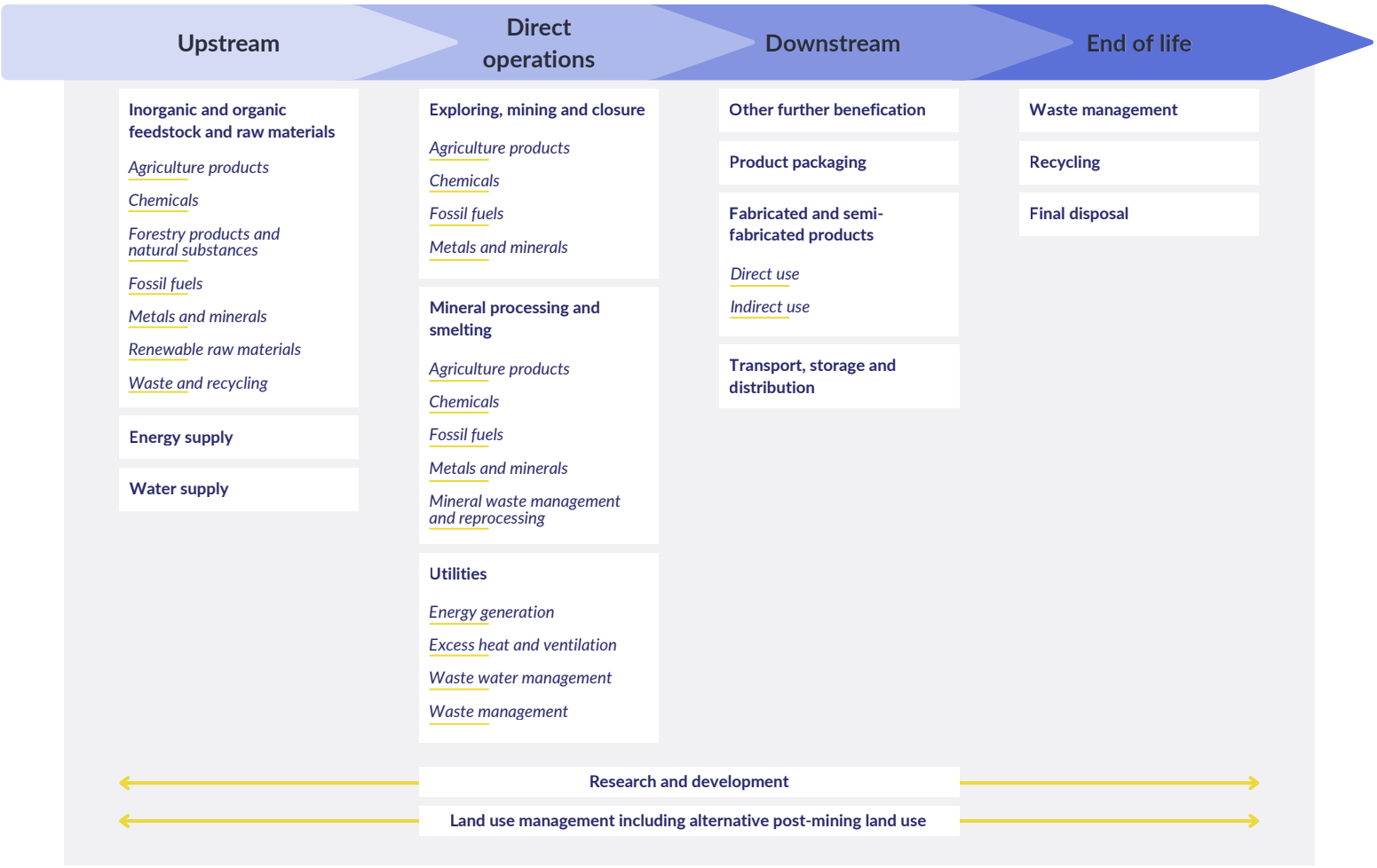


Figure 1: Value chain illustration proposed by the TNFD for the Metals and Mining sector. TNFD Additional Sector Guidance, Metals and Mining (2024)

The nature impact of a mine will obviously be most significant during the development and operation phases, however the planning and mine closure phases will be very significant in terms of mitigating nature harms and ensuring nature restoration.

This sector brief focuses on the direct operations of companies in the sector. As Figure 1 highlights, investors wishing to address the nature impacts and dependencies embedded in their portfolios relating to this sector will need to consider the upstream part of the value chain as well, particularly given its links to the chemicals and fossil fuel industries, and the downstream sections when considering the sources of demand for particular metals.

The mining sector is key to the global economy

Demand will increase as economies transition to clean power

Everything used in the global economy ultimately depends upon a product that is mined, unless it can be grown, or manufactured from petrochemicals.

The Metals and Mining sector is also an essential component in the transition away from a fossil-fuel dependent economy. Substantial extra volumes of 'transition minerals' (such as lithium, cobalt, rare earth elements (REEs) and vanadium) and increased production of more common elements such as copper and iron ore, will be required to help achieve the goals of the Paris Agreement on Climate Change. The International Energy Agency (IEA) estimated that clean energy technologies (batteries, wind farms, solar panels, etc) could require six times more mineral inputs in 2040 compared to a 2020 baseline if the world was aiming to hit net zero globally by 2050. Even a more moderate scenario could imply a quadrupling of demand by 2040.[7]

As a result, it is clear that more mines will be required, expanding the land-use footprint and supporting demands for the introduction of deep sea-bed mining.

Production is geographically concentrated

The total land area currently devoted to mining is small, around 0.07%-0.08% of total land area,[8] and concentrated in only a few countries – see Figure 2.

However, much of this land-use footprint relates to coal mining and construction materials which accounted for 88% of production volumes (metric tonnes) in 2024.[9]

When mineral fuels and industrial minerals are excluded, and production values are considered, China's dominance as a producer of metals becomes clear – it accounts for 18% of the total. Six countries (China, South Africa, Australia, Russia, Indonesia and Chile) accounted for 52% of the total value of metals produced in 2024 – see Figure 3.

The small land-use footprint of mining might suggest that its nature impact would also be small, however, as discussed later in this report, mines are frequently located in areas that are highly sensitive from a nature perspective and so have an outsized impact on nature.

In addition to the land actually devoted to mining, the activities of mining companies often have a wider impact as a result of the associated development such as roads, railways and ports, construction of towns for miners and support services, and broader legal and illegal development associated with the economic benefits brought by the mine.

7. EA. (2022). The Role of Critical Minerals in Clean Energy Transitions. International Energy Agency (IEA) https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions.
8. 0.07% from Cheng, YT., Hoang, N.T., Maupu, L. et al. Classifying land use within 80,000 mining sites on a global scale. Sci Data 13, 338 (2026). https://doi.org/10.1038/s41597-026-06681-x; 0.08% from Maus V, Giljum S, da Silva DM, et al. An update on global mining land use. Sci Data. 2022;9(1):433. Published 2022 Jul 22. doi:10.1038/s41597-022-01547-4.
9. https://www.world-mining-data.info/?World_Mining_Data___Data_Section

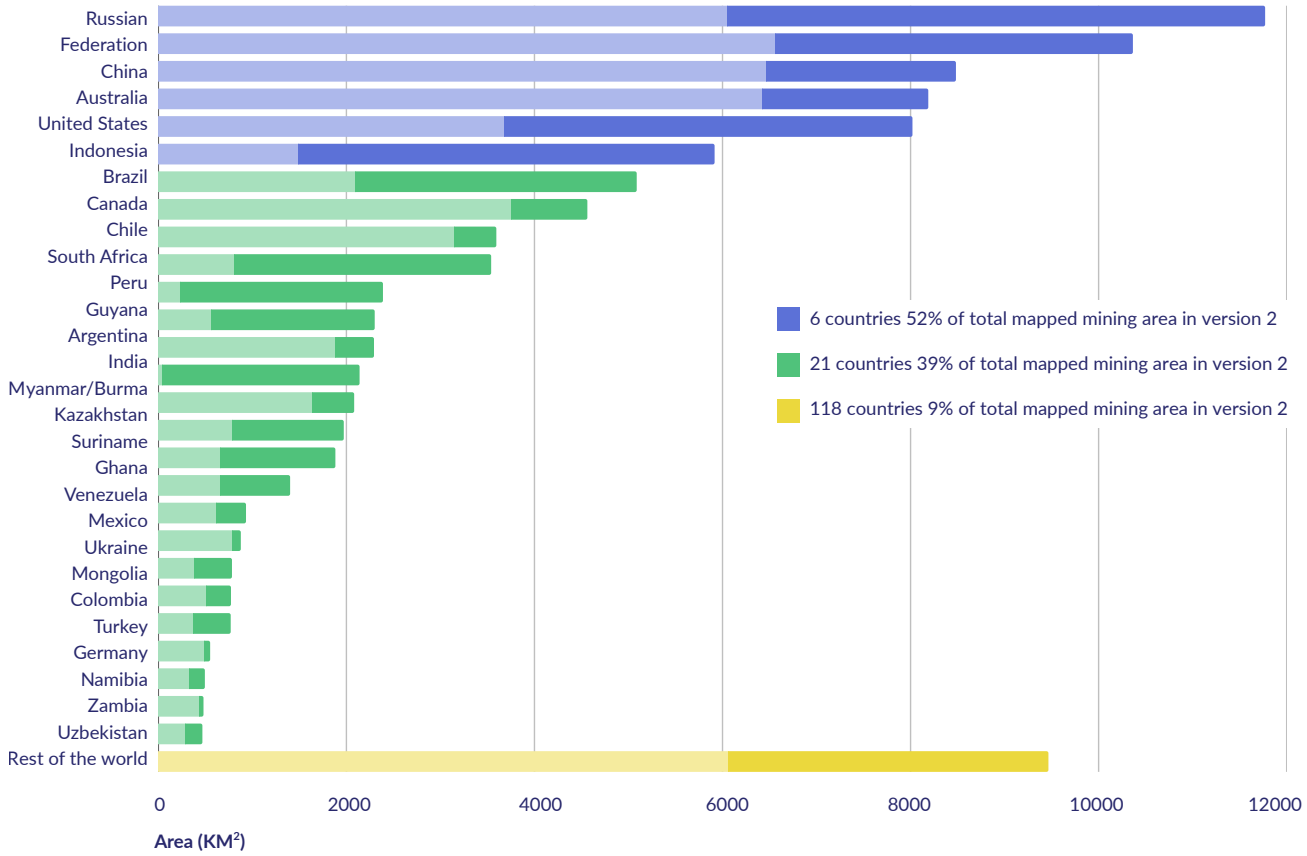


Figure 2: Mining land use per country in square kilometres. Maus et al, 2022 (version 2 - the lighter bars indicate the areas mapped in Version 1 of the dataset used in an earlier study by the same authors)

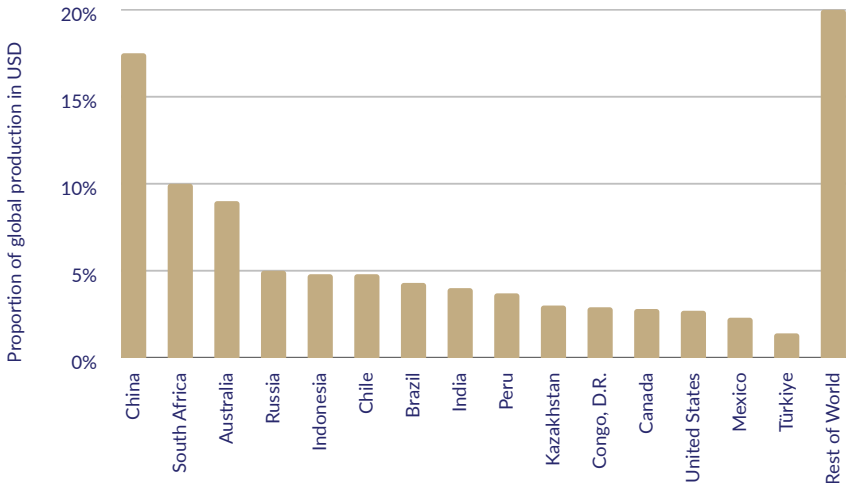


Figure 3: Mining production by country in USD (excluding fuel and minerals). World Mining Data 2026

Deep sea-bed mining

Deep sea-bed mining (DSM) is presented as a potential solution to the increased demand for transition minerals that would avoid using more land. Supporters argue that this would avoid the negative nature impacts associated with terrestrial mining. However, there are significant concerns that the environmental impacts of DSM are poorly understood (and could be significant), and that the nature of deep sea mining will mean monitoring of mining activities and any resulting environmental harms will be very difficult.

DSM is not currently a commercial proposition although a few companies are conducting experiments to demonstrate its feasibility.[10] However, the expected increase in demand for transition minerals is likely to lead to increased pressure from supporters of DSM for mining licences to be granted.

At present, the International Seabed Authority (ISA) has failed to agree a Mining Code and has not approved any exploration activities. The ISA is responsible under the UN Convention on the Law of the Sea (UNCLOS) for legislating exploration and exploitation activities in international waters, however individual countries regulate what happens in their Exclusive Economic Zones (EEZ), creating potential opportunities for seabed mining in those areas.[11]

There is strong debate regarding the economic merits and potential nature impact of DSM. For example, Planet Tracker has published a series of reports casting doubt on the economic case for DSM and highlighting the environmental concerns.[12]

The Metals Company has supported the publication of a number of academic papers and released a series of videos to make the case supporting DSM.[13]

In 2021, IUCN Members adopted Resolution 122 to protect deep-ocean ecosystems and biodiversity through a moratorium on deep-sea mining unless and until a number of conditions are met, notably including that the risks of deep-sea mining are comprehensively understood and effective protection can be ensured.

To date, 41 countries have taken positions against DSM in international water (including advocating moratoriums or precautionary pauses),[14] and 32 financial institutions have published policies that explicitly exclude the provision of financial services for DSM activities.[15]

Given the lack of commercial DSM operations and the pre-profit nature of the companies involved, the nature impacts and risks associated with DSM are not discussed in this Sector Brief.

10. For example, The Metals Company https://metals.co/
11. The USA is not a signatory to UNCLOS. Under US law (Deep Seabed Hard Mineral Resources Act 1980), companies can be granted licences to mine in international waters
12. See https://planet-tracker.org/the-sky-high-cost-of-deep-sea-mining/ and https://planet-tracker.org/how-to-lose-half-a-trillion/ .
13. https://investors.metals.co/news-releases/news-release-details/tmc-subsidiaries-submit-massive-deep-sea-dataset-public-database
14. https://deep-sea-conservation.org/solutions/no-deep-sea-mining/momentum-for-a-moratorium/governments-and-parliamentarians/
15. Investors can refer to the Deep Sea Mining Campaign for more information and a list of investors that have published policies excluding the provision of financial services for DSM activities

How this sector impacts and depends on nature

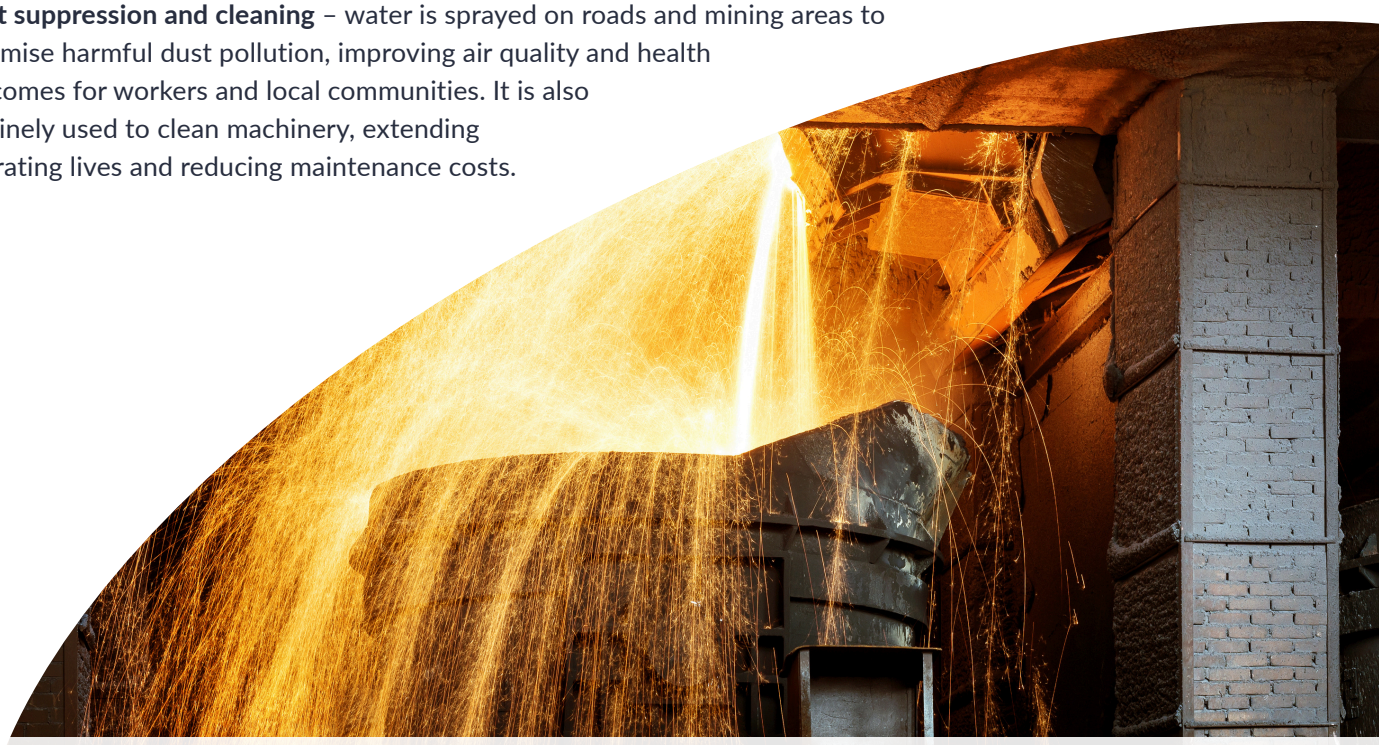
It is crucial for investor engagement practices to be anchored in science and best practices to help drive the sustainable transformation of companies toward the goals and targets of the Kunming-Montréal Global Biodiversity Framework (GBF). Understanding, as well as measuring, how this sector impacts[16] and depends on nature is, therefore, essential for the better management of supply chains and to encourage more nature-friendly and regenerative practices.

Mining has the potential to affect nature throughout the life cycle of a project, both directly and indirectly. Direct or primary impacts from mining can result from any activity that involves land clearance (such as access road construction, exploration drilling, overburden stripping or tailings[17] impoundment construction) or direct discharges to water bodies (riverine tailings disposal, for instance, or tailings impoundment releases) or to the air (such as dusts or smelter emissions). Indirect or secondary impacts can result from social or environmental changes induced by mining operations, and are often harder to identify immediately.[18]

Water and waste ('tailings')

Water is essential to mining operations, serving multiple functions throughout the extraction and processing stages, including:

- **Material handling** – water is mixed with finely ground ore particles to create a slurry which can then be easily transported through pipes or channels around the mining site for further processing
- **Flotation processing** – water is frequently used to help separate valuable minerals from the ore relying on their different densities compared to water.
- **Dust suppression and cleaning** – water is sprayed on roads and mining areas to minimise harmful dust pollution, improving air quality and health outcomes for workers and local communities. It is also routinely used to clean machinery, extending operating lives and reducing maintenance costs.



16. Refer to Appendix 2 for a summary of the different terms relating to nature impacts used by different tools
17. In mining, tailings are the materials left over after the process of separating the valuable fraction from the uneconomic fraction of an ore.
18. https://www.cbd.int/development/doc/Minining-and-Biodiversity.pdf

As a result, mines are particularly dependent on available freshwater resources and at risk from droughts. However, the exact extent of the water-related risks to the mining company will depend on the extent to which it has taken mitigating actions (such as water recycling), the geology of the mine location, the product being mined, and the specific processes being deployed to extract the metal from the ore.[19]

As well as being heavily dependent on water, mining operations also create significant risks to nature from pollution when the water is allowed to return to the environment unless it has been properly treated.

In addition to this, a second significant source of pollution risk is the liquid waste ('tailings') created by the processes used to extract the desired commodity from the mined ore.

Because most ore processing uses significant quantities of water, the tailings that result usually take the form of a solution or slurry, typically 1 to 2 parts solid waste to 1 to 2 parts water.[20] This will be pumped from the processing plant to a tailings facility – in basic terms, a slurry-filled lake contained by a dam.

The ore processing stage can result in the release of toxic by-products (e.g. cyanide compounds in the processing of gold ore). Mining companies should take action to remove these from the process before the tailings are sent to the tailings facility, however, the tailings may still contain products that are harmful to humans and the environment (e.g. high levels of acidity, dissolved metal compounds, etc.) and so require further treatment, continuous monitoring, and effective containment.

The consequences of failure can be catastrophic due to the quantities of waste involved. The Mount Polley and Fundão[21] tailings dam failures (in 2014 and 2015 respectively) each released more than 25 million cubic metres of tailings into the environment – the equivalent volume of more than 20,000 Olympic swimming pools. The Fundão dam failure resulted in the deaths of 19 people, and the tailings slurry travelled 650km until it reached the Atlantic Ocean 17 days after the breach.[22] Nearly 1,500 hectares of vegetation was devastated and large numbers of fish were killed. The total land area affected was estimated at approximately 2,000 hectares.[23]

Although the sector is heavily dependent on water, and has the potential to cause significant impacts as a result of water and waste pollution, these are not the only nature impacts and dependencies, as the next sections explain.

19. This paper provides comparative data on water use by different mines: Final Report: Water Use and Risks in Mining; Assoc. Prof. Gavin M. Mudd, Stephen A. Northey, Dr Tim Werner Report to Columbia Water Center, Earth Institute, Columbia University December 2017
20. Tailings treatment approaches vary – some processes result in thicker slurry or even relatively dry tailings which can be stored without the use of lakes and dams https://smenet.blob.core.windows.net/smecms/sme/media/smeazurestorage/about%20sme/technical%20briefings/whataretailingsfinal-02152021.pdf
21. The Fundão dam in Brazil was part of the tailings storage facilities at the Germano mine in Minas Geras state, Brazil. The mine was operated and owned by Samarco, which in turn was jointly owned by BHP and Vale
22. Roche, C., Thygesen, K., Baker, E. (Eds.) 2017. Mine Tailings Storage: Safety Is No Accident. A UNEP Rapid Response Assessment. United Nations Environment Programme and GRID-Arendal, Nairobi and Arendal, www.grida.no
23. Sánchez, L.E., et al,. (2018).Impacts of the Fundão Dam failure. A pathway to sustainable and resilient mitigation. Rio Doce Panel Thematic Report No. 1. Gland, Switzerland: IUCN.

Assessing potential nature impacts using ENCORE

The potential nature impacts of the Metals and Mining sector are summarised in the ENCORE database (scale from Very Low to Very High), providing a clear insight into the effects that different products and supply chains will have on a company's potential nature impacts[24] - see Figure 4.

Impact drivers	Potential impacts ('pressures')	Mining of ireon ores	Mining of non-ferrous metal ores	Support activites for other mining and quarrying
Land/freshwater /ocean-use change	Area of land use	Medium	Medium	Medium
	Area of freshwater use	High	Very high	Medium
	Area of seabeduse	High	Very high	No data
Climate change	Emissions of GHG	Medium	Medium	High
Pollution	Emissions of non-GHG air pollutants	Medium	High	High
	Emissions of toxic soil and water pollutants	High	Very high	Very high
	Emissions of nutrient soil and water pollutants	No data	No data	No data
	Generation and release of solid waste	Very high	High	Medium
Resource exploitation	Volume of water use	Low	Medium	Medium
	Other biotic resource extraction (e.g. fish, timber)	N/A	N/A	N/A
	Other abiotic resource extraction	High	High	Medium
Invasives and other	Disturbances (e.g. noise, light)	High	Very high	Very high
	Introduction of invasive species	Very low	Low	Low

Figure 4: Summary of potential nature impacts for the Metals and Mining sector as shown in ENCORE (2024 version). FfB Foundation analysis.

The ENCORE analysis highlights the significant potential nature impacts that the Metals and Mining sector has, with Very High potential impacts in relation to freshwater use, emissions of toxic soil and water pollutants, release of solid waste and 'disturbances'.[25]

A further three potential impacts are scored as High: emissions of GHGs, emissions of non-GHG air pollutants, and other abiotic resource extraction, showing the extent of the potential threat to nature from the sector's activities.

The SBTN High-Impact Commodities List (HICL) provides a more detailed view of the most common environmental impacts associated with the production of major commodities (i.e., the direct operations stage). Table 1 presents the potential environmental impacts associated with common mining commodities: iron; lithium; nickel; platinum; silver; zinc; bauxite/aluminium.

24. In this guide, consistent with SBTN and TNFD, 'impact' refers to actual changes in the state of nature, and 'pressure' or 'potential impact' refers to the potential harm (identified in the ENCORE database). It is also important to note that a single 'pressure' (e.g. 'Emissions of toxic pollutants to water and soil') can result in multiple 'impacts' on nature.
25. ENCORE includes the potential impact on the 'area of seabed use' as Very High – this relates to the potential impact of deep sea mining

Commodity	Iron	Lithium	Nickel	Platinum	Silver	Zinc	Bauxite/ Aluminium
Land use and land change	X	X	X	X	X	X	X
Freshwater ecosystem use/change	X	X		X	X	X	X
Marine ecosystem use/change	X	X		X	X		X
Water use	X	X	X	X	X		X
Other resources use	X	X	X	X	X	X	X
Soil pollution	X	X		X	X	X	X
Freshwater pollution					X		X
Water pollution	X	X		X		X	
Marine pollution					X		X
Solid waste			X				
Climate change	X	X	X	X	X	X	X
Non-GHG air pollution				X			

Table 1: Impacts of the commodities the Metals and Mining sector produces. SBTN High-Impact Commodities

Assessing nature dependencies using ENCORE

In its Sector Guidance on Metals and Mining, the TNFD highlights that the Metals and Mining sector's dependencies may vary for individual commodities, mining methods, production processes, organisational risk tolerance and geographical contexts; and their assessment is generally conducted during the feasibility stage of the project and the risk review.

These risks and dependencies are reflected in ENCORE - Figure 5 shows the results of this analysis.

		Aquaculture	Fishing	Meat production
Provisioning services	Biomass provisioning	Very low	Very low	N/A
	Genetic material	N/A	N/A	N/A
	Water supply	High	High	Medium
	Other provisioning services - Animal-based energy	N/A	N/A	N/A
Regulating and maintenance services	Global climate regulation	High	High	Low
	Rainfall pattern regulation	Very high	Very high	High
	Local (micro and meso) climate regulation	Low	Low	Very low
	Air filtration	Very low	Very low	Very low
	Soil quality regulation	N/A	N/A	N/A
	Soil and sediment retention	Medium	Medium	Medium
	Solid waste remediation	Low	Low	No data
	Water purification	Very high	Very high	Medium
	Water flow regulation	High	High	Medium
	Flood mitigation services	High	High	Low
	Storm mitigation	Medium	Medium	Medium
	Noise attenuation	Very low	Very low	Very low
	Pollination	N/A	N/A	N/A
	Biological control	N/A	N/A	N/A
	Nursery population and habitat maintenance	N/A	N/A	N/A
	Other regulating and maintenance service - Dilution	Medium	Medium	Very low
	Other regulating and maintenance service - Mediation	Low	Low	Low

Figure 5: Summary of nature dependencies for the Metals and Mining sector (ENCORE, 2024 version). FfB Foundation analysis.

As Figure 5 shows, the Metals and Mining sector is Very Highly dependent on the rainfall pattern regulation and water purification ecosystem services provided by nature, and has a High dependency on water supply, global climate regulation, water flow regulation and flood mitigation services. Indeed, the fact that mines are invariably at or below ground level means that they are also very susceptible to the risk of flooding and associated landslides.

Soil and sediment retention, storm mitigation, and dilution are also important ecosystem services, with Medium rankings in ENCORE.

Priority locations within the sector value chains

As noted earlier, mines occupy a relatively small proportion of the land available, but are often located in areas of particular significance from a nature perspective.

In many respects, this fact naturally aligns the operations of a mining company with the TNFD recommendations,[26] which emphasises that nature-related impacts and dependencies are location-specific and therefore require local, context-specific assessment and responses. The TNFD provides sectoral guidance for individual companies on how to "Locate" their impacts on biodiversity, as the first step of their LEAP assessment (Locate-Evaluate-Assess-Prepare), a four-step integrated assessment framework for nature-related issues.

Financial institutions will also benefit from identifying the locations and types of ecosystems linked to the material sectors in their portfolios (including through supply chains) when assessing nature impacts and dependencies.

Companies and investors should focus on identifying 'priority locations' i.e. areas that are:

- Material locations – where the organisation has material nature-related impacts, dependencies, risks and/or opportunities;[27] and/or
- Sensitive locations – defined by the TNFD as ecologically sensitive locations that meet one or more of five criteria: 1) important for biodiversity, including species; and/or 2) areas of high ecosystem integrity; and/or 3) areas of rapid decline in ecosystem integrity; and/or 4) areas of high physical water risks; and/or 5) areas of importance for ecosystem service provision, including benefits to Indigenous Peoples, local communities and stakeholders.[28]

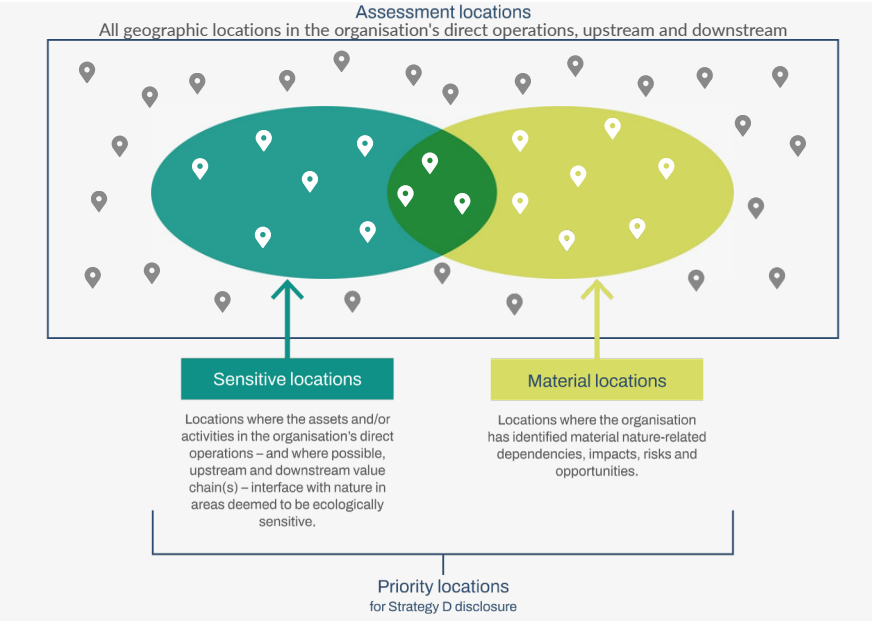


Figure 6: Priority locations, Guidance on the identification and assessment of nature-related issues - The TNFD LEAP approach v1 - September 2023

26. These are recommendations that provide companies and financial institutions of all sizes with a risk management and disclosure framework to identify, assess, manage and, where appropriate, disclose nature-related issues, green transition plans, nature markets and bioeconomy investment strategies.
27. 'Material' in the context of impacts and dependencies is defined by the TNFD as ' the organisation's most significant impacts on the … environment'
28. See: https://tnfd.global/wp-content/uploads/2023/08/Guidance_for_Financial_Institutions_v1.pdf?v=1695215983

The assessment of impacts on priority locations will vary greatly for each individual company.

In an ideal world, specific company disclosures will provide the location detail that investors need to investigate their potential exposure to companies operating in priority locations. However, in the absence of such disclosures, investors can use a variety of tools to support this analysis.

Case study: mapping mine locations to water risk

Companies can use the water quality map available in the Water Risk Filter of the World Wildlife Fund to identify their exposure to water-related risks such as water availability, risks of drought or flooding, etc., based on the locations of their direct and indirect operations – see Figure 7.

In addition to the WWF tool, the WRI provides Aqueduct, an interactive water risk atlas that enables users to analyse current and future water risks in different locations around the globe.

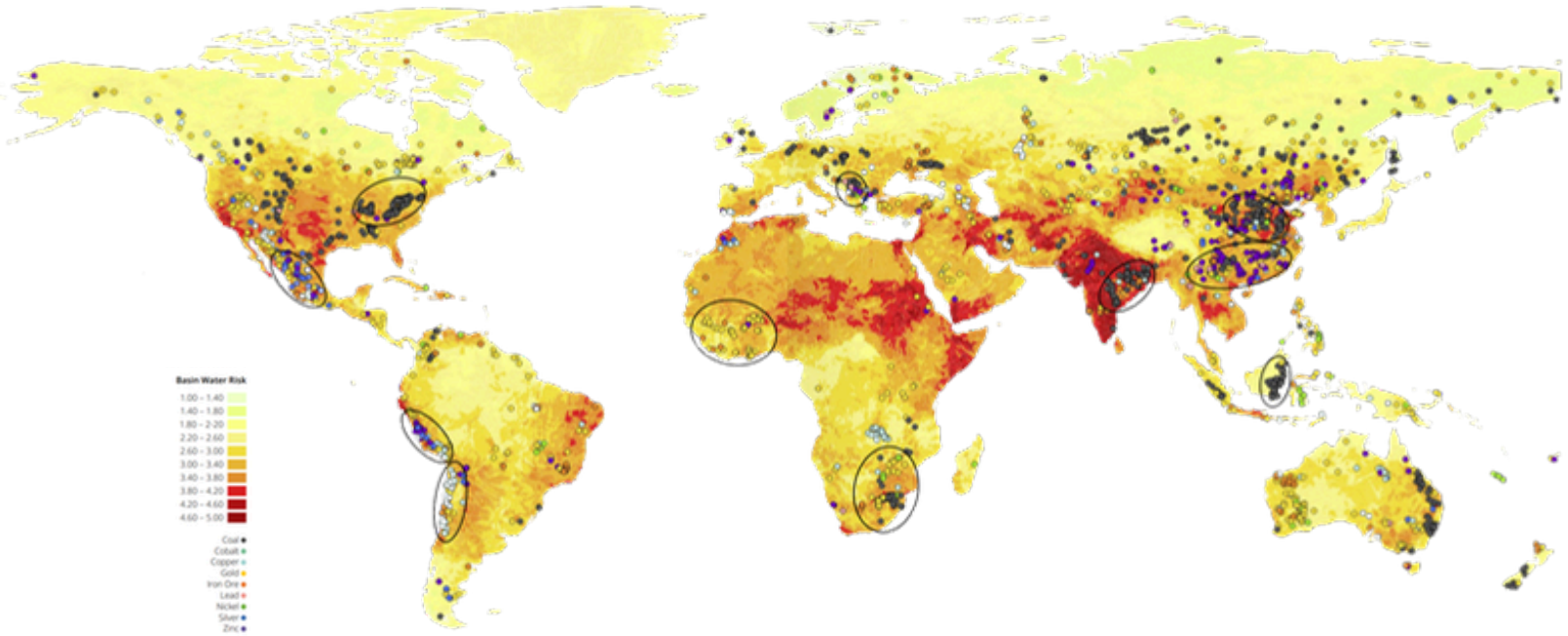


Figure 7: Mine locations compared to water risk. Morgan, A. J. and Dobson, R. (2020) An analysis of water risk in the mining sector. Water Risk Filter Research Series Volume 1, WWF

Case study: mapping mine locations to biodiversity hotspots

A similar exercise can be conducted using IUCN data. Figure 8 below provides an overview of where mining projects overlap with the 36 regions identified by the IUCN where success in conserving species can have an enormous impact on securing our global biodiversity.

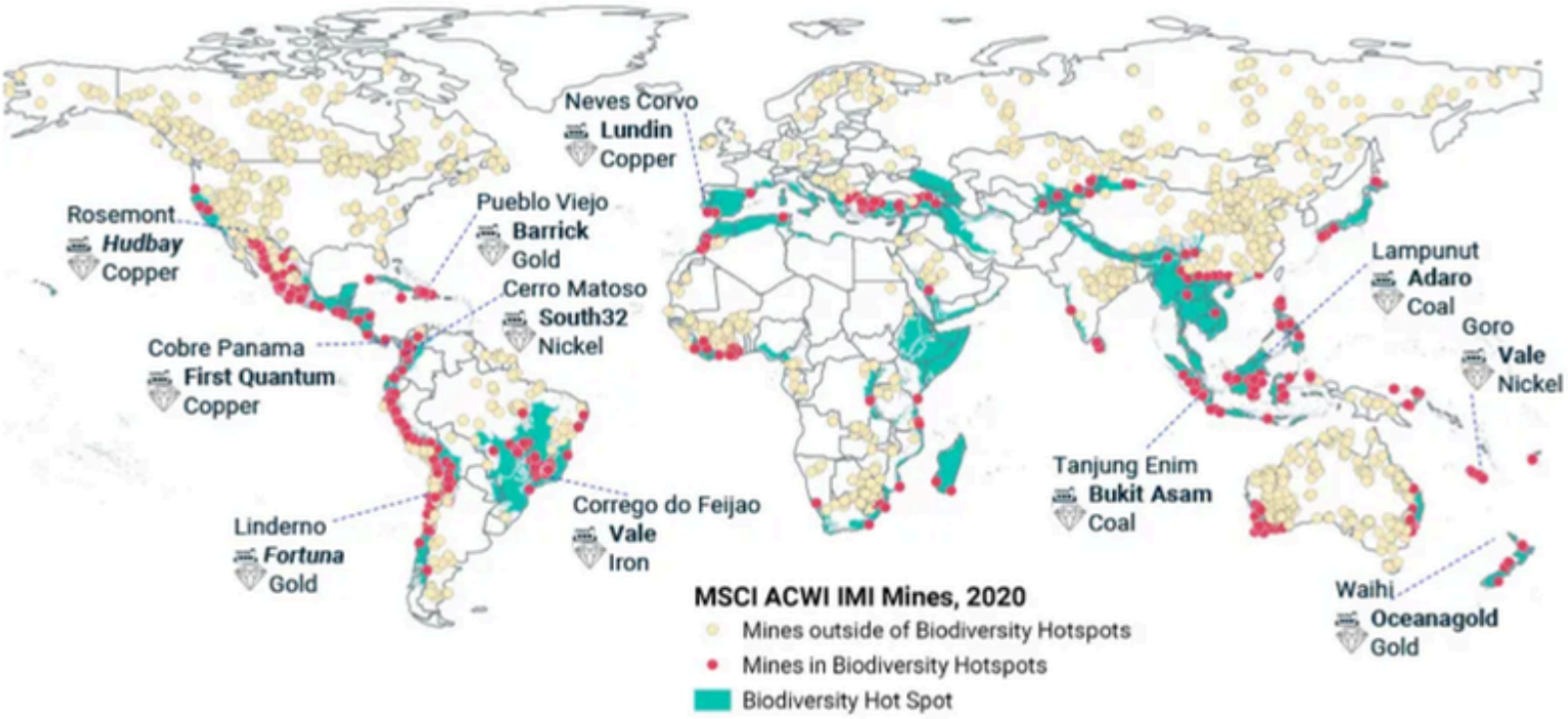


Figure 8: Mine locations compared to biodiversity hotspots. MSCI Research & Insights, 'Mining's Impact on Biodiversity: A Rising Risk', 2021

Mine closure

A mine is a finite asset. At some point the material being mined will run out or will become too costly to continue extracting. Mining companies have an opportunity to restore nature, and even achieve a nature-positive result after the closure of a mine, actions that are likely to significantly enhance the company's social licence to operate, adding value for investors as a result – see Figure 9.

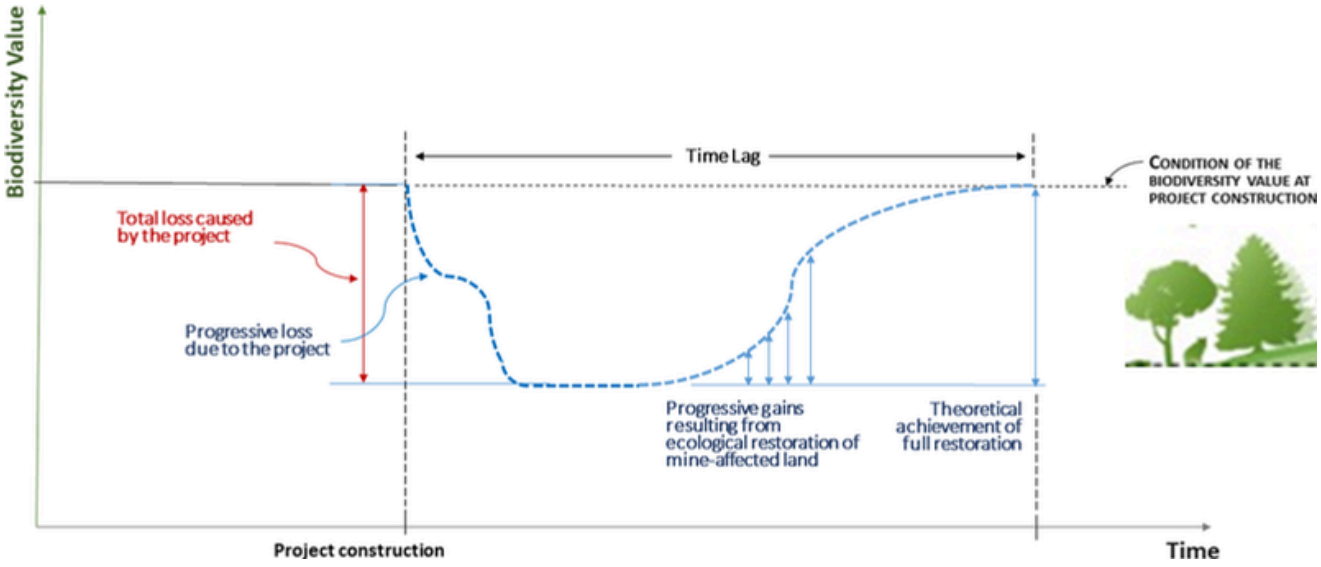


Figure 9: Biodiversity losses and gains over the life of a mine assuming effective restoration. Sánchez et al (2025).[29]

Mine closure should be treated as a positive legacy challenge, not only as an environmental rehabilitation obligation. Closure planning should begin at the earliest stages of the mine life cycle and remain iterative as the local environmental, social, economic, legal and technical context changes. Effective closure plans should address progressive rehabilitation, biodiversity restoration, water and pollution risks, long-term monitoring and maintenance, and the socio-economic transition of workers and local communities.

Companies should work with affected stakeholder, local authorities and biodiversity experts to define closure outcomes, including post-mining land use, economic diversification, employment transition, infrastructure legacy, and arrangements for long-term environmental stewardship.

Investors should expect companies to disclose closure plans, and explain how they are funded, how assumptions are reviewed,[30] and how restoration and socio-economic commitments are monitored after operations cease.

29. Sánchez et al (2025). Mine Closure Planning Must Face the Challenge of a Nature Positive Future. Research Directions: Mine closure and transitions. 2. 1-23. 10.1017/mcl.2025.1.
30. Statements regarding closure plans and associated legacy costs should reconcile to the company's accounting disclosures for closure and rehabilitation liabilities

Financial materiality

Because the activities of the sector take place in specific locations, failure to mitigate nature-related risks can have group-level financial consequences, including production disruption, litigation and loss of social licence to operate.[31]

The financial consequences of poorly managed tailings and water-pollution risks are particularly clear. Following the 2015 Fundão tailings dam failure at Samarco, jointly owned by BHP and Vale, the 2024 settlement with Brazilian public authorities had a total financial value of R$170bn / US$31.7bn on a 100% basis, including amounts already spent, future payments and performance obligations.[32] Vale's 2019 Brumadinho dam failure also demonstrates the scale of exposure: Vale's 2021 Global Settlement to repair environmental and social damage had an economic value of R$37.7bn / USD 7bn (not including individual divisible damages).[33] Smaller operators can be disproportionately affected: after the 2014 Mount Polley breach, Imperial Metals reported suspension of the mine, loss of its main source of cash flow, C$67.4m / USD 52.5m of breach-related costs, and a C$49.2m / USD 36.7m quarterly net loss largely attributable to remediation costs.[34]

These examples show that the financial impact that can come from ignoring nature-related risks can be significant, and can last more many years into the future (for example, the Fundão dam settlement includes provisions for future payments over a 20-year period). The reputational damage and reduced stakeholder trust can also be significant and long-lasting unless the remedial actions taken are swift, significant, and effective.

Conversely, strong management of water, pollution, waste, tailings, biodiversity, and community risks can reduce downside volatility, protect margins, and support long-term value creation. Measures such as independent tailings review, emergency preparedness, public disclosure, progressive rehabilitation, water stewardship, and integration of nature risks into capital allocation help reduce the probability and severity of catastrophic failures.

The actions companies should be taking to address their nature-related risks are discussed in detail in Part II.

31. This Sector Brief focuses on nature, however investors will need to consider how a company engages with stakeholders, particularly Indigenous Peoples and Local Communities (IPLCs) to ensure equitable and sustainable benefit sharing
32. https://www.bhp.com/news/media-centre/releases/2024/10/bhp-brasil-reaches-final-settlement
33. https://saladeimprensa.vale.com/w/agreement-seals-vales-commitment-to-full-reparation-of-brumadinho-and-support-economic-development-of-the-state-of-minas-gerais
34. https://imperialmetals.com/for-our-shareholders/press-releases/imperial-reports-2014-third-quarter-financial-results

How the sector links to the objectives of the Global Biodiversity Framework

The sustainable transformation of the companies in the Metals and Mining Sector can contribute to halting biodiversity loss by 2030. Below is a list of issues to keep in mind, and also levers that could be activated in the sector, with regard to the targets of the Global Biodiversity Framework (GBF), and which could be applied to find ways to reduce company pressures on biodiversity and/or develop concrete solutions for nature recovery.

Targets 1, 2 & 3: **Spatial Planning & Ecosystem Restoration**
Issue: Land-use change and ecosystem degradation caused by exploration, extraction, and infrastructure development.
Materiality: Poor spatial planning drives biodiversity loss, creates conflicts with Indigenous Peoples and local communities (IPLCs), and increases legal and reputational risks. Integrating biodiversity into site planning and aligning with restoration targets helps mitigate these pressures.
Related frameworks:

- TNFD / SBTN: Location-specific risk analysis, ecosystem restoration pathways.
- SDGs: 14 (Life Below Water), 15 (Life on Land).

Target 4: **Habitat Loss & Threatened Species Protection**
Issue: Mining activities often destroy or fragment habitats of threatened or endemic species. Human-wildlife conflict near operational sites is also prevalent.
Materiality: Protecting species and habitats reduces legal exposure, preserves biodiversity value, and supports companies' "social license to operate."
Related frameworks:

- IUCN Guidelines & CITES: Species-specific protections.
- TNFD: Integrates species-level risk metrics.

Target 7: **Pollution Management**
Issue: Mining produces heavy metal run-off, acid mine drainage, dust, and hazardous waste, polluting soils, rivers, and groundwater.
Materiality: Pollution undermines local ecosystem services and threatens community relations and operational continuity. Better waste and water management reduce costs and biodiversity impacts.
Related frameworks:

- TNFD / SBTN: Pollution pressure indicators and dependencies.
- SDGs: 6 (Clean Water), 14, and 15.

Target 8: Climate Impacts on Biodiversity
Issue: Metals & mining activities generate significant GHG emissions (e.g., methane, CO_2) that accelerate climate change, indirectly impacting biodiversity.
Materiality: Addressing operational emissions reduces biodiversity loss linked to climate impacts and improves access to green finance.
Related frameworks:

- SBTi / TNFD: Climate-nature risk integration.
- SDGs: 13 (Climate Action), 15 (Life on Land).

Target 14: Integrating Biodiversity into Project Development
Issue: Failure to incorporate biodiversity considerations into project design, operations, and closure leads to long-term ecological damage.
Materiality: Companies that integrate biodiversity early reduce permitting delays, operational conflicts, and rehabilitation costs.
Related frameworks:

- TNFD: Embeds biodiversity in financial and operational decision-making.

Target 15: Biodiversity Risk & Impact Disclosure
Issue: Limited disclosure of biodiversity-related impacts, dependencies, and risks across mining operations and supply chains.
Materiality: Investors increasingly demand transparent nature disclosures; companies failing to report risk losing access to sustainable finance.
Related frameworks:

- TNFD: LEAP approach for assessing and reporting risks.
- CSRD / ESRS: Mandatory reporting requirements in the EU.

Target 22: Rights of Indigenous Peoples & Local Communities
Issue: Mining projects often overlap with Indigenous territories and areas of high biodiversity value. Lack of Free, Prior, and Informed Consent (FPIC) creates legal, reputational, and operational risks.
Materiality: Indigenous peoples are critical stewards of biodiversity; engaging them meaningfully improves site-level outcomes and safeguards biodiversity-rich areas.
Related frameworks:

- UNDRIP & Nagoya Protocol: Indigenous rights and equitable benefit-sharing.
- TNFD: Stakeholder rights and governance integration.

Forward-looking regulations relevant to the sector

Regulatory change constitutes a significant investment risk in relation to businesses that are not prepared. Investors can be inspired by forward-looking regulations on biodiversity to guide the transformation of the companies in their portfolio. With engagement, they can exercise influence on companies to improve their practices and be prepared in the context of a sustainable policy transition, which goes further than simply complying with environmental safeguards.

In the Metals and Mining sector, the most forward-looking regulations on biodiversity have been identified in Europe serving as best-practice examples for setting minimum standards.

Europe

- Raw Materials Action Plan – published in 2020, the Plan sets out 10 non-legislative measures - including mapping 'potential supply' and promoting 'responsible mining.
- Critical Raw Materials Act – this EU regulation took effect in May 2024, establishing an EU framework to secure a sustainable and diversified supply of critical and strategic raw materials. The Act includes 2030 benchmarks that at least 10% of EU annual consumption of strategic raw materials should be extracted in the EU, 40% processed in the EU, and 25% supplied from EU recycling, while no more than 65% of EU annual needs for each strategic raw material at any relevant processing stage should come from a single third country. The Act also aims to encourage investment in research, innovation, and skills, and protect the environment by improving circularity and sustainability of critical raw materials.
- EU Corporate Sustainability Due Diligence Directive (CS3D) – The CSDDD entered into force in March 2026; Member States must transpose it by July 2028, and national laws will apply from July 2029. It requires in-scope companies (including those in the Metals and Mining sector) to identify and address actual and potential adverse human-rights and environmental impacts in their own operations, subsidiaries and, where related to their value chains, business partners.
- Conflict Minerals Regulation (EU Regulation 2017/821) – came into force in January 2021. The regulation required EU importers of tin, tungsten, tantalum, and gold to meet the responsible sourcing standards set by the OECD to ensure that these minerals come from conflict-free sources only.
- Carbon-border Adjustment Mechanism (CBAM) – the EU's CBAM became fully effective in January 2026, requiring importers of specific materials to buy CBAM certificates based on the emissions embedded in their imports. CBAM certificates will be priced based on the EU Emissions Trading Scheme (ETS) auction price for CO_2 allowances. The CBAM covers six sectors including aluminium, and iron and steel. Companies supplying the EU will need to maintain robust product-level embedded-emissions data and supporting documentation so EU importers can meet the CBAM declaration, verification and certificate-surrender obligations.
- EU Batteries Regulation – took effect in 2023 but will introduce due diligence requirements in August 2027 which will impact companies supplying transition minerals to battery manufacturers. It introduces sustainability and supply-chain due diligence requirements for batteries, including obligations covering the sourcing, processing and trading of cobalt, natural graphite, lithium and nickel used in battery manufacturing.

United States

The US does not currently have federal laws that are equivalent to the EU regulatory framework and there are no plans to change this during the current administration.

Previously, in September 2023, the Biden-Harris administration released a report containing recommendations to reform and improve the way mining is conducted on U.S. public lands. The report was intended to inform efforts to modernise the Mining Law of 1872 and related federal permitting processes.

However, under the Trump-Vance administration, the federal policy context has shifted. In March 2025, Executive Order 14241, 'Immediate Measures to Increase American Mineral Production', directed federal agencies to accelerate domestic mineral production, identify priority mineral projects, expedite permits and approvals where possible, prioritise mineral production on relevant federal lands, and expand the use of the Defense Production Act and other federal financing authorities to support mining, processing, refining and smelting.

Mining industry sustainability commitments

Refer to Part IV for information on several non-binding industry-led sustainability commitments, including the ICMM Position Statement on Nature (setting out five commitments that members are expected to abide by), and the Global Industry Standard on Tailings Management which sets a global standard for tailings management with the goal of zero harm to people and the environment and zero tolerance for human fatality.

The five ICMM commitments have no legal force but provide a useful guide to best practice in the sector:

1. Protect and conserve pristine areas of our natural environment: No mining or exploration in World Heritage Sites and respect all legally designated protected areas.
2. Halt biodiversity loss at our operations: Achieve at least no net loss of biodiversity at all mine sites by closure against a 2020 baseline.
3. Collaborate across value chains: Develop initiatives and partnerships that halt and reverse nature loss throughout supply and distribution chains.
4. Restore and enhance landscapes: Around operations through local partnerships, including with Indigenous Peoples, land-connected peoples and local communities.
5. Catalyse wider change: Acting to change the fundamental systems that contribute to nature loss and fostering opportunities for nature's recovery.

Part II

Recommended Company Actions to help address Biodiversity Loss

Introduction

All companies in the Metals and Mining sector need to have a clear nature strategy to minimise negative impacts on nature and contribute to the reversal of nature loss by 2030. This nature strategy should be embedded in the company's overall business and climate strategy, and should encompass its supply chain as well as its direct operations. Supply chain traceability is an essential tool for companies that wish to put in place an effective nature strategy, and effective implementation will invariably require collaboration with other companies in the value chain.

The Metals and Mining sector's concentrated land footprint is a potential advantage in this context. In 2021, the UN Environment Programme Finance Initiative (UNEP-FI) and the Natural Capital Finance Alliance found that more than half of the mining sector's potential for reducing species extinction risk is concentrated in only 2% of mines worldwide. Better biodiversity management in just this small portion of mining sites as a first step, could have an outsized benefit.[35]

The company's nature strategy should follow the **ACT-D framework:[36] Assess, Commit, Transform, Disclose.[37]**

Assess

Measure and prioritize impacts and dependencies on nature to ensure the company is acting on the most material ones.

As a starting point, investors need to ensure that companies understand their supply chains' dependency and impacts on nature, as identified through an assessment of nature-related dependencies, impacts, risks, and opportunities (DIRO), conducted following the TNFD LEAP[38] process.

The assessment needs to encompass biodiversity loss pressures on all relevant biomes, as well as evaluate risks and impacts across the whole supply chain, from indirect raw material and components suppliers to how consumers use and dispose of the company's products. The assessment will allow companies to identify and address the most material biodiversity risks and impacts (using tools such as ENCORE or the SBTN Materiality Screening Tool[39]), as well as understanding its sphere of influence.

35. https://www.unepfi.org/themes/ecosystems/cutting-edge-biodiversity-module/
36. Developed by a variety of organisations including the Capitals Coalition, Business for Nature, WBCSD, TNFD, Science Based Targets Network, WEF and WWF.
37. https://capitalscoalition.org/business-actions/
38. See TNFD's Tool catalogue for Nature-related data tools to help assess nature-related issues and aligned with the TNFD's LEAP approach. https://tnfd.global/guidance/tools-catalogue/
39. https://sciencebasedtargetsnetwork.org/companies/take-action/assess/materiality-screening/

Commit (set targets)

Set transparent, time-bound, specific, science-based targets to put the company on the right track towards operating within the Earth's limits and aligning with the Global Biodiversity Framework, with the aim of reversing nature loss by 2030.

Targets need to be ambitious (while also being achievable), set against a clear baseline,[40] with specific cut-off dates and measurable KPIs to fulfil the company's biodiversity ambition. The targets should be based upon the company's assessment of its impacts and dependencies on nature, and should focus on the most material factors in its direct operations and those of its value chain.

The Science Based Targets Network (SBTN) provides extensive guidance for companies on how to decide which nature impacts to prioritise and how to develop, measure, set and disclose related science-based targets.[41]

Transform (take action)

The company should design an action plan using the SBTN's AR3T Action Framework: Avoid, Reduce, Regenerate, Restore, and Transform.

Companies at the start of their nature positive journey will need to focus on avoiding and reducing their negative impacts on nature. However, more mature companies should take actions that will actually regenerate and restore nature, with the ultimate aim of acting to transform the underlying systems that are driving nature loss.

At all stages of the value chain, it is important that companies are not simultaneously supporting business associations or other lobbying efforts that act in opposition to their nature action plans, and are engaging positively with regulators and policy makers to support the transformation of the sector.

It is also particularly important that the design and implementation of the plan prioritises rights-based approaches and is developed in collaboration with Indigenous Peoples and local communities when they are affected (as is often the case with mining activities).

Companies will inevitably need to consider trade-offs when deciding what actions to take. Investors should look for clear, science-based and evidenced-backed, explanations to support such decisions.

40. Credible baselines are obviously a key component of any target
41. https://sciencebasedtargetsnetwork.org/step-up-for-nature/

Disclose

Track performance and publicly report material nature-related information on a regular and consistent basis. Companies should use the overall reporting framework provided by the TNFD to guide them when compiling and reporting nature-related information, and their reporting should comply with the relevant sustainability reporting standards such as those provided by the ISSB, EFRAG, and the GRI.

An integrated approach is essential

In addition to using the ACT-D framework discussed above, it is important that companies in the sector take a holistic, integrated, and systems-based approach to addressing their nature-related dependencies, impacts, risks, and opportunities.

This requires an approach that incorporates nature into the entire mining lifecycle (exploration, planning, development, operation, and closure), and that recognises that the nature risks to be addressed are highly interconnected and cannot be managed in isolation.[42]

42. These Sector Briefs focus on addressing nature-related issues but the social aspects of a mining company's operations are also an important consideration and should be included in this systemic approach to ensure any trade-offs are balanced appropriately

Recommended company actions

Introduction

The specific actions taken by a company will depend on its position in the value chain, the nature of the products and services it provides, the inputs it depends on, and will be location-specific. However, given the most material impacts discussed earlier, it is possible to identify several actions that are likely to be relevant to many companies in the sector.[43] The actions will apply to companies' direct operations and to activities across their supply chains.

The actions that are appropriate will also depend upon the company's 'maturity level'. In this Sector Brief we have used a scale from 'basic' to 'advanced' summarised in Table 2 below. The levels assigned are meant as guidance only and do not represent precise classifications.[44]

Maturity level	Description
Basic	This action should be within the grasp of the majority of companies.
Intermediate	This action is more likely to require a greater level of organisational maturity with respect to nature actions.
Advanced	The prioritisation of strategic actions takes place according to where the company has the most influence or impact on nature and the multiple core benefits.

Table 2: Company maturity levels. Finance for Biodiversity Foundation (2025), derived from WBCSD and Capitals Coalition

More mature companies will be able to extend their actions across the majority of their operations and a larger proportion of their supply chains than less mature companies.

43. The 'Assess' and 'Commit' stages of the ACT-D framework obviously involve taking action; in addition, positive policy engagement is an essential tool that should be deployed alongside any set of actions to align with the 'Transform' element of ACT-D. These elements are not included in the action lists in this section to avoid repetition.
44. There are numerous ways to define maturity level – investors can refer to WBCSD's Roadmaps to Nature Positive - Foundations for all businesses and the Capitals Coalition Maturity Tool for further guidance.

Certification

Investors should expect companies to demonstrate responsible mining performance through credible, independent, site-level assessment and assurance. Certification should provide evidence that the company is identifying risks, addressing non-conformities, engaging affected stakeholders, and continuously improving performance across all material sites and related processing facilities.

Companies should disclose which standards or assurance schemes they apply, the scope of coverage by site and production volume, the reasons for selecting those schemes, the frequency of audits, the independence and competence of auditors, and the extent to which full site-level assurance reports are made public. Higher-risk operations, including sites with significant biodiversity, water, tailings, pollution, human rights or community risks, should be prioritised for independent assurance.

Refer to Part IV for more details on two examples (Initiative for Responsible Mining Assurance (IRMA) and Towards Sustainable Mining (TSM)).

Priority actions

The recommended company actions are grouped into seven categories for ease of reference.[45]

- Reduce water use and improve water stewardship
- Reduce pollution
- Reduce GHG emissions
- Reduce and improve management of solid waste and tailings
- Reduce land-use impacts and restore ecosystems
- Build responsible supply chains
- Embed nature strategy, governance and disclosure

The actions are shown on a heatmap to indicate:

1. the likely nature benefit from taking the action (higher or lower); and
2. the likely feasibility of the action in the near to mid-term (dependent on cost, current technology, regulatory clarity, etc).[46]

Companies should prioritise more feasible actions with a high benefit to nature, as summarised in Table 3.

		Feasibility	
		'Easy'	'Difficult'
Benefit to nature	High	Priority 1 - P1	Priority 2 - P2
	Lower	Priority 3 - P3	Priority 4 - P4

Table 3: Prioritising actions (nature benefit vs feasibility).[47] Finance for Biodiversity Foundation.

45. In practice, many actions will relate to more than one category
46. Feasibility is estimated independent of the maturity of the company. However, more mature companies are more likely to be able to undertake actions that are judged to be less feasible ('difficult') where organisational capacity (knowledge, and resources) is an important factor. For example, creating products that are 'safe and sustainable by design' is often challenging, but mature organisations are more likely to have the capacity to achieve this due to stronger leadership, human resources, supplier relationships, etc. Conversely, some 'easy' actions will still be more challenging for organisations with lower capabilities
47. Important caveat: the 'feasibility' of a particular action is based on broad judgements, not on detailed analysis, and changes in technologies, regulation, and other factors may significantly change the assessed feasibility of an action in the future

Reduce water use and improve water stewardship

Action	Maturity	Priority
Perform water scarcity and water-quality risk assessments to identify vulnerabilities in water-stressed or ecologically sensitive catchments, prioritise actions in those locations, and prepare for potential disruptions	Basic	P1
Develop site-level water stewardship plans, water balances and reduction targets for withdrawals, consumption, discharge quality and operational water intensity	Basic	P1
Invest in water-efficient technologies and process optimisation to reduce freshwater demand, including water recycling, reuse and recovery from tailings and process circuits	Basic	P1
Implement integrated water systems and closed-loop water management where feasible, with monitoring to avoid transferring impacts to water quality, energy use or downstream ecosystems	Intermediate	P2
Collaborate with local stakeholders, regulators and other water users to strengthen catchment-level water governance and improve water outcomes in priority basins	Intermediate	P2
Publicly disclose site-level water withdrawals, consumption, recycling, discharge quality and water-stress exposure using consistent metrics	Intermediate	P3
Engage local communities and Indigenous Peoples to ensure water use, discharge, and watershed interventions respect rights, livelihoods and FPIC principles[48]	Advanced	P2
Replenish, restore and protect watersheds and aquatic ecosystems affected by mining, prioritising nature-based solutions where they are ecologically appropriate and durable	Advanced	P2

Reduce pollution (air, water, and soil)

Ensure all mining, processing and associated infrastructure facilities meet or exceed applicable site-level regulations and recognised good-practice standards for air, water and soil pollution	Basic	P1
Identify and prioritise the most material pollutants for each site, including acid mine drainage, metals and metalloids, cyanide, mercury, dust, particulate matter, SOx/NOx and processing reagents including Volatile Organic Compounds (VOCs)	Basic	P1
Deploy technologies and operational controls to capture, contain and treat harmful air emissions, effluents, seepage and runoff before they reach the environment	Basic	P1
Implement continuous monitoring, incident-response procedures and public reporting for spills, seepage, dust, contaminated runoff, and breeches of discharge limits	Intermediate	P1
Substitute, reduce or tightly control high-risk reagents and hazardous substances where feasible, and apply recognised standards for cyanide, mercury and other chemicals of concern	Intermediate	P2
Remediate legacy pollution and contaminated soils, sediments and water bodies, using plans with clear targets, timelines, responsibilities and long-term monitoring	Advanced	P2
Collaborate across industry, suppliers and regulators to identify, phase down and prevent the most material and ecotoxic mining-related pollutants	Advanced	P2

48. Free, Prior and Informed Consent

Reduce GHG emissions

Action	Maturity	Priority
Increase energy efficiency in mining, processing, smelting or refining, site services and logistics through process optimisation, efficient motors, ventilation management, heat recovery and route optimisation	Basic	P1
Use life-cycle assessment and product-level carbon accounting to identify priority areas for emissions reduction across mined materials and associated processing routes	Basic	P2
Expand renewable electricity procurement, on-site renewable generation and electrification of mobile equipment, haulage, processing and site infrastructure to reduce fossil fuel dependency	Intermediate	P1
Adopt lower-carbon processing, smelting and refining technologies where applicable, including fuel switching, green hydrogen, low-carbon heat and alternative reductants	Intermediate	P2
Align operations, capital allocation and portfolio strategy with a credible net-zero transition pathway, including reducing methane and other fugitive emissions were material.	Intermediate	P2
Prioritise mineral efficiency, recovery rates, secondary materials and circular business models that reduce the need for high-impact primary extraction while supporting low-carbon transition demand	Advanced	P2

Reduce and improve management of solid waste and tailings

Map, classify and monitor all mineral waste, waste rock, overburden, slag and tailings streams by volume, hazard, acid-generating potential and long-term storage requirement	Basic	P1
Implement the Global Industry Standard on Tailings Management or equivalent good practice, including independent review, clear accountability, emergency preparedness and community engagement	Basic	P1
Minimise waste generation through mine planning, selective mining, ore sorting, improved recovery rates, and process optimisation	Basic	P1
Prevent and monitor seepage, acid rock drainage and metal leaching from waste rock, tailings and closed facilities using engineered controls and long-term treatment plans	Intermediate	P1
Adopt safer tailings and waste-management technologies where feasible, including filtered or thickened tailings, dry stacking, paste backfill, and enhanced water recovery	Intermediate	P2
Recover, reuse or safely reprocess waste rock, tailings and by-products where this reduces net environmental risk and does not create new pollution or safety risks	Intermediate	P2
Establish fully funded closure and post-closure plans for waste and tailings facilities, including financial provisioning, biodiversity restoration and long-term monitoring obligations	Advanced	P2

Reduce land-use impacts and restore ecosystems

Action	Maturity	Priority
Avoid exploration and mining in World Heritage Sites and apply stringent safeguards for protected areas, conserved areas, Key Biodiversity Areas and critical habitats	Basic	P1
Integrate nature preservation and restoration into site selection, project design and mine planning, using spatial planning tools, field surveys and early screening to avoid high-risk locations	Basic	P1
Ensure site selection, land access and raw material sourcing respect Indigenous Peoples' and local communities' rights and are supported by FPIC where applicable	Basic	P2
Apply the mitigation hierarchy rigorously: avoid impacts where possible, minimise unavoidable impacts, restore affected ecosystems and use offsets only for residual impacts	Basic	P1
Undertake progressive rehabilitation and ecological restoration during operations rather than deferring restoration until closure	Intermediate	P1
Prevent, reduce and monitor direct and indirect mining-related deforestation and conversion, including secondary impacts from access roads, in-migration and associated infrastructure	Intermediate	P1
Minimise the physical footprint and fragmentation caused by mines, roads, rail, power lines, ports and camps by using existing corridors and shared infrastructure where feasible	Intermediate	P2
Set and implement site-level plans to achieve at least no net loss, and where feasible net gain, of biodiversity by closure against a credible baseline	Intermediate	P2
Develop closure and restoration plans with communities, Indigenous Peoples, biodiversity experts and regulators, supported by adequate financial assurance	Advanced	P2
Support ecosystem conservation and restoration beyond operational boundaries where this addresses cumulative impacts or improves landscape connectivity and resilience	Advanced	P2

Build responsible supply chains

Action	Maturity	Priority
Map priority mineral supply chains to mine, smelter, refiner or origin level where possible, identifying high-risk geographies, commodities and suppliers for nature impacts	Basic	P1
Include human rights, FPIC and environmental safeguards in supplier and contractor agreements, aligned with the UN Guiding Principles on Business and Human Rights	Basic	P1
Require responsible mining, processing and sourcing standards from suppliers and contractors, including independent assurance where available and appropriate	Basic	P2
Integrate environmental stewardship requirements into supplier contracts, including GHG reduction, water efficiency, pollution prevention, waste management, biodiversity safeguards and incident reporting	Intermediate	P1
Support supplier capacity building through training, joint improvement plans, technical assistance and knowledge-sharing on water, pollution, waste, restoration and community engagement	Intermediate	P2
Conduct enhanced due diligence for high-risk suppliers, including artisanal and small-scale mining links, mercury use, deforestation, protected-area overlap and conflict or human-rights risks	Intermediate	P2
Collaborate with customers, recyclers and peers to increase recycled and secondary metal supply, improve recovery rates and reduce demand for high-impact primary extraction	Advanced	P2
Work with suppliers to ensure nature, climate and closure plans incorporate just transition principles and protect workers, communities and local livelihoods	Advanced	P2

Embed nature strategy, governance and disclosure

Adopt a board-approved nature strategy that commits the company to contribute to a nature-positive economy and assigns senior accountability for delivery	Basic	P1
Apply a LEAP-style assessment to identify and prioritise material nature-related impacts, dependencies, risks and opportunities across mining assets, associated infrastructure and material value-chain stages	Basic	P1
Disclose how the mitigation hierarchy is being applied to mine site selection and development plans	Basic	P1
Establish site-level biodiversity, water, pollution, waste and land-use baselines, and use them to set time-bound nature targets and transition-plan milestones	Intermediate	P1
Integrate nature-related risks and targets into capital allocation, project approval, M&A due diligence, mine planning, closure planning and executive performance management	Intermediate	P2
Disclose site-level and portfolio-level nature metrics, including priority locations, protected area or Key Biodiversity Area (KBA) proximity, water use, discharges, waste and tailings, rehabilitation progress and closure liabilities	Intermediate	P2
Participate in landscape, catchment and sector collaborations with governments, Indigenous Peoples and local communities, conservation organisations, peers and customers to address cumulative nature impacts	Advanced	P2

Part III

Finance for Biodiversity Foundation's Call to Action: Questions for Investors to Engage Companies on Nature

As investors enter into engagements with companies from the Metals and Mining sector, we propose the list of questions below that investors can select from to help to evaluate companies' performance and push for more ambitious actions. The questions have been organised following the structure of the Nature Action 100 Investors Expectations, covering ambition, assessment, targets, implementation, governance and engagement with stakeholders.

Questions are divided into those that investors should expect to be answered from company filings,[49] and those questions that are more likely to require a specific response from management.

A number of the questions are cross-sectoral and have been applied across all of our briefs. **The questions shown in blue are specific to the Metals and Mining sector**.

49. The disclosure-based questions can also be used as part of the assessment of a company's 'maturity' on the assumption that less mature companies may struggle to provide the same level of information in their filings compared to their more mature peers

1. Ambition

Companies need to publicly commit to minimise contributions to key drivers of nature loss and to conserve and restore ecosystems at the operational level and throughout value chains by 2030.

Disclosure-based questions (from reports)

1A Does the company publicly commit to minimising contributions to key drivers of nature loss and to conserving and restoring ecosystems across its operations and value chain by 2030?

1B How is nature integrated and positioned within the company's overall sustainability strategy?

1C Has the company committed to reporting regularly on nature using frameworks such as TNFD?

1D Has the company adopted a board-approved nature strategy that commits it to contribute to a nature-positive economy and assigns senior accountability for delivery?

1E Has the company publicly committed to reducing water use and improving water stewardship in water-stressed or ecologically sensitive catchments?

1F Has the company publicly committed to reducing pollution from all its operations (including acid mine drainage, metals and metalloids, cyanide, mercury, dust, particulate matter, SOx/NOx and processing reagents)?

1G Has the company publicly committed to reducing and improving the management of mineral waste, waste rock, overburden, slag and tailings?

1H Has the company publicly committed to avoiding and reducing land-use impacts, applying the mitigation hierarchy, and restoring ecosystems affected by its operations and associated infrastructure?

1I Has the company publicly committed to responsible mineral supply chains, including environmental safeguards, human rights, FPIC, and just transition principles?

Potential follow-up questions (for engagement interactions)

- Does the company have Board-level or executive buy-in for its nature ambition, and is there evidence of a public commitment to this ambition?
- How does the company define success in achieving its nature commitments by 2030?
- If no nature commitments exist, is the company willing to set one/more, and could this be linked to executive remuneration to signal ambition?
- How material are nature considerations in relation to the company's long-term strategy and financial performance?
- How are nature considerations integrated into long-term strategy and capital allocation decisions?
- How does the company balance growth objectives with the need to reduce impacts on ecosystems?
- How does the company balance increased demand for transition minerals with the need to avoid, minimise and restore impacts on water, land, ecosystems and communities?
- What role do mine planning, processing routes, secondary materials and circular business models play in the company's nature ambition?
- How does the company's nature ambition address closure, rehabilitation and post-closure obligations across both operating and legacy assets?
- How does the company define responsible growth in jurisdictions where mining assets overlap with protected areas, Key Biodiversity Areas, water-stressed basins or Indigenous Peoples' lands?

2. Assessment

Companies need to assess and publicly disclose nature-related dependencies, impacts, risks, and opportunities at the operational level and throughout value chains.

Disclosure-based questions (from reports)

2A Does the company disclose priority locations under TNFD for its direct operations and, where material, for upstream and downstream activities in its value chain?

2B What proportion of the supply chain can the company trace (including Tier 1 suppliers and beyond)?

2C Has the company conducted nature-related impact and dependency assessments for its direct operations and value chain?

2D What metrics does the company use to assess and manage nature-related risks and opportunities?

2E Has the company undertaken a nature-related risk scenario analysis? If so, what are the results?

2F Does the company disclose site-level exposure to protected areas, Key Biodiversity Areas, critical habitats, Indigenous Peoples' lands, water-stressed basins and other sensitive or priority locations?

2G Does the company disclose water withdrawal, consumption, recycling, discharge quality and water-stress exposure at site level?

2H Does the company assess and disclose the most material air, water and soil pollutants by asset (including acid mine drainage, metals and metalloids, cyanide, mercury, dust, particulate matter, SOx/NOx and processing reagents including volatile organic compounds)?

2I Does the company disclose mineral waste, waste rock, overburden, slag and tailings streams by volume, hazard, acid-generating potential and long-term storage requirement?

2J Does the company disclose tailings facility risk classifications, independent review processes, emergency preparedness arrangements and community engagement outcomes?

2K Does the company disclose date-stamped biodiversity baselines, habitat condition, rehabilitation progress, restoration outcomes and closure liabilities for operating and legacy sites?

2L Does the company assess and disclose emissions hotspots across mining, processing, smelting, refining, site services and logistics?

2M Does the company disclose the extent to which priority mineral supply chains can be traced to mine, smelter, refiner or origin level?

2N Does the company assess high-risk suppliers, including artisanal and small-scale mining links, mercury use, deforestation, protected-area overlap and conflict or human-rights risks?

2O Are certification audit reports published in full (including non-conformities, corrective action plans, and stakeholder input)?

2. Assessment (continued)

Companies need to assess and publicly disclose nature-related dependencies, impacts, risks, and opportunities at the operational level and throughout value chains.

Potential follow-up questions (for engagement interactions)

- What has the company identified as its most material nature dependencies and risks, and how do these link to financial risks?
- Which regions, sourcing landscapes or commodities pose the greatest nature-related risks to the business?
- How frequently are nature-related risk assessments updated and reviewed by management?
- What proportion of significant operating sites have had nature-related risks assessed and monitored?
- What tools or methodologies does the company use to assess nature impacts and dependencies?
- What plans does the company have to increase the proportion of its supply chain that is traceable?
- What nature risks have crystalised, what were the related financial consequences, and to what extent was the company's risk-mitigation strategy effective?
- Which assets have the highest exposure to water stress, sensitive ecosystems, protected areas, Key Biodiversity Areas or Indigenous Peoples' lands, and how are those findings used in decision-making?
- How does the company assess cumulative impacts at a landscape level from its activities and those of its value chain partners and other associated activities?
- How does the company assess the probability and potential severity of pollution incidents involving tailings, waste-rock, acid drainage, seepage, spill or contaminated-runoff?
- How does the company assess biodiversity and water risks when considering new exploration, project approvals, expansions, acquisitions or disposals?
- How does the company determine biodiversity baselines, and how does the company ensure they exclude the impact of any initial exploratory activities or other related activities?
- What confidence does the company have in its liability estimates relating to closure, rehabilitation and restoration costs, and how often are they independently reviewed?
- What certification systems does the company currently use and to what extent are they supported by third-party independent audits? What proportion of sites and/or production volumes are currently covered, what timeline does the company have to extend certification coverage and what obstacles need to be overcome to achieve this?

3. Targets

Companies need to set time-bound, context-specific, science-based targets informed by risk assessments on nature-related dependencies, impacts, risks and opportunities and disclose annual progress against targets.

Disclosure-based questions (from reports)

3A Has the company published science-based targets on nature with baselines, milestones, and transparent methodologies?

3B Has the company published science-based targets to:
- Reduce GHG emissions?
- Decrease water use and water pollution?
- Minimise the release of hazardous and priority substances to air, water and soil?
- Achieve deforestation- and conversion-free supply chains where relevant?
- Reduce hazardous waste generation and increase circular material use?

3C Has the company set targets to reduce freshwater withdrawals, operational water intensity and harmful discharges in priority basins and water-stressed locations?

3D Has the company set targets to reduce mining-related air, water and soil pollution, including site-specific priority pollutants and exceedances of discharge or emission limits?

3E Has the company set targets to reduce mineral waste generation, increase recovery or reuse of by-products, and improve the safety and environmental performance of tailings and waste facilities?

3F Has the company set time-bound targets for progressive rehabilitation, ecological restoration, closure outcomes and post-closure monitoring?

3G Has the company set site-level targets to achieve at least no net loss, and where feasible net gain, of biodiversity by closure against credible baselines?

3H Has the company set targets to reduce GHG emissions from mining, processing, smelting, refining, site services, logistics and fugitive methane where relevant?

3I Has the company set targets to increase traceability and responsible sourcing across priority mineral supply chains to mine, smelter, refiner or origin level where possible?

3J Has the company set targets to increase the ratio of secondary materials vs primary, improve recovery rates or support circular models that reduce pressure on primary extraction?

Potential follow-up questions (for engagement interactions)

- How were the company's nature-related targets determined and what scientific frameworks informed them?
- What milestones will indicate that the company is on track to achieve its nature commitments?
- How do nature targets link to employee incentives, procurement policies, and product portfolio decisions?
- What constraints are preventing the company from setting targets in particular areas, and how might these be overcome?
- To what extent are targets differentiated across business operations or product lines with materially different nature risk profiles?
- Which targets apply at asset level, and how are they aggregated without masking high-risk sites or underperforming facilities?
- How are targets for water, pollution, tailings, rehabilitation and closure linked to the mine plan and life-of-asset economics?
- What metrics does the company use to track progress on biodiversity condition, no net loss or net gain, ecological restoration and closure outcomes?
- How does the company ensure that targets for production growth or mineral recovery do not undermine water, pollution, waste, land-use or restoration targets?

4. Implementations

Companies need to develop a company-wide plan on how to achieve targets. The design and implementation of the plan should prioritise rights-based approaches and be developed in collaboration with Indigenous Peoples and local communities when they are affected. The plan should encompass its direct operations and its value chain. Progress against the plan should be disclosed annually.

Disclosure-based questions (from reports)

4A Does the company have a Nature Action Plan linked to its impact and dependency assessments?

4B Are the company's actions to reduce nature impacts prioritised according to the mitigation hierarchy?

4C What investments, including capex, has the company made (and what is planned) to reduce its impact on nature and to protect or restore ecosystems?

4D What actions is the company taking to reduce freshwater withdrawals, increase water recycling and reuse, improve discharge quality and strengthen catchment-level water stewardship?

4E What actions is the company taking to capture, contain and treat harmful mining-related pollution before it reaches the environment (e.g. air emissions, effluents, seepage, dust, runoff, etc.)?

4F What actions is the company taking to manage mineral waste, waste rock, overburden, slag and tailings safely over the full life cycle of assets, including after closure?

4G What steps is the company taking to implement the Global Industry Standard on Tailings Management or equivalent good practice?

4H How is the company integrating biodiversity into site selection, project design, mine planning, infrastructure routing and closure planning?

4I What steps is the company taking to avoid exploration and mining in World Heritage Sites and apply stringent safeguards for protected areas, conserved areas, Key Biodiversity Areas and critical habitats?

4J How is the company undertaking progressive rehabilitation and ecological restoration during operations rather than deferring restoration until closure?

4K How does the company implement responsible sourcing, supplier due diligence and environmental stewardship requirements across mineral supply chains?

4K How is the company increasing energy efficiency, renewable electricity procurement, electrification and lower-carbon processing while avoiding unintended nature impacts?[50]

50. For example, increasing the use of solar power for electricity production will have an impact on land use which could be negative for nature

4. Implementations (continued)

Companies need to develop a company-wide plan on how to achieve targets. The design and implementation of the plan should prioritise rights-based approaches and be developed in collaboration with Indigenous Peoples and local communities when they are affected. The plan should encompass its direct operations and its value chain. Progress against the plan should be disclosed annually.

Potential follow-up questions (for engagement interactions)

- To what extent is nature risk management integrated into enterprise risk management and investment planning?
- What investments are planned over the next five years to reduce the company's impact on nature?
- What are the main barriers to implementation, and how is the company addressing them?
- How does the company ensure operational teams implement nature-related commitments in practice?
- What partnerships are in place to support ecosystem restoration or conservation projects?
- What steps is the company taking to ensure that actions to reduce nature-related harms in one part of the supply chain do not simply displace those harms to other regions, suppliers or commodities?
- How are nature-related requirements embedded in mine planning, feasibility studies, project approvals, M&A due diligence and contractor management?
- How does the company prioritise investments between production expansion, water efficiency, pollution control, tailings safety, rehabilitation and closure?
- How are Indigenous Peoples and local communities involved in the design and monitoring of water, pollution, tailings, restoration and closure plans?
- What contingency plans are in place for tailings, seepage, acid drainage, spills, drought, water restrictions or other events that could cause acute harm to nature and communities?
- How does the company ensure that offsets are used only for residual impacts and are not a substitute for avoiding and minimising harm?

5. Governance

Companies need to establish Board oversight[51] - which is key to ensuring biodiversity is embedded in strategic decisions and implementation - and disclose management's role in assessing and managing nature-related dependencies, impacts, risks, and opportunities.

Disclosure-based questions (from reports)

5A What governance structures, policies, and procedures are in place to ensure the achievement of the company's nature commitments and targets, and the effective application of the company's nature strategy and risk management processes?

5B Does the Board oversee nature-related dependencies, impacts, risks, and opportunities?

5C Are capital allocation, project approval, M&A, mine planning, closure planning and executive performance processes aligned with the company's nature commitments and targets?

5D Does the company assign clear executive and site-level accountability for water stewardship, pollution prevention, waste and tailings management, biodiversity, rehabilitation and closure?

5E Does the Board receive regular reporting on high-risk tailings facilities, environmental incidents, rehabilitation progress, closure liabilities and material nature-related risks?

Potential follow-up questions (for engagement interactions)

- How are nature-related issues reflected in Board discussions and decision-making?
- How often does the board review nature-related risks and progress toward environmental targets?
- How are nature-related KPIs incorporated into executive performance evaluation and remuneration?
- What governance mechanisms ensure accountability for sustainability commitments?
- What is the current level of nature-related expertise in the C-suite and Board, and what plans are in place to maintain or increase this expertise?
- How does governance ensure that capital allocation and project design are influenced by biodiversity, water, pollution, waste, tailings and closure risks before irreversible decisions are made?
- Who is accountable at Board, executive and site level for tailings safety, closure provisioning, rehabilitation performance and community grievance management?
- How are contractor and joint-venture operations governed where the company does not have full operational control but retains exposure to nature-related impacts?
- How does the company ensure that remuneration metrics do not incentivise production growth, cost reduction or recovery rates at the expense of nature outcomes?
- How does the company manage sustainability risks when selling, transferring, or acquiring mining assets?
- How does the Board ensure that the company's lobbying activities and use of legal mechanisms do not conflict with its nature strategy and related policies, and its other stakeholder engagement activities?

51. Board oversight involves the continual inquiry by directors into whether the board's delegation of authority to management is reasonable, and whether the board has received sufficient and accurate information from management to make that determination. See: https://corpgov.law.harvard.edu/2022/01/05/board-oversight-key-focus-areas-for-2022/

6. Engagement with Stakeholders

Companies need to engage with external parties including actors throughout value chains, trade associations, policymakers, and other stakeholders to create an enabling environment for implementing the plan and achieving targets.

Disclosure-based questions (from reports)

6A Has the company published a sustainable procurement code or policy?

6B To what extent does the company engage with stakeholders to create an enabling environment for implementing its Nature Action Plan and achieving the targets of the Global Biodiversity Framework?

6C Are supplier scorecards, commercial incentives and innovation funding aligned with the company's nature, climate and just-transition expectations?

6D How does the company engage with Indigenous Peoples and local communities affected by exploration, mining, processing, infrastructure, closure and restoration activities?

6E How does the company engage local stakeholders, regulators and other water users to strengthen catchment-level water governance and improve outcomes in priority basins?

6F How does the company engage (and support) suppliers and contractors on responsible mining, processing and sourcing standards, including biodiversity safeguards, pollution prevention, water stewardship, waste management and incident reporting?

6G How does the company conduct enhanced due diligence and engagement for high-risk suppliers, including artisanal and small-scale mining links, mercury use, deforestation, protected-area overlap and conflict or human-rights risks?

6H How does the company collaborate with customers, recyclers and peers to increase recycled and secondary metal supply, improve recovery rates and reduce demand for high-impact primary extraction?

6I How does the company engage with policymakers to support progressive nature-positive policies relevant to the Metals & Mining sector?

6. Engagement with Stakeholders (continued)

Companies need to engage with external parties including actors throughout value chains, trade associations, policymakers, and other stakeholders to create an enabling environment for implementing the plan and achieving targets.

Potential follow-up questions (for engagement interactions)

- What barriers currently limit effective stakeholder engagement, and how is the company addressing them?
- What examples or case studies can the company provide to demonstrate effective collaboration with suppliers, customers, or regulators on biodiversity outcomes?
- How does the company collaborate with suppliers to reduce environmental impacts across the value chain?
- How are suppliers assessed and rewarded for progress on nature outcomes, not just cost and volume performance?
- How does the company verify that suppliers comply with sourcing and production policies?
- How does the company ensure that its lobbying activities and trade-association memberships are aligned with its stated nature commitments?
- What role do partnerships with governments or NGOs play in achieving nature-related goals?
- How does the company engage with Indigenous Peoples and Local Communities affected by its operations to ensure the implementation of its Nature Action Plan follows a rights-based approach, including adherence to FPIC principles and to Access and Benefit Sharing requirements, and how is this engagement maintained throughout the full life cycle of the asset?
- What demand or pressure is coming from customers to move towards more nature-friendly practices, and how is the company responding?
- How does the company engage local communities on tailings safety, emergency preparedness, water use, pollution monitoring, rehabilitation and closure?
- How are local stakeholders involved in monitoring environmental performance and grievance/remedy processes at high-risk assets?
- How does the company collaborate across landscapes, catchments and transport corridors to address cumulative impacts from mining and associated infrastructure?
- How does the company engage and support downstream customers on traceability, circularity, recycling and responsible mineral sourcing expectations?

Part IV

Supporting Resources for Company Analysis

This section provides various supporting tools in the form of recommended resources and collaborative engagements covering issues in the sector, as well as sector-specific and cross-sectoral data sources. These supporting tools help to access more information and build further knowledge to mobilise when engaging with companies.

Recommended resources

We recommend the following resources to help investors gather more information about the sustainable transformation of the sector toward the protection and restoration of nature:

- TNFD Additional Sector Guidance: Metals and Mining: Sector-specific guidance on applying the LEAP approach and TNFD disclosure metrics to metals and mining business models and value chains. The 2026 final guidance supersedes the 2023 draft guidance and should be used as the current TNFD sector reference.
- WEF / Oliver Wyman, Nature Positive: Role of the Mining and Metals Sector: Sets out five high-level priority actions for a nature-positive mining and metals sector: transform operations across the mine life cycle; improve water stewardship; expand circularity and source responsibly; restore and regenerate landscapes; and transform policy systems and collaborate across sectors.
- ICMM Nature Position Statement: Sets out ICMM member commitments to contribute to a nature-positive future, including no mining or exploration in World Heritage Sites, respect for protected areas, at least no net loss of biodiversity at all mine sites by closure against a 2020 baseline, value-chain collaboration and landscape restoration.
- ICMM, Achieving No Net Loss or Net Gain of Biodiversity: Good Practice Guide: Provides a practical framework for mining and metals companies to establish baselines, apply the mitigation hierarchy, implement no-net-loss or net-gain approaches, and disclose progress across the mine life cycle. This guide replaces the older ICMM / IUCN Good Practice Guidance for Mining and Biodiversity as the main ICMM biodiversity implementation reference.
- World Bank, Forest-Smart Mining: Nature-Based Solutions for Climate Resilience: Provides practical guidance on using nature-based solutions around mining projects to manage climate, water, erosion, ecosystem and community risks, especially in forest landscapes.
- WWF et al., Extracted Forests: Assesses mining-related pressures on forests and provides a useful reference for investors analysing deforestation, conversion, associated infrastructure, and cumulative landscape impacts linked to mining.

- Society for Ecological Restoration, International Principles and Standards for the Ecological Restoration and Recovery of Mine Sites: Provides a mining-specific restoration framework and standards for socially and environmentally responsible restoration and recovery of mine sites.
- Responsible Mining Foundation / Responsible Mining Index material: Useful for assessing mining companies against responsible-mining expectations, including environmental management, community engagement, tailings and rehabilitation. The Responsible Mining Index and related materials can support company comparison and engagement prioritisation.
- Planet Tracker, deep sea mining research: Planet Tracker's deep sea mining reports provide investor-relevant analysis of the financial, ecological and transition-risk issues associated with deep sea-bed mining.

Collaborative investor engagements covering issues in the sector

In its Guide on Engagement with Companies, the FfB Foundation provides an overview of biodiversity-related collaborative engagements. For the Metals and Mining sector, the following initiatives are particularly relevant:

- As You Sow, deep sea mining shareholder engagement: Engagement and shareholder proposals asking automobile manufacturers to commit to, or disclose policies on, not sourcing minerals from deep sea-bed mining.
- Ceres, Valuing Water Finance Initiative: A global investor-led engagement initiative focused on corporate water stewardship, freshwater risk and resilience. It is cross-sectoral but relevant for mining companies and major customers with material water dependencies and impacts.
- Finance for Biodiversity Foundation, Global Financial Institutions Statement to Governments on Deep Seabed Mining: A completed public-policy investor statement relevant to sea-use change and pollution risks associated with deep sea-bed mining.
- Mining 2030 (The Global Investor Commission on Mining 2030): a collaborative investor-led multi-stakeholder initiative, launched in January 2023, seeking to define a vision for a socially and environmentally responsible mining sector overall by 2030, and to develop a consensus about the role of finance in realising this vision.
- Nature Action 100: A global investor-led engagement initiative focused on greater corporate ambition and action to reverse nature and biodiversity loss. Relevant for mining and metals companies covered by the initiative and for cross-sector comparison of investor expectations.
- PRI, Spring stewardship initiative for nature: A PRI stewardship initiative designed to address systemic biodiversity risks and contribute to halting and reversing nature loss by 2030. It is currently most focused on forest loss and land degradation, but PRI has signalled interest in transition-mineral supply chains.
- Sustainalytics, Biodiversity & Natural Capital Stewardship Program: Cross-sector stewardship programme focused on biodiversity and natural capital risks and opportunities.

- **VBDO / Rainforest Foundation Norway, Investor Initiative on Responsible Nickel Supply Chains:** An investor-led, civil-society-supported initiative focused on responsible nickel supply chains, especially in relation to electric vehicles, deforestation, sensitive ecosystems and social due diligence.

Useful engagement guides

Investors requiring additional or more detailed engagement questions than those included in this Sector Brief can also refer to these documents:

- **IUCN NL / VBDO, Investor Engagement Guide on Biodiversity and Mining:** Investor-focused engagement guidance developed with responsible-mining investors, with practical questions and expectations on biodiversity management, sensitive locations, mitigation hierarchy use and disclosure.
- **IUCN NL / VBDO, Investor Engagement Guide on Reclamation and Mining:** A companion investor guide focused on reclamation, restoration and closure, useful for assessing whether mine rehabilitation and closure planning are credible, adequately funded and aligned with community and ecological objectives.
- **UNEP FI / The Biodiversity Consultancy, PRB Sector Action Guidance for Nature:** Banking-sector guidance on nature-related sector actions, including metals and mining, useful for translating sector impacts into financing, engagement and client-assessment expectations.

The broader engagement context

Company engagement in the Metals and Mining sector should be complemented by investor action across the wider investment ecosystem. Current market dynamics may reward low-cost production while providing limited price premiums for responsibly produced minerals and insufficient recognition of strong environmental and social performance. This can weaken incentives for companies to invest in higher nature standards, particularly where customers, lenders, insurers, rating agencies or indices do not differentiate credible improvement from poor performance.

Investors can help address these barriers by supporting clearer and more consistent expectations for responsible mining, encouraging ESG data providers and index providers to use more nuanced assessments, engaging banks and insurers on due diligence and underwriting expectations, and supporting credible sustainable debt structures linked to responsible mining and processing.

This broader engagement approach provides an important support for nature engagement because improved market incentives can help finance water stewardship, tailings safety, pollution control, restoration, traceability and closure planning at scale.

Part IV

Sector-relevant sustainability initiatives

When assessing companies in the sector, investors can also refer to sustainability initiatives and commitments that signal the level of ambition expected from leading companies.

- Act4nature International: A voluntary biodiversity commitment platform that can help investors identify companies willing to make more specific and measurable nature commitments.
- Global Industry Standard on Tailings Management and the Global Tailings Management Institute: The GISTM sets a global standard for tailings management with the goal of zero harm to people and the environment and zero tolerance for human fatality. The Global Tailings Management Institute oversees implementation and conformance.
- Initiative for Responsible Mining Assurance (IRMA): Provides independent third-party assessment of industrial-scale mine sites for all mined materials, governed by the private sector, local communities, civil society and workers. IRMA site-level audit reports can help investors assess whether company claims are independently tested.
- ICMM Mining Principles: A broader responsible-mining framework for ICMM members, relevant to environmental performance, social performance, transparency, water, tailings and biodiversity expectations.
- ICMM Integrated Mining Closure – Good Practice Guide: promotes a disciplined approach to integrated closure planning; designed to apply equally to large and small mining companies.
- OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas: The leading due diligence framework for responsible mineral supply chains, especially relevant where companies source or process tin, tungsten, tantalum, gold, cobalt or other minerals linked to conflict, human rights or governance risks.
- Responsible Minerals Initiative (RMI): An industry initiative supporting responsible mineral sourcing across global supply chains, including standards for smelters, refiners and recyclers, data and collaborative actions.
- Science Based Targets Network (SBTN): Provides methods for companies to assess, prioritise, set and disclose science-based targets for nature, including freshwater and land targets relevant to mining operations and supply chains.
- Towards Sustainable Mining (TSM): A performance system used by mining associations in several jurisdictions, with protocols on biodiversity conservation, water stewardship, tailings management, climate and community relationships.
- The Consolidated Mining Standard Initiative (CMSI) is working on a Consolidated Standard, designed to replace the standards published by The Copper Mark, the ICMM, TSM, and the World Gold Council. The objective of the Consolidated Standard is to reduce complexity and clarify responsible practices for mining companies of all sizes, across all locations and commodities. The Consolidated Standard is expected to be published later in 2026.

Sector-specific and cross-sectoral data

The following resources provide useful data relevant to the sector:

- World Benchmarking Alliance, Nature Benchmark: Assesses high-impact companies, including mining and metals, across nature-specific and core social indicators. It can support peer comparison and engagement prioritisation.
- IRMA mine-site audit reports: Provide site-level independent assessment results for mines that have undergone IRMA audit or surveillance, useful for testing asset-level performance claims.
- Global Tailings Portal / tailings disclosures: Useful for reviewing company tailings facility disclosures, facility-level risk, conformance claims and implementation of the GISTM.
- Responsible Mining Foundation tools and datasets: Useful for comparing corporate responsible-mining practices and identifying areas for engagement on governance, environmental management and community impacts.

For cross-sector information, we recommend turning to the following data sources:

- Aqueduct Water Risk Atlas: Open-source mapping tool for analysing water stress, drought, flooding and related water risks.
- CDP - forests and water disclosure: A major source of company-reported environmental data on forests, land and water, increasingly useful for checking disclosure quality and comparability.
- ENCORE: Helps investors explore sector-level dependencies and impacts on nature and identify nature-related risk exposure.
- Global Biodiversity Information Facility: Global biodiversity occurrence data that can support location-based screening and context-setting.
- Integrated Biodiversity Assessment Tool: Provides authoritative biodiversity information for screening locations against protected areas, Key Biodiversity Areas and species-related sensitivities.
- SBTN High Impact Commodity List: A screening tool listing major commodities and associated environmental impacts, including mining commodities such as iron, lithium, nickel, silver, zinc and bauxite/aluminium.
- SBTN Natural Lands Map: Useful in the context of no-conversion commitments and land target setting.
- TNFD Tools Catalogue: A dynamic catalogue of nature-related data tools aligned with TNFD's LEAP approach.
- WWF Biodiversity Risk Filter: A corporate and portfolio-level screening tool to prioritise action on biodiversity risk exposure by geography and issue.
- WWF Water Risk Filter: A corporate and portfolio-level screening tool to prioritise action on water-related risk exposure.

Acknowledgements

Original version

The original version of this guide was written by members of the Finance for Biodiversity (FfB) Foundation, under a subgroup of the Engagement with Companies working group.

The overall review of the original "Sectoral Investor Engagement Brief Series on Nature" was led by working group co-chair, Sonya Likhtman (Federated Hermes Limited), and subgroup lead, Sarah Woodfield (Schroders), with support from the FfB Foundation secretariat (Natacha Boric and Diane Roissard), and sectoral impact analysis developed by Julen Gonzalez-Redin (Technical Director, FfB Foundation).

Authors

The lead author of this revised version of the Metals and Mining Sector Brief is Peter Elwin, Director of Engagement and Research, FfB Foundation, with assistance from colleagues including Francisco Botero, Jaime Sanchez, Natacha Boric, Diane Roissard, and Julen Gonzalez.

Editor

The lead editor of this guide is Chloé J. Hill.

Expert review

This Metals and Mining Sector Brief has been reviewed by a number of experts including Clemence Bourcet (Sycomore Asset Management), Chloe Duboille (Zencap Asset Management), Elissa EL Moufti (Federated Hermes), and Graham Hamley (Ceres), and some who wished to remain anonymous. We are very grateful for their feedback.

With thanks to our funder

We are grateful for the funding and support provided by the Accountability Accelerator for this project.

Join the Finance for Biodiversity Foundation

This publication is one of the many practical guides developed by the Finance for Biodiversity (FfB) Foundation in collaboration with its members, to support financial institutions on their journey towards fully integrating nature into their businesses. FfB Foundation membership allows financial institutions to take part in our active working groups which bring together leading banks, investors and insurers to independently share perspectives and best practices. The many guidance documents we produce are the result of these collaborations. We welcome all financial institutions to join the Foundation and fast track alignment of their financial activities and investments with nature recovery. There are now two options to work with us: membership and Hub participation. Visit Finance for Biodiversity Foundation | Join us to find out more.

Appendix 1

Terminology

ENCORE Impacts and Dependencies Database – Metals and Mining

Below are listed the main impacts and dependencies identified in ENCORE for the Metals and Mining sector (on a scale from Very Low to Very High materiality). Impacts and dependencies where the ENCORE result is Medium or below have been excluded.

ENCORE sets out how the economy - sectors, subsectors and activities - depends and impacts on nature. Financial institutions in particular can use data from ENCORE to identify nature-related risks they are exposed to through their lending, underwriting and investment in high-risk industries and sub-industries.

ENCORE Impacts Database

Disturbances (e.g. noise and light pollution): VERY HIGH / HIGH

- Mining of non-ferrous metal ores causes significant disturbances through noise, light, and dust pollution, especially from heavy machinery during excavation and transportation.
- These disruptions can fragment habitats and negatively affect species populations.
- Mining of iron ores is rated HIGH by ENCORE.

Area of freshwater use: VERY HIGH / HIGH

- Mining operations make use of dams and nearby rivers, leading to impacts on the geomorphology of freshwater areas and their fluvial processes, disrupting aquatic habitats.
- Mining of iron ores is rated HIGH by ENCORE.

Area of seabed use: VERY HIGH / HIGH

- Deep-sea mining for critical minerals like cobalt and nickel disturbs fragile ecosystems including hydrothermal vents and seamounts.
- Impacts include physical habitat destruction, biodiversity loss, and long-term alteration of seabed structure.
- Mining of iron ores is rated HIGH by ENCORE.

Emission of non-GHG air pollutants: HIGH / MEDIUM

- Mining and processing emits pollutants such as PM2.5, PM10, VOCs, NOx, SO2, and CO.
- Use of cyanide in leaching processes and coal gangue dust are specific contributors to toxic air emissions.
- Mining of iron ores is rated MEDIUM by ENCORE

Other abiotic resource extraction: HIGH

- Mining of iron ores and non-ferrous metal ores extracts and erodes these abiotic resources during the mining and quarrying process, which can disrupt or negatively affect species and lead to habitat degradation and fragmentation.

Generation and release of solid waste: VERY HIGH / HIGH

- Mining generates large volumes of solid waste, including heavy metal-laden tailings.
- Improper management can cause leaching, leading to soil and groundwater contamination.
- Mining of non-ferrous metal ores is rated HIGH by ENCORE.

Emissions of toxic pollutants to water and soil: VERY HIGH / HIGH

- Mines can leach toxic pollutants that contain high concentrations of heavy metals and other toxic chemicals (e.g., sulphuric acid, cyanide, mercury, arsenic, asbestos). Dust clouds and mineral deposition can alter soil characteristics making it unsuitable or even killing native vegetation, negatively impacting habitats and species. This is particularly destructive in wetlands that are highly sensitive to changes in pH.
- Open-cast iron mining operations cause drastic alterations of chemical soil properties. This activity also causes water pollution from heavy metals and acid that drain from mines. Iron-ore mining and tailing wastewaters, besides being a source of trace metals, usually show high levels of dissolved ions and particulate suspended matter, leading to potential of indirectly changing metal bioavailability.
- Mining of iron ores is rated HIGH by ENCORE.

ENCORE Dependencies Database

Water supply - HIGH

- Mining operations depend on a stable supply of freshwater for processing, dust suppression, and other industrial uses.
- Ecosystem services such as water flow regulation and purification support the quality and quantity of water available to mines.

Global climate regulation services - HIGH

- Forests, peatlands, and other carbon-rich ecosystems sequester greenhouse gases that would otherwise accelerate climate change.
- Mining operations depend on global climate regulation by ecosystems to mitigate climate change and reduce the frequency and intensity of major climate events that could damage buildings and infrastructure or affect mining operations including worker safety.

Rainfall pattern regulation services (at sub-continental scale) – VERY HIGH

- Vegetation, particularly forests, recycle atmospheric moisture and influence rainfall distribution across continents.
- Mining operations depend on consistent rainfall patterns for water availability and to mitigate the risk of floods that could damage or stop mining operations.

Appendix 1

Water purification services – VERY HIGH

- Natural ecosystems (e.g. wetlands, riparian zones) filter out pollutants, protecting water quality used in and around mining sites.
- Mining is dependent on water purification by ecosystems to uphold the chemical composition of water necessary for cooling and cracking purposes, detoxification of potential effluents, and other critical stages throughout the production process.

Water flow regulation services - HIGH

- Forests, wetlands, and soils provide baseflow maintenance during dry periods, securing continuous freshwater supply to mining operations.
- These ecosystems also reduce peak flows, helping prevent operational disruptions from floods or waterlogging.

Flood mitigation services - HIGH

- Riparian vegetation and coastal ecosystems like mangroves and dunes help shield mining infrastructure from flooding and storm surges.
- Mines in flood risk areas rely on these services to protect mine sites and related infrastructure.

Appendix 2

Terminology – nature 'impacts'

ENCORE, TNFD and SBTN use similar concepts but apply different terminology when discussing 'impacts'.

ENCORE focuses on the potential impact that a sector can have on nature as a result of its direct operations and its value chain. In ENCORE, 'impacts' refer to categories of environmental pressures associated with an economic activity (e.g., water abstraction, land use change, pollution, resource extraction), assessed on a scale from Very Low to Very High.

ENCORE ratings signal the potential significance of a pressure for a given sector, but they do not measure the resulting ecological state change, nor are they location-specific. In other words, ENCORE highlights potential impact, not actual impact.

By contrast, **SBTN and TNFD distinguish clearly between the potential impact and the actual impact on nature.**

In **SBTN terminology**, a 'pressure' (e.g., water withdrawal) may lead to an 'impact', defined as a change in the state or functioning of ecosystems. TNFD uses the term 'impact driver' (instead of 'pressure') and 'impacts on nature' for the resulting ecological change.

The potential harms assessed by all three systems (ENCORE's pressures, SBTN's pressures and TNFD's impact drivers) all map to the IPBES five drivers of nature loss: (1) land and sea use change, (2) direct exploitation of organisms, (3) climate change, (4) pollution, and (5) invasive alien species.

However, potential harm is different from actual harm – a distinction made clear by SBTN and TNFD's terminology. A sector may exert a high level of pressure associated with one or more IPBES drivers (for example, by heavy freshwater use), but the actual impact on nature of a sector and/or a specific company might not be significant (for example, because fresh water is plentiful in that location). The actual impact depends on geographic context, ecosystem sensitivity and cumulative effects.

It is also important to note that a single 'pressure' (e.g. 'Emissions of toxic pollutants to water and soil') can result in multiple 'impacts' on nature.

In this guide, consistent with SBTN and TNFD, 'impact' refers to actual changes in the state of nature, and 'pressure' or 'potential impact' refers to the potential harm.

Appendix 3

Comparing different economic classification systems

Investors generally use the Global Industry Classification Standard[52] (GICS) to manage and track the progress of the companies in their portfolio as well as determine which specific type of activities the companies in their portfolio are involved in.

However, governments and other organisations, particularly those focused on assessing nature-related activities, use alternative coding systems that don't precisely match to the GICS system. In particular, tools that help organisations explore their exposure to nature-related risk and take the first steps to understand their dependencies and impacts on nature such as the Science Based Targets Network (SBTN) Materiality Screening Tool (MST)[53] and ENCORE[54], use the ISIC system.[55] The Nature Action 100 investor initiative groups the companies that it focuses on into eight sectors based on the Sustainable Industry Classification System (SICS).[56]

As a result, it is particularly important for investors engaging with companies to understand these alternative systems so that they can identify where the impacts are occurring and which actors can have the most influence to transform practices for the overall processes in the sector.

This guide is structured to provide useful insights and to support engagement with companies in the Metals and Mining sector whichever classification system is being used by the financial institution.[57]

Global Industry Classification Standard[58] (GICS) Level 3 and 4	151040 – Metals & Mining
International Standard Industrial Classification[59] (ISIC)	B07 - Mining of metal ores
Nomenclature of Economic Activities[60] (NACE)	B07 – Mining of metal ores
Sustainable Industry Classification System[61] (SICS)	Metals & Mining

Table 4: Classification and scope of the Metals and Mining Sector

52. The Global Industry Classification Standard (GICS) is an industry taxonomy developed in 1999 by MSCI and Standard & Poor's (S&P) for use by the global financial community.
53. The SBTN's MST is designed to help users carry out a first screening of the types of environmental impacts that are potentially materially relevant to the direct and upstream operations of a sector and a company's activities
54. ENCORE (Exploring Natural Capital Opportunities, Risks and Exposure)
55. The International Standard Industrial Classification of All Economic Activities (ISIC) is the international reference classification of productive activities.
56. SICS uses sustainability profiles to group similar companies within industries and sectors. In SICS, a company's sustainability risks and opportunities are more important for its classification than other traditional factors, such as economic cycles and revenue streams
57. The Nature Action 100 investor initiative uses SICS when allocating companies to sectors for engagement purposes. Commercial banks often use NACE and ISIC codes in their analysis of their lending portfolios.
58. The Global Industry Classification Standard (GICS) is an industry taxonomy developed in 1999 by MSCI and Standard & Poor's (S&P) for use by the global financial community.
59. The International Standard Industrial Classification of All Economic Activities (ISIC) is the international reference classification of productive activities.
60. The Statistical Classification of Economic Activities in the European Community, commonly referred to as NACE, is the industry standard classification system used in the European Union.
61. SASB Standards use the Sustainable Industry Classification System® (SICS®) to group companies based on shared sustainability risks and opportunities.

Appendix 3

Investors generally use the Global Industry Classification Standard[62] (GICS) to manage and track the progress of the companies in their portfolio as well as determine which specific type of activities the companies in their portfolio are involved in.

The ISIC system[63] is used by a number of tools that help organisations explore their exposure to nature-related risk and take the first steps to understand their dependencies and impacts on nature such as the Science Based Targets Network (SBTN) Materiality Screening Tool (MST)[64] and ENCORE.[65]
The NACE system[66] is frequently used by governments and other related organisations, when classifying economic activities.

The Sustainable Industry Classification System (SICS)[67] was developed by the Sustainable Accounting Standards Board (SASB, now incorporated into the International Sustainability Standards Board (ISSB). It is used by the Nature Action 100 investor initiative to group the companies that it focuses on into eight sectors.

62. The Global Industry Classification Standard (GICS) is an industry taxonomy developed in 1999 by MSCI and Standard & Poor's (S&P) for use by the global financial community.
63. The International Standard Industrial Classification of All Economic Activities (ISIC) is the international reference classification of productive activities.
64. The SBTN's MST is designed to help users carry out a first screening of the types of environmental impacts that are potentially materially relevant to the direct and upstream operations of a sector and a company's activities
65. ENCORE (Exploring Natural Capital Opportunities, Risks and Exposure)
66. The Statistical Classification of Economic Activities in the European Community, commonly referred to as NACE, is the industry standard classification system used in the EU.
67. SICS uses sustainability profiles to group similar companies within industries and sectors. In SICS, a company's sustainability risks and opportunities are more important for its classification than other traditional factors, such as economic cycles and revenue streams

Disclaimer

Finance for Biodiversity Foundation is committed to full compliance with all applicable laws and regulations, including antitrust and competition law, data protection, and rules on acting in concert rules. We maintain strict safeguards around information sharing and do not facilitate or require collective decision-making or coordinated actions regarding investments or voting. Members of the Finance for Biodiversity Foundation continue to act independently, making unilateral decisions based on their own strategies, policies, and fiduciary duties. Our initiatives, guidance, and tools are voluntary, with adoption and application entirely at the discretion of individual members. We do not provide financial, legal, or investment advice, nor do we support or engage in collective boycotts.

Finance *for* Biodiversity Foundation

Get in touch

Responses and ideas? Please reach out.

info@financeforbiodiversity.org

Bluesky: @financeforbiodiversity.org

LinkedIn: Finance for Biodiversity

www.financeforbiodiversity.org