fairphone

The impact of consumer electronics on nature and biodiversity

February 2026

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Executive summary

The global economy is intrinsically linked to nature, with over half of the world's GDP estimated to be moderately or highly dependent on natural capital. The electronics industry negatively impacts this natural capital through resource depletion, freshwater use, and biodiversity loss, particularly in mining areas. Wildlife populations have declined by 73% the past fifty years and parts of our planet are approaching dangerous tipping points driven by nature loss and climate change. This poses significant threats to humanity, nature and our economies.

By sharing this report, outlining our analysis and the (public) sources we used, we want to help move the electronics industry forward faster, driving a much-needed focus on nature and biodiversity beyond climate and taking positive action immediately. The Science Based Targets Network (SBTN) framework offers a solid foundation for a holistic environmental due diligence and impact assessment, including biodiversity. The assessment highlights Fairphone's impact and dependencies on nature across our value chain, focusing on manufacturing stages and the mining of minerals present in our products.

Key Findings and Hotspots

Approximately 75% of a smartphone's environmental impact occurs in our supply chain. Building on the SBTN framework, we combined publicly available datasets (ENCORE, IBAT, WWF Risk Tool) with Fairphone's product Life Cycle Assessment (LCA) data and supplier insights to define material pressures and identify hotspots.

1. Electronics Manufacturing Hotspots.

- Key impacts on nature are **pollution (waste, water, and air), GHG emissions, and disturbances**. These in turn may negatively impact local ecosystems and biodiversity.
- Manufacturing is highly dependent on **water supply**.
- The production of the **main Printed Circuit Board (PCB), display, and battery** creates the highest pressures, specifically related to water use, soil pollution, and GHG emissions.
- Based on site-specific data, the **display, PCB, and final assembly** are considered hotspot suppliers from a **water and soil pollution** perspective.

2. Minerals Assessment Hotspots

- Mineral extraction and processing pose the **highest risk to ecosystems and biodiversity** across our supply chain.
- **Pollution** is the biggest risk across all assessed minerals. Mining further risks directly **negatively impacting local biodiversity and conservation** efforts, heavy **water use** and cause **changes in landscapes, and fresh water and marine basins**. Combined, these may lead to further degradation or loss of nature.
- The highest-risk minerals were identified, and combining this with Fairphone's consumption, our priority materials include **Gold, Tin, Copper, Nickel, Lithium, Cobalt, Aluminum, Iron/Steel, Graphite, Magnesium, and Chromium**.

- By assessing the state of nature in key production regions, we identified 11 hotspots with the highest risk to negatively impact local ecosystems and biodiversity:
    - **Brazil (Minas Gerais):** Gold, Iron
    - **China (Ningxia):** Magnesium
    - **Guinea (Bauxite Belt):** Aluminium
    - **India (Karnataka):** Iron
    - **Indonesia (Maluku, Sulawesi, Bangka Belitung Islands):** Cobalt, Nickel, Tin
    - **Myanmar (Wa State):** Tin
    - **Peru (Ancash, San Rafael):** Copper, Tin
    - **Philippines (Palawan Island):** Nickel

Conclusion and Call to Action

The completion of this foundational work enables us to identify what and where the key impacts on nature are throughout our supply chain. Fairphone's next steps will involve further measuring and reducing the impact with indirect component suppliers and improving and remediating the impact on nature in key hotspot mining regions via joint initiatives.

We urge the industry to join us:

- **Assess your impact** and apply the SBTN methodology.
- **Set actionable goals** and move to target setting.
- **Collaborate** by sharing insights and accelerating learning.
- **Support local nature impact assessments in joint hotspots**.
- Design and implement **prevention, mitigation, and remediation measures in a multi-stakeholder setting.**
- **Engage with key stakeholders,** especially affected people and communities, indigenous peoples, and workers.

1. Introduction

The global economy is intrinsically linked to nature. Over half of the world's GDP (estimated at over $44 trillion) is moderately or highly dependent on what occurs naturally, such as clean water, pollination, and climate regulation.[1] So it's quite unfortunate that the electronics industry is responsible for negatively impacting much of this natural capital, from resource depletion and freshwater use to biodiversity loss in mining areas. The daily water consumption of a single large chip manufacturing facility can be comparable to the needs of a small to mid-sized city, placing immense strain on local municipal and agricultural water supplies.[2] In the past 50 years, wildlife populations have declined by a staggering 73%.[3] WWF warns that parts of our planet are approaching dangerous tipping points driven by the combination of nature loss and climate change, posing grave threats to humanity and our economies. Keeping one eye towards a more sustainable future, we asked ourselves: **What is the real impact that producing a smartphone has on nature? How can we act beyond climate action?**

So we examined our supply chain closely, looking at all our existing programs and previous studies for answers. This study is a result of that exercise, mapping the company's impact and dependencies on nature across its supply chain, more specifically on final assembly, component suppliers and minerals, keeping in mind the global shift towards holistic nature impact assessment.

We have used the Science Based Targets Network (SBTN)[4] framework as the foundation for this analysis and adapted it to Fairphone's and tech industry reality. SBTN provides a credible, standardized pathway for companies to comprehensively assess and address their environmental performance across four key domains: biodiversity, land, freshwater, and ocean. SBTN's methodology intentionally complements and builds upon the existing Science Based Targets initiative (SBTi) for climate.

Using SBTN's systematic approach, we defined the organizational boundaries of our value chain. We conducted a materiality screening, starting with our headquarters, passing through final manufacturing sites, and then on to key components manufacturing and high impact commodities (minerals).

The materiality screening conducted was aligned with the eight pressure categories required by SBTN (including land use, water use, GHG emissions, and pollutants). We have employed sophisticated tools (including SBTN Materiality Screening Tool, ENCORE, IBAT, and WWF Risk Tool) to provide an industrywide view of impacts and dependencies at the manufacturing and commodity level. To refine the results and make it Fairphone-specific, we used our product life cycle assessment (LCA) data, and the insights gained from our Fair Materials Roadmap. This data helped us quantify local environmental pressures and assess the local state of nature to prioritize key components and hotspot commodity regions.

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[1] WEF (2020) Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy
[2] Sustainability Directory, "Electronics Manufacturing Water Use."
[3] World Wildlife Fund (2024) 2024 Living Planet Report.
[4] "Why SBTN?," Science Based Targets Network.

Why are we doing this? Firstly to make our impact on nature clear and understandable, enabling us to drive positive impact in hotspot places. Second, this report can be used by other companies as a foundation for mapping and identifying hotspots in their own organizations and supply chains, setting strategy and targets, and jointly driving positive impact as an industry at the places that need it most. After all, the only way forward to our vision of a sustainable future is together.

2. Methodology

This chapter will provide a high level overview of the methodology we used to identify the impact on nature and biodiversity. By using the SBTN framework, we're providing a structured and transparent basis for understanding and prioritizing our environmental impacts and dependencies at different stages of Fairphone's value chain. We combined publicly available datasets with our own Life-Cycle Assessments (LCA) and supplier data to develop an assessment that is both credible and actionable. The results help us identify where to focus our efforts and provide a foundation for further steps in the SBTN framework. At the same time, this approach and its outcomes can serve as a useful starting point for other companies in the electronics industry aiming to better understand and address their impacts on nature and biodiversity.

2.1. Why Science Based Targets for nature?

Selecting the right framework is key to assess the risks and impacts on nature and biodiversity. We chose the Science Based Targets Network (SBTN) methodology for four critical reasons:

- **Scientific Credibility and Consistency**

The SBTN framework is rooted in the essential scientific concept of Planetary Boundaries (PBs). These PBs, originally defined by scientists to map the eight environmental limits within which humanity can safely operate, provide a non-negotiable global ceiling for human activity, and is a concept that was later utilized in prominent models like the Doughnut Economics Framework. Strategically, the SBTN standard was designed as a practical framework that directly breaks down the insights of PBs science, translating those global limits into a measurable methodology for companies to set concrete targets. This framework was developed in partnership with leading organizations like the WWF, WRI, and the UN Global Compact, ensuring the methodology is robust, peer-reviewed, and globally recognized, making the assessment and targets truly meaningful for the planet.

- **Holistic Approach Beyond Climate**

Fairphone has already set a carbon reduction and net-zero target following the Science Based Target's initiative (SBTI). SBTN is built on the SBTi's approach, and further incorporates lessons from older methodologies and metrics that aimed to assess the impact on the environment and biodiversity. It provides a truly holistic framework by systematically addressing the four critical domains material to our value chain: **Biodiversity, Land, Freshwater, and Ocean.** This allows us to map the full impact and recognize how environmental factors are interconnected, building on our own work on climate action.

- **Actionability and Target Setting**

The framework offers a clear, five-step pathway (Assess, Interpret & Prioritize, Measure, Set & Disclose, Act and Track) designed specifically for assessing the dependencies and impact on nature, and setting measurable, time-bound, and science-based targets. It guides past risk assessment to establish a concrete plan for change: identifying where to act (hotspots), what to address (material pressures), and how much impact reduction is required.

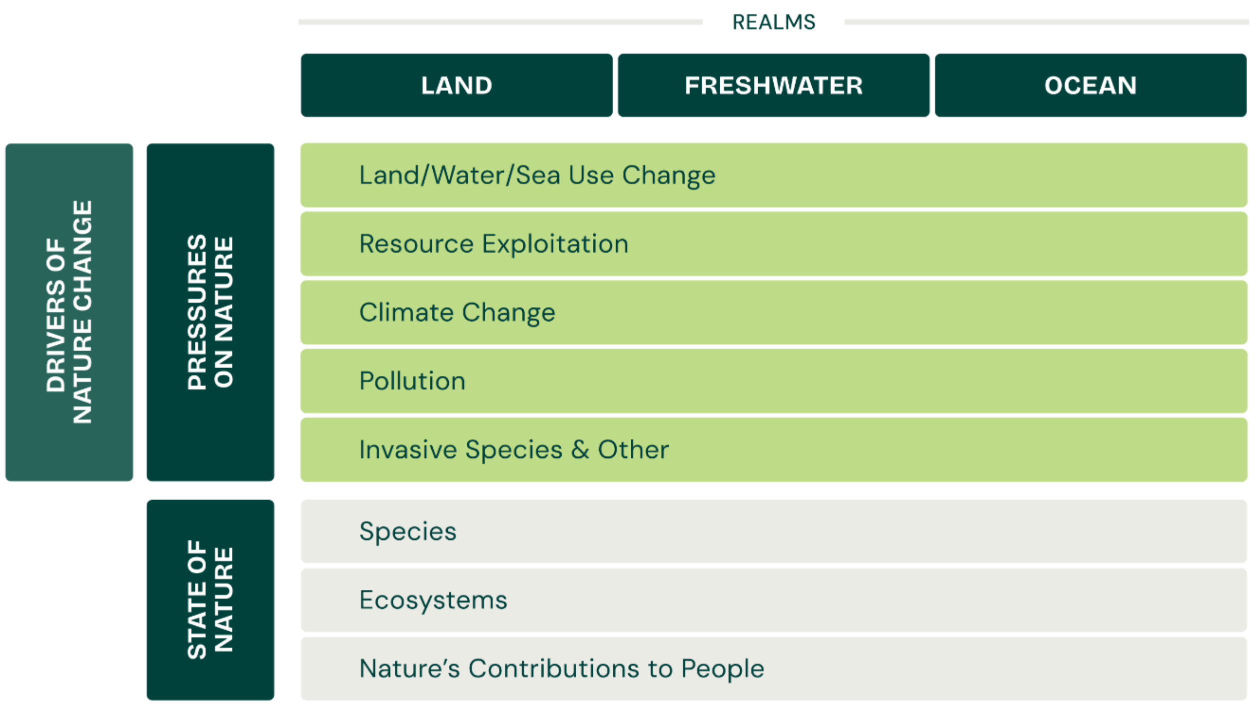
- **Alignment with International Standards**

Adopting SBTN ensures future-proofing. Its design is aligned with major global standards and emerging regulations, like the Taskforce on Nature-related Financial Disclosures (TNFD) and the EU's Corporate Sustainability Reporting Directive (CSRD). This consistency enhances transparency, and streamlines our compliance efforts.

SBTN and TFND are complementary frameworks that cross-recognize each other: SBTN focuses on strategy and target setting, TFND focuses on reporting. The two frameworks are co-designed, so it’s not an either-or decision for companies seeking tools and support.

2.2. How did we perform the assessment?

We followed the systematic approach based on the first two steps outlined by SBTN: **Assess** and **Interpret & Prioritize**. The assessment starts with mapping the different ways companies can have dependencies and impacts on the environment. To this end, SBTN defines the following “pressure” categories:



First, we map the biggest dependencies and impact, based on generic data for our industry from the SBTN Materiality Tool public database. We then refine these results of this generic assessment using different tools such as the ENCORE Natural Capital module[5]. Both datasets are a compilation of the results of large amounts of life cycle assessments and studies, offering insights at a sector level. The result of this materiality assessment is listed in **Chapter 3**. If you are a consumer electronic company looking to build your impact strategy, these results are the perfect starting point.

Of course, we didn't stop there. To make the assessment more specific and actionable, we enriched the assessment with our own LCA data and primary supplier data related to the manufacturing of our products and their components. This gave us a list of hotspot manufacturers to focus our efforts on, as presented in **Chapter 3.2**.

For the minerals (commodities present in our value chain), this exercise is a little more challenging. Mineral supply chains are long, complex, and continuously changing. As a result, it becomes extremely hard to identify the exact location where most minerals are mined, as a brand at the end of the supply chain. Yet, we know there are material risks and opportunities to address in mining.

To identify the hotspot to focus on first, we have researched impact indicators from public sources for each nature pressure category for 23 minerals. These minerals were previously identified in our Fair Materials Roadmap 2030 as key materials, not only specifically to our products, but also in general for the electronics industry. We then looked at main production countries and regions. Once we shortlisted the production regions most likely to appear in our supply chain, we mapped the state of nature of these regions, using two indicators from IBAT public database[6] and ENCORE Biodiversity Module[7]. This helped us further shortlist mining regions with a very high risk of negatively impacting nature and biodiversity.
This list is an excellent starting point for collective action by the electronics industry.
For more information, please see **Chapter 4.2**.

To ensure the assessment is credible, and the results verifiable and usable for the wider industry:

- We used primarily public databases and sources. The full list of indicators and sources can be found in **Annex II**.
- Our methodology has been reviewed by external consultancy, as well as five other electronics companies. Their feedback has strengthened our methodology.

We are confident this systematic approach has successfully delivered a credible, action-oriented foundation for our nature strategy, blending high level SBTN requirements with product specific data. By completing the Assess and Interpret & Prioritize steps, we have established a clear and verifiable basis for identifying material pressures and value chain hotspots, that is crucial for meaningful target setting. The completion of this foundational work enables us to confidently move into the next SBTN phase: **defining site-specific, measurable targets** and **continuing to drive industry-wide transparency**. If you are an electronics company, join us on this journey!

[5] Encore - Natural Capital Module
[6] IBAT Alliance, Integrated Biodiversity Assessment Tool
[7] ENCORE - Biodiversity Module

3. Electronics Manufacturing

This chapter showcases the results of our nature impact assessment for the electronics manufacturing industry, covering both final product assembly and sub-component production. We cover a general sector level assessment, as well as a more focused, smartphone-specific evaluation. Our key findings confirm that **manufacturing the main PCB, display, and battery creates the highest pressures,** particularly related to water use, soil pollution, and GHG emissions. This serves as the basis for the next steps in our value chain assessment: **ranking our key components by their location and impact.** For this, we have been collecting primary data and assessing the state of nature locally, eventually enabling us to set targets and act.

3.1. Electronics Manufacturing - Sector-level Assessment

The first step to understand the possible impacts a value chain has on natural resources is conducting a materiality screening. To begin this step, we first define the company's organizational boundaries. Since Fairphone already has climate action targets validated by SBTi, we used the company's previously defined organizational boundaries. Based on that, we:

- Mapped all economic activities across our supply chain using the International Standard Industrial Classification of All Economic Activities (ISIC) system;
- Identified all high-impact commodities present in our products, using SBTN High Impact Commodity List (HICL). Considering Fairphone production, the commodities used are in the vast majority minerals.

Based on the information gathered, we conducted a sector-level assessment using the SBTN Materiality tool, and refined the results using the ENCORE Natural Capital Module. The ENCORE public database provides the possible impacts and dependencies on nature of each economic activity on a sector level. The ENCORE Natural Capital Module offers an impact score from Very Low to Very high.

The results gathered using the SBTN Materiality tool and the ENCORE databases are generated based on the ISIC categories, which are common to the industry. That's why the results presented here form an ideal baseline for these categories throughout the industry.

ENCORE- MOST MATERIAL IMPACT ON NATURE									
Nature related issue area	Pressure category	ISIC Categories	Activities of head offices	Manufacture of consumer electronics	Manufacture of electronic components and boards	Manufacture of batteries and accumulators	Manufacture of optical instruments and photographic equipment	Manufacture of wiring and wiring devices	Manufacture of rubber and plastic products
		Fairphone manufacturing /component description	Headquarters	Final assembly	Display, Main PCB, Secondary PCB, Speaker, Earpiece	Battery	Camera	USB-C Connector	Back Cover
Land/Water/ Sea Use Change	Terrestrial ecosystem use		Medium	Low	Low	Low	Low	Low	Low
	Freshwater ecosystem use		no data	no data	no data	no data	no data	no data	no data
	Marine ecosystem use		no data	no data	no data	no data	no data	no data	no data
Resource exploitation	Water use		Low	Medium	Low	Low	Medium	Low	Low
	Other resource use		no data	no data	no data	no data	no data	no data	no data
Climate Change	GHG emissions		Very Low	Medium	Very Low	Very Low	Medium	Very Low	Medium
Pollution	Non-GHG air pollutants		Very Low	Medium	Low	Low	High	Low	Medium
	Water pollutants		Very Low	High	High	High	Medium	Medium	Very High
	Soil pollutants		Very Low	High	High	High	Medium	Medium	Very High
	Solid waste		Very Low	Low	Low	Low	Low	Low	Medium
Invasives and Others	Disturbances		Very Low	Medium (Noise, Light)	Medium (Noise, Light)	Medium (Noise, Light)	Medium (Noise, Light)	Medium (Noise, Light)	Medium (Noise, Light)
	Biological alterations/ interferences		no data	no data	no data	no data	no data	no data	no data

ENCORE - MOST MATERIAL DEPENDENCIES ON NATURE								
Dependency Category	ISIC Categories	Activities of head offices	Manufacture of consumer electronics	Manufacture of electronic components and boards	Manufacture of batteries and accumulators	Manufacture of optical instruments and photographic equipment	Manufacture of wiring and wiring devices	Manufacture of rubber and plastic products
	Fairphone manufacturing/ component description	Headquarters	Final assembly	Display, Main PCB, Secondary PCB, Speaker, Earpiece	Battery	Camera	USB-C Connector	Back Cover
Other regulating and maintenance service - Dilution by atmosphere and ecosystems		no data	Very Low	Low	Low	Low	Low	Low
Global climate regulation services		Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Local (micro and meso) climate regulation services		Low	Low	Low	Low	Low	Low	Low
Storm mitigation services		Low	Medium	Medium	Medium	Medium	Medium	Medium
Water flow regulation services		Very Low	Medium	Medium	Medium	Medium	Medium	Medium
Water supply		Very Low	Medium	Medium	Medium	Medium	Medium	Low
Flood mitigation services		Very Low	Medium	Medium	Medium	Medium	Medium	Medium
Water purification services		no data	Medium	Medium	Medium	Medium	Medium	Medium
Rainfall pattern regulation services (at sub-continental scale)		no data	Very Low	Very Low	Medium	Very Low	Medium	Very Low
Air filtration services		no data	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Solid waste remediation		no data	Low	Low	Low	Low	Low	Low
Soil and sediment retention services		Very Low	Low	Low	Low	Low	Low	Low
Noise attenuation services		Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Other regulating and maintenance service - Mediation of sensory impacts (other than noise)		Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low

Conclusions

The electronics manufacturing's highest dependency is on water, and many manufacturers are in areas with a risk of storms, typhoons and floods. Key impacts of electronics manufacturing on nature include pollution (waste, water, air), GHG, and disturbances to nature.

Companies can immediately prioritize their environmental due diligence strategy, supply chain assessments and target setting, using these results. We urge everyone in the electronics industry to use them as a starting point to conduct their own operational analysis and set measurable targets.

The materiality assessment indicates that key impacts on nature are actually in the manufacturing of electronic products and components. This aligns with findings from our product Life Cycle Assessments[8], which indicates that approximately 75% of a smartphone's total environmental impact occurs during the manufacturing stage. From mining raw materials to the assembly of the final product. For Fairphone, that's linked to our supply chain, as we don't own any factories ourselves. So the next step for us is to dive deeper into our supply chain.

3.2. Electronics Manufacturing – Smartphones

Following the materiality assessment, it made sense for us to investigate the supply chain in more detail. Smartphones represent >80% of supply chain spend for Fairphone. Therefore, we went beyond the electronics industry-generic assessment to examine the nature impacts of a Fairphone smartphone.

This helped us define "hotspot" components and suppliers linked to the manufacturing of our smartphones, identifying which part of the value chain has the highest impact on nature (relative to other units) and the greatest operational control or influence for effective target setting.

Using the results of the Life Cycle Assessment (LCA) for Fairphone 5, we were able to more specifically assess how Fairphone 5's production contributes to different types of pressures on nature than we could using the ENCORE tool. To do this, we matched indicators available in the LCA with the SBTN pressures. Next, we translated the values into a numerical score of one to five, where 1 means "low risk" and 5 "high risk". **Annex I** describes in detail the indicators we used, and how scores were translated to a quantitative rating. The Fairphone 5 LCA primarily uses data from the Sphera database to calculate the environmental impacts, demonstrating these also for key components. This allows us to identify more precisely the ways in which the manufacturing of electronic products and components impact the environment.

Moving beyond generic sector results is essential for securing operational resilience and accountability for the impact on nature. Once again, we invite our industry peers to use primary data to enrich their assessments, define their own specific hotspots and set meaningful targets that contribute to shared industry-wide progress.

[8] For more information, please check our product LCAs here.

FAIRPHONE - MOST MATERIAL IMPACT ON NATURE														
Nature-related issue area	**Pressure category**	**Headquarters**	**Final Assembly**	**Display**	**Main PCB** (incl ICs, memory and processor)	**Secondary PCB**	**Earpiece and Speaker**	**Battery**	**Big angle camera**	**Front and Main Camera**	**Back cover**	**USB-C Connector**	**Packaging** (related to product & distribution)	**Middle housing**
Land/Water/Sea Use Change	Terrestrial ecosystem use	Very Low	Medium	Low	High	Very Low	Very Low	Very Low	Low	Very Low	Very Low	Low	Very Low	Low
	Freshwater ecosystem use	no data	Medium	High	High	Low	Very Low	Low	Medium	Low	Very Low	Low	Very Low	Low
	Marine ecosystem use	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
Resource exploitation	Water use	Very Low	Medium	Medium	Very High	Very Low	Very Low	Low	Medium	Low	Very Low	Low	Very Low	Low
	Other resource use	Very Low	Very Low	High	Very High	Very Low	Very Low	Low	Medium	Low	Very Low	Low	Very Low	Very Low
Climate Change	GHG emissions	Very Low	Low	Very High	Very High	Very Low	Very Low	Medium	High	Medium	Very Low	Low	Low	Very Low
Pollution	Non-GHG air pollutants	Very Low	Very High	Medium	High	Very High	Very High	Medium	Medium	Low	Very Low	Low	High	Very Low
	Water pollutants	Very Low	Medium	Very High	High	Low	Low	Medium	Low	Low	Very Low	Very Low	Low	Very Low
	Soil pollutants	Very Low	High	Medium	Very High	Low	Low	Medium	Medium	Low	Low	Low	Low	Very Low
	Solid waste	Very Low	Low	Low	Low	Low	Low	Low	Low	Low	Medium	Low	no data	no data
Invasives and Others	Disturbances	Very Low	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	no data	no data
	Biological alterations/ interferences	Very Low	High	High	Very High	Very Low	Very Low	Low	Medium	Low	Medium	Low	Very Low	Very Low

The table highlights that GHG emissions, water use, and pollution are key impacts. The manufacturers of the main printed circuit board, integrated circuits and memory chip, display, final assembly, camera and battery are all medium- to high-risk to negatively impact one or more of these dimensions of nature.

GHG emissions impacts are not location-dependent. The other impacts on nature and biodiversity dimensions are very location-specific. Therefore, the next step is to assess the current state of nature of the geographical location where sub-suppliers are located. This enables us to be able to identify and prioritize what the highest environmental pressures of each of these manufacturing sites are locally, on four main topics: **Land use, Water use, Soil Pollution, Water pollution and GHG emissions.** This analysis is done by assessing site-level Pressures and Local state of nature (SoNP) and state of biodiversity (SoNB)[9].

To assess the site level pressures, we have selected relevant data sets from our LCA and collected more on-site environmental data of these suppliers and sub-suppliers of Fairphone 5 and Gen 6, as table below:

Component	Georeferenced Location	Environmental Compliance	Climate strategy	Water data	Waste data
Manufacturing Facility	x	x	x	x	x
Display	x	x	x	x	x
PCB	x	x	x	x	x
PCB	x	x	x	Not available	x
Speaker	x	x	x	Not available	x
Battery	x	x	x	Not available	x
Camera	x	x	x	x	x

To assess the local state of nature (SoNP) and state of biodiversity (SoNB), we have used relevant data sets on Water stress baseline, Global terrestrial species richness, Biodiversity intactness index, etc. Different sources can be used to conduct this assessment, we encourage companies to check the SBTN Step 1 Toolbox[10].

[9] To know more about how to quantify environmental pressures on your activities please see step 1b from SBTN.
[10] SBTN Step 1 Toolbox

This analysis established a baseline, allowing comparison between the component sites. The results lead to the prioritization of the component sites that represent the highest impact on each pressure category. See below the combined top three ranking across component sites:

Water use Rank	Component site	Water Pollution Rank	Component site	Soil Pollution Rank	Component site
1	Display	1	Display	1	PCB
2	PCB	2	PCB	2	PCB
3	PCB	3	PCB	3	Final assembly

Even though land use is considered low materiality and we have relatively low land impact in the manufacturing stages, we have also estimated the land footprint of seven supplier and sub-supplier sites, which is approximately 855 m2. It may still offer an area to consider for compensating the unavoidable impact of manufacturing.

The GHG pressure category was excluded from this analysis since Fairphone already set reduction and Net Zero targets validated by SBTi.

Conclusions

The analysis using Fairphone 5's LCA data shows that GHG emissions, water use, and pollution are key impacts of our smartphone. The manufacturers of the main printed circuit board, integrated circuits and memory chip, display, final assembly, camera and battery are medium- to high-risk to negatively impact nature.

Going a step deeper, we assessed the local state of nature and biodiversity versus the actual impact data of the suppliers. The display and PCB sub-suppliers and the final assembly were ranked as the hotspot suppliers from a water and soil pollution perspective. All the assessed manufacturers are located in industrial areas, therefore the land use dimension is not material. These results will guide our next steps and engagement with these key sub-suppliers for the development of future actions on nature related topics. We invite the industry to collaborate closely with their own hotspot component suppliers - beyond their tier 1 final assemblies.

4. Minerals Assessment

The impact on the nature of a smartphone goes beyond its manufacturing stages. From a material perspective, mineral extraction and processing pose the highest risk to nature across our value chain. A smartphone depends on numerous raw materials, and their extraction and processing severely impact the local environment.

To address this, we assessed the impacts on nature of our 23 Focus Materials, which we know have the highest social and environmental impacts in the electronic industry, including for our smartphones. We started by conducting a sector-level assessment to understand the most likely global nature impact every material can have on each pressure category, as described in the SBTN Methodology. This process enabled us to create a ranking based on global impact and Fairphone's consumption of these materials in our smartphones. We ultimately identified 11 top minerals (including gold, tin, copper, and nickel) and mapped 11 hotspot regions where their respective extraction processes have the highest impact on nature currently.

4.1. Minerals - Sector-level assessment

4.1.1. Minerals Materiality Assessment

Similar to **Chapter 3.1**, we first conducted a **sector-level assessment**, based on the relevant ISICs categories and the SBTN High Impact Commodity List (HICL). For economic activities, we used the SBTN Materiality tool and ENCORE to obtain a global baseline. This assessment helped us assess the most likely impacts and dependencies on nature, according to the eight SBTN pressure categories[11] associated with our value chain activities and commodities. When it comes to Fairphone's smartphone production, the commodities used are in the vast majority, minerals.

This leads to the following materiality assessment, based on the ENCORE database.

[11] ***SBTN Pressure Categories:*** *Land use and land use change; Freshwater ecosystem use and use change; Marine ecosystem use* ***and use change; Water use;*** *Other resource use; Greenhouse gas emissions; Freshwater pollutants; and Soil pollutants*

ENCORE - Most material potential pressures on nature						
Nature-related issue area	Pressure category	Smelters and refiners			Mining sites	
		Manufacture of basic iron and steel	Manufacture of basic precious and other non-ferrous metals / Iron metal production and Steel production	Manufacture of basic precious and other non-ferrous / Casting of Metals (Alumina Refining)	Mining of non-ferrous metal ores	Mining of iron ores
Land/Water/Sea Use Change	Terrestrial ecosystem use	Low	Low	Low	Medium	Medium
	Freshwater ecosystem use	Medium	Low	Low	Very High	High
	Marine ecosystem use	no data	no data	no data	Very High	High
Resource exploitation	Water use	Medium	Low	Low	Medium	Low
	Other resource use	no data	no data	no data	no data	no data
Climate Change	GHG emissions	High	Medium	Medium	Medium	Medium
Pollution	Non-GHG air pollutants	High	High	Medium	High	Medium
	Water pollutants	Very High	Very High	High	Very High	High
	Soil pollutants	Very High	Very High	High	Very High	High
	Solid waste	Medium	Medium	Low	High	Very High
Invasives and Others	Disturbances	Very High	Very High	High	Very High	High
	Biological alterations/ interferences	no data	no data	no data	High	High

ENCORE - Most material potential dependencies					
Dependency Category	Sub-supplier 3 / Smelters			Mining sites	
	Manufacture of basic iron and steel	Manufacture of basic precious and other non-ferrous metals / Iron metal production and Steel production	Manufacture of basic precious and other non-ferrous / Casting of Metals (Alumina Refining)	Mining of non-ferrous metal ores	Mining of iron ores
Other regulating and maintenance service - Dilution by atmosphere and ecosystems	no data	no data	no data	Medium	Medium
Global climate regulation services	Very Low	Very Low	no data	High	High
Local (micro and meso) climate regulation services	Low	Low	Very Low	Low	Low
Storm mitigation services	Medium	Medium	Medium	Medium	Medium
Water flow regulation services	High	Medium	Medium	High	High
Water supply	High	Medium	Medium	High	High
Flood mitigation services	Medium	Medium	Medium	High	High
Water purification services	Medium	Medium	Medium	Very High	Very High
Rainfall pattern regulation services (at sub-continental scale)	Medium	Medium	Medium	Very High	Very High
Air filtration services	Very Low	Medium	Medium	Very Low	Low
Solid waste remediation	Low	Low	no data	Low	Very Low
Soil and sediment retention services	Low	Low	Medium	Medium	Medium
Noise attenuation services	Very Low	no data	no data	Very Low	Very Low
Other regulating and maintenance service - Mediation of sensory impacts (other than noise)	Very Low	no data	no data	Low	Low
Biomass provision services	no data	no data	no data	Very Low	Very Low

Conclusions

Our assessment shows that there is a considerable risk of impact on nature during mining, smelting and refining minerals. They can impact land use and water ecosystem change, water use, greenhouse gas emissions, pollution and disturbances.

However, this ISIC-based analysis still lacks the necessary granularity to identify the hotspot materials and regions with the highest impacts. A smartphone contains over 60 materials, spread over hundreds of components, coming from thousands of refiners, smelters, and mining sites. Despite the complexity and dynamic nature of these supply chains, in the next section we will offer a more refined risk assessment per mineral than the ISIC-based analysis allows.

4.1.2 Refined Mineral Risk Assessment - Sector-level

For the development of Fairphone's Fair Material Roadmap 2030, we researched risk and opportunity profiles for 68 minerals that are commonly used in smartphones and other electronic products. The minerals were evaluated on a variety of factors, including potential human right violations as well as environmental impact. From this list of 68 materials, we derived priority materials that posed the highest environmental and social risks, and are the most important supply chains to look into[12]. This is precisely why these 24 minerals formed the base for our next step in nature assessment.

Based on the SBTN pressures categories, we researched relevant indicators from primarily public sources that could give us a generic quantitative risk rating for each mineral. **Annex II** lists the full list of indicators and their sources. This overview is the first of its kind to our knowledge, and we invite the rest of the industry to further refine and expand this together.

The results can be seen below:

[12] For more information, see our Fair Material Roadmap 2030

Mineral Risk Profiles

Nature-related issue area		Aluminum (Bauxite)	Chromium	Cobalt	Copper	Glass / glass fiber (silica sands / limestone)	Gold	Graphite (natural)	Indium	Iron / Steel	Lithium	Magnesium	Manganese	Mica	Nickel	Rare Earth Elements			Silicon	Silver	Tantalum	Tin	Titanium	Tungsten	Zinc
																Neodymium	Praesodymium	Dysprosium							
Land/ Water/ Sea Use Change	Terrestrial ecosystem use: deforestation	3	3	2	2	no data	4	1	n.d.	1	1	1	2	1	3	1	1	2	1	1	2	3	1	2	2
	Terr. ecosystem use: degraded landscapes	4	3	2	4	no data	4	1	n.d.	1	3	1	3	1	4	2	3	2	1	1	1	3	2	1	3
	Freshwater ecosystem use[13]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Marine ecosystem use	1	1	5	5	5	5	1	1	5	5	5	5	1	5	1	1	1	5	5	1	5	5	1	5
Resource exploitation	Water use	2	3	3	2	no data	5	no data	3	n.d.	3	1	1	n.d.	2	3	n.d	n.d	n.d	3	3	3	3	n.d	1
	Other resource use	2	1	3	2	no data	5	no data	3	n.d.	4	1	1	n.d.	1	n.d	n.d	n.d	1	5	5	5	1	3	1
Climate Change	GHG emissions	1	1	1	1	1	5	1	2	1	1	1	1	n.d.	1	2	1	1	1	2	4	1	1	1	1
Pollution	General pollution, incl.: - non GHG air pollutants - water pollutants - soil pollutants - solid waste	5	4	5	5	1	5	3	n.d.	4	4	1	4	3	5	3	5	4	1	4	4	5	2	3	4
	Specific: Water pollutants	2	3	1	3	no data	5	no data	3	n.d.	3	3	1	n.d.	3	3	n.d.	n.d	n.d	3	3	2	3	n.d	1
		2	3	2	3	no data	5	no data	3	n.d.	3	2	2	n.d.	3	3	n.d.	n.d	n.d	3	3	2	2	n.d	2
	Specific: Water pollutants, soil pollutants	2	2	1	3	1	5	1	n.d.	2	1	1	2	1	2	2	1	2	1	2	1	2	1	1	3
	Specific: Solid waste	1	no data	1	1	1	1	1	n.d	1	1	1	1	1	1	2	4	3	1	1	1	n.d	2	1	n.d
Invasives and Others	Disturbances[13]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Biological alterations/ interferences	5	4	5	5	no data	4	1	n.d.	3	4	1	3	2	4	2	3	2	1	2	1	3	2	1	3
Average Risk Score		2.50	2.55	2.58	3	1.80	4.42	1.25	2.50	2.25	2.75	1.58	2.17	1.43	2.83	2.18	2.38	2.13	1.44	2.67	2.42	3.09	2.08	1.56	2.36
Ranking (based on risks)		9	8	7	3	19	1	24	10	14	5	20	16	23	4	15	12	17	22	6	11	2	18	21	13

[13] Considering the complexity of these categories and how it will vary from region to region, this will be rated as yes for all minerals and should be further assessed locally in next steps.

Conclusions

The analysis confirms mineral extraction and processing pose the highest risk to ecosystems and biodiversity across our supply chain. It shows that mining can have a negative impact on all of the dimensions of nature, yet it differs per mineral what the biggest risks are. Pollution is one of the highest risks across all assessed minerals, making pollution control and remediation an essential focus area for prevention and mitigation. Mining further risks directly negatively impacting local biodiversity and conservation efforts, causing changes in landscapes, fresh water and marine basins and heavy water use. Combined, these pressures may accelerate the degradation of ecosystems and loss of biodiversity.

From this analysis, we can also see that the following minerals have the highest risk profile:

1. Gold
2. Tin
3. Copper
4. Nickel
5. Lithium
6. Silver
7. Cobalt
8. Chromium
9. Aluminium
10. Indium

These mineral risk profiles can be used by any company using these minerals, irrespective of their industry.

4.2. Minerals – Smartphone

Following the creation of the generic risk profiles of the minerals, we introduced an additional analysis layer: Fairphone's consumption of each mineral. This is calculated by multiplying the use of each mineral in our final products times by the number of products produced. The combination of the generic risk profiles and consumption of the minerals created a shortlist of priority minerals to focus our efforts on.

Minerals Risk Profiles and Fairphone Consumption

Nature-related issue area		Aluminum (Bauxite)	Chromium	Cobalt	Copper	Gold	Graphite (natural)	Iron / steel	Lithium	Magnesium	Nickel	Tin
Land/ Water/Sea Use Change	Terrestrial ecosystem use: deforestation	3	3	2	2	4	1	1	1	1	3	3
	Terrestrial ecosystem use: degraded landscapes	4	3	2	4	4	1	1	3	1	4	3
	Freshwater ecosystem use	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Marine ecosystem use	1	1	5	5	5	1	5	5	5	5	5
Resource exploitation	Water use	2	3	3	2	5	no data	no data	3	1	2	3
	Other resource use	2	1	3	2	5	no data	no data	4	1	1	5
Climate Change	GHG emissions	1	1	1	1	5	1	1	1	1	1	1
Pollution	General pollution, including: - non GHG air pollutants - water pollutants - soil pollutants - solid waste	5	4	5	5	5	3	4	4	1	5	5
	Specific: Water pollutants	2	3	1	3	5	n/a	n/a	3	3	3	2
		2	3	2	3	5	n/a	n/a	3	2	3	2
	Specific: Water pollutants, soil pollutants	2	2	1	3	5	1	2	1	1	2	2
	Specific: Solid waste	1	no data	1	1	1	1	1	1	1	1	no data
Invasives and Others	Disturbances	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Biological alterations/interferences	5	4	5	5	4	1	3	4	1	4	3
RESULTS	Average Risk Score	2.50	2.55	2.58	3.00	4.42	1.25	2.25	2.75	1.58	2.83	3.09
	Ranking by Fairphone consumption	1	10	4	2	21	6	5	8	9	7	11

Mineral	Ranking (based on generic risk)	Ranking (based on Fairphone consumption)
Aluminum	9	1
Chromium	8	10
Cobalt	7	4
Copper	3	2
Glass	19	3
Gold	1	21
Graphite	24	6
Iron/Steel	14	5
Lithium	5	8
Magnesium	20	9
Nickel	4	7
Tin	2	11

The table illustrates that the ranking of the mineral supply chains of a smartphone is different from the generic ranking of the minerals of the electronics industry. We recommend that other electronic companies use the generic assessment as a first step, and then adapt it to their specific products and own material consumption.

Based on the risk and consumption rankings, we took the decision to cut glass from the shortlist and add tin and gold instead. Mapping the impact of glass is very complex, as it is made of a variety of components such as sand, soda and limestone and there is much data missing. This requires further investigation. Tin and gold supply chains have the highest risk to negatively impact nature and are crucial minerals for the electronics sector. Taking all these factors into account, our final list of priority materials include **Aluminum, Copper, Cobalt, Iron/Steel, Graphite, Nickel, Lithium, Magnesium, Chromium, Tin,** and **Gold.**

4.3. Minerals – Hotspot assessment

The supply chains of these eleven minerals for smartphones are complex and constantly changing. The mine sites where they are extracted, and the smelters and refiners where they are processed, keep changing over the lifespan of a smartphone. This means these eleven minerals theoretically come from all over the world. However, practically, there is a high likelihood that they come from key production countries and mining regions where the majority of that specific material (globally) is currently produced.

Based on this premise, and to accommodate for the dynamic nature of mineral supply chains, we identified the top three countries and their mining regions with the highest production volumes for each of these 11 minerals. We assessed the state of nature in these regions, and identified which of them posed the highest risk to nature and biodiversity using IBAT. We also examined the risks posed to protected species in these areas using the ENCORE Biodiversity module.

KEY PRODUCTION REGIONS

Identifying top 3 production countries and their key production regions per mineral

(Source: Material Insights, Our world in Data, Mining Technology)

↓

STATE OF NATURE

For 74 key regions, assess high level state of nature and biodiversity using Ecological Integrity Risk and Species Threat Abatement and Restoration Scores

(Source: IBAT, Encore)

↓

HOTSPOTS

Ranking the averaged scores, the highest risk rating, and taking into account overlap of mineral sourcing regions

After assessing 74 regions in 33 countries, the following mining regions scored the highest risk on both the Ecological Integrity Risk rating and STAR score. See **Annex II** for more detailed information of the mapping for each of the eleven priority minerals.

Country	Region	Key minerals
Brazil	Minas Gerais	Gold, Iron
China	Ningxia	Magnesium
Guinea	Bauxite Belt (Boké, Kindia)	Aluminium
India	Karnataka	Iron
Indonesia	Maluku	Cobalt, Nickel
Indonesia	Saluwesi	Cobalt, Nickel
Indonesia	Bangka Belitung Islands	Tin
Myanmar	Wa State	Tin
Peru	Ancash	Copper
Peru	San Rafael	Tin
Philippines	Palawan Island	Nickel

It is key to note that a region can be a nature impact hotspot for more than one mineral, such as Maluku in Indonesia and Minas Gerais in Brazil. Other regions are impacted primarily by the production of one specific mineral, such as Puno in Peru which is responsible for approximately 12% of the world's tin extraction.

The next step with these insights is to assess the exact impact of mines and processing facilities on the local flora and fauna in these high-risk regions. For three of these regions we had a locational sensitivity screening and local state of nature assessment conducted: Maluku, Indonesia for cobalt and nickel; Puno, Peru for tin, and Minas Gerais, Brazil, for gold and iron. For each of these regions, we assessed the location of the main mining sites, relative to their proximity with protected areas, high integrity forests, the local species richness and level of species rarity, water stress and potential human rights issues. All three regions face significant risks driven by mining activities. These risks primarily concern water quality and pollution, deforestation and land use change, which are interconnected with high impacts on the rights and livelihoods of indigenous and local communities.

While we recommend the industry conduct their own assessments, our assumption is that these hotspot regions will be similar across our industry. We therefore call on our industry peers to collaborate on assessing the specific local impacts in nature in these hotspots, and to devise collective strategies to prevent and mitigate them, using this list of hotspots as a starting point.

Conclusion:

Our efforts in preventing, mitigating and remediating impacts on nature in our mineral value chains need to focus on 11 key regions:

- **Brazil (Minas Gerais):** Gold, Iron
- **China (Ningxia):** Magnesium
- **Guinea (Bauxite Belt):** Aluminium

- **India (Karnataka):** Iron
- **Indonesia (Maluku, Sulawesi, Bangka Belitung Islands):** Cobalt, Nickel, Tin
- **Myanmar (Wa State):** Tin
- **Peru (Ancash, San Rafael):** Copper, Tin
- **Philippines (Palawan Island):** Nickel

This assessment marks a critical first step in our journey. We will continue to conduct local sensitivity screenings of hotspot mining regions, and most importantly exploring opportunities to drive positive change. We urge the industry to join us in this mission and work together on nature related projects and move beyond risk avoidance towards Nature Positive goals in mineral extraction and processing.

5. Conclusion and next steps

This assessment is a milestone in Fairphone's nature strategy. It provides a holistic view of our impact on nature.

For the manufacturing and key components, we identified the environmental impacts associated with the different pressures on nature, defined by SBTN (Land, Water, GHG, Pollution and Biodiversity). We prioritized where the most significant environmental impacts are located, based on the Fairphone 5's life cycle assessment, primary data, and geospatial analysis. We concluded that the manufacturing sites of the display and PCB, and the final assembly are the key priority component sites from a water and soil pollutants perspective. Even though the land use dimension is not material, it may still offer an opportunity for restoration to compensate for the unavoidable impact of manufacturing. These results will guide our next steps and engagement with suppliers for the development of future actions on nature-related topics.

Our minerals assessment confirmed that mineral mining has the biggest negative effect on nature across our supply chain. The main risks are pollution, impact on biodiversity and conservation efforts, heavy water use and changes to landscapes, fresh water and marine basins. To pinpoint where to act, we combined the risk profiles of the minerals with the use of much of each mineral by Fairphone. This allowed us to focus on eleven key minerals (like gold, tin, and copper) and their high-risk production regions globally. We discovered eleven hotspot mining regions with the highest risk to negatively impact local ecosystems and biodiversity, such as Minas Gerais in Brazil (for gold and iron), Malaku in Indonesia (for cobalt and nickel), and Puno, Peru (for tin). Our foundational work has given us a clear plan for charting next steps: conducting further locational sensitivity screening for the other high-risk regions, connecting with local stakeholders, and designing joint programs to drive positive change locally. We call on the industry to join us in this journey.

So what's next for Fairphone?

Our work now transitions directly into action and primary data collection. This includes reaching out to component sub-suppliers for further actionable data on GHG, water, and pollution, as well as setting joint reduction targets on, for example, water use, reuse or discharge. This will be crucial in driving positive impact on the manufacturing side of things. When it comes to mineral extraction and processing, we will be looking at joining or setting up initiatives to prevent, mitigate, and remediate the impacts on nature in the identified hotspot regions. We will continue to update, strengthen, and expand the assessment as further insights become available. An example of this is the impact of smelting and refining, which we could not cover fully in the current assessment due to a lack of data. We have also joined the SBTN Corporate Engagement program and would love to see our fellow electronics companies do the same.

What's next for the industry?

We believe the SBTN framework offers a solid foundation for a holistic environmental due diligence approach and impact assessment, including biodiversity. By sharing this report, our analysis, the results, and the (public) sources we used, we want to help move the industry forward faster, driving a much-needed focus on nature and biodiversity beyond climate and taking positive action immediately.

We call on other companies to join us in establishing a new standard for technology production by following these steps:

- **Do your due diligence:** Apply the SBTN methodology to your products and supply chains.
- **Set actionable goals:** Move to target setting and action instead of getting lost in data.
- **Collaborate with each other:** Share your insights and accelerate learning in environmental due diligence and impact assessments.

We urge the industry to **support local nature impact assessments in joint hotspots** and **design and implement prevention, mitigation, and remediation measures in a multi-stakeholder setting**. This means engaging with partners on the ground, with representatives from the supplier companies and mines, the governmental authorities, and local (indigenous) communities. This commitment to sharing experiences and learnings will empower companies to develop their individual strategies while actively protecting nature and biodiversity where it is needed most urgently.

Annex

Annex I - Methodology for refining the impact of manufacturing based on LCA results

Methodology for Assessment of SBTN Nature Pressures Based on LCA Results of Fairphone 5

This methodology outlines a structured approach for translating Life Cycle Assessment (LCA) results into quantitative pressure ratings aligned with the Science-Based Targets Network (SBTN) framework. The goal was to assess how Fairphone 5's production contributes to different types of pressures on nature, using existing environmental impact indicators. Below picture explains our approach stepwise:

Our Approach:

1 — **Select Relevant Indicators**
Identify LCA Indicators matching each SBTN pressure

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2 — **Extract component-Level LCA Data**
Break down results by component/Material

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3 — **Definition of Rating Scale**
Consistent scale applied across all SBTN pressure categories generating ratings from very low to Very High

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4 — **Aggregate Scores (if any)**
Average multiple indicators and translate back to qualitative scale

↓

5 — **Interpretation and Mapping**
Use final rating to assign qualitative impact SBTN pressure category

1. Selection of Relevant LCA Indicators: For each SBTN pressure category, relevant LCA impact indicators were identified based on their alignment with the environmental mechanisms described in the SBTN guidance, as shown in the table below:

SBTN Pressure Category	Fairphone 5 LCA Impact indicators	Type of indicator	Alternate approach
Terrestrial ecosystem use	EF 3.1 Land Use [Pt]	Direct	
Freshwater ecosystem use	– Water use [kg]; –Water consumption [kg]; –USEtox 2.12, Ecotoxicity (recommended only) [CTUe]; –CML2001 – Aug. 2016, Eutrophication Potential (EP) [kg Phosphate eq.]	Indirect/proxy	
Marine ecosystem use	None	None	None
Water use	Water use [kg]	Direct	
*Other resource use (natural fossil resources)	CML2001 – Aug. 2016, Abiotic Depletion (ADP fossil) [MJ]	Direct	
GHG emissions	ISO 14067 GWP (based on IPCC AR6) KgsCO2e	Direct	
Non-GHG air pollutants	LANCA v2022.1, Physicochemical Filtration Reduction Potential (Occupation) [mol*a]	Indirect/proxy	
Water pollutants	–USEtox 2.12, Ecotoxicity (recommended only) [CTUe] –CML2001 – Aug. 2016, Eutrophication Potential (EP) [kg Phosphate eq.]	Direct	
Soil pollutants	LANCA v2022.1, Soil Organic Carbon Reduction Potential (Occupation) [kg]	Indirect/proxy	
Solid waste	None	None	ENCORE
Disturbances	None	None	ENCORE
*Biological alterations/interferences	Not Material	Not Material	Not Material

Direct LCA impact indicators: To do the initial screening on nature impact we have referred to an environmental metric derived from LCA results that quantifies the actual biophysical pressure on nature (e.g. GHG emissions in kg CO_2e). These come directly from FP5 LCA modelling and used to quantify and compare environmental pressures across products

Indirect LCA impact indicators (as proxy): In the absence of a relevant direct LCA impact indicator we have used a proxy indicator which is an indirect metric used to signal a potential pressure. At a screening level assessment, we have used proxies to help fill the data gaps, but are less precise than direct indicators, but should be replaced with direct indicators in later steps when measuring and setting targets. In the next LCA, Fairphone intends to include more specific impact indicators to better capture the full scope of SBTN pressure categories like Non-GHg air pollutant, Solid waste and disturbances.

ENCORE as an alternate approach: In the absence of direct and indirect LCA impact indicators we have used ENCORE results to map the pressure category as an alternative.

Important notes:

- **Biological alterations/interferences Excluded**: For the manufacturing stage, the "biological alterations / interference (e.g., invasive species)" pressure category is considered immaterial due to the low likelihood of direct ecological disruption. This will be noted as out of scope for this stage of the value chain. This category typically addresses impacts such as the introduction of invasive species, disruption of ecological processes, or genetic interference—all of which are not associated with Fairphone's core activities. As an electronics brand, Fairphone's suppliers and sub-suppliers operate within industrial settings that do not interact directly with living ecosystems in ways that would trigger such pressures. Instead, nature-related impacts from Fairphone's operations are more accurately reflected in categories like freshwater ecosystem use, water pollution, land use, and climate change. Therefore, the biological alterations/ interferences pressure category was excluded from the assessment due to lack of applicability.

- **Non-GHG air pollutants LCA impact indicator is weak:** The current Fairphone 5 LCA impact indicator does not cover directly non-GHG air pollutants. We have plans to strengthen this area in our next LCA by incorporating additional non-GHG pollution indicators available in Sphera (e.g. Acidification Potential, PM2.5 formation, Human Toxicity) to fully capture potential air pollution impacts.

- **ENCORE tool is used for assessing SBTN pressure categories: Solid Waste and Disturbances:** These SBTN pressure categories solid waste and disturbances were not in the scope of LCA Fairphone 5. Here we have filled the gap by using the ENCORE tool for the screening.

- **Fairphone HQ - Nature Pressure Assessment:** The Fairphone headquarters in Amsterdam, The Netherlands has been assessed using a qualitative proxy approach. Based on available operational data, the site has been assigned a default value of "very low" pressure across all nature categories (land, water, biodiversity, pollution, and climate). This assessment is supported by the following factors:

    - The site employs approximately 135 staff.
      The office building is powered by 100% renewable electricity, including rooftop solar panels.
    - Heating is supplied via heat pumps, minimizing fossil fuel use.
    - The company has adopted a nearly paperless working culture.
    - A high rate of office waste recycling is in place.
    - There is a 60% work-from-home policy, significantly reducing commuting-related impacts.

Given these measures and the relatively small scale of operations, the nature-related pressures from HQ operations are considered negligible in the context of Fairphone's overall value chain. No further action is required at this stage, though this may be revisited as part of future site-level assessments.

2. Component-Level Breakdown: LCA results were analyzed at the component level (e.g., display, battery, PCB) to identify the relative and absolute contributions of different parts of the product to each environmental pressure.

3. Definition of Rating Scale: A consistent scale was applied across all the SBTN pressure categories to ensure consistency and comparability:

- Very Low
- Low
- Medium
- High
- Very High

Each indicator value was then mapped to this scale using predefined thresholds. These thresholds were set either:

- Based on **absolute values** (e.g., for water consumption in kg), or
- Based on **normalized scoring** (e.g., where multiple impact indicators were combined using scoring and averaging methods).

Our approach: We have used absolute values rather than percentages to classify nature-related impacts because environmental pressures such as land use, water consumption, or eutrophication affect ecosystems in absolute terms, not relative ones. A component may represent a small percentage of a product's total impact, yet still exert a significant pressure on nature in absolute terms. Using fixed, science-aligned thresholds allows us to consistently identify and address environmental hotspots, regardless of the product or portfolio size. This approach is aligned with frameworks like the Science-Based Targets Network (SBTN) and ensures that our assessments reflect real world ecological risks, not just internal product comparisons.

Using percentage of total impact can be misleading when assessing environmental pressures. For example, the earpiece accounts for just 0.02% of total water use, but its absolute consumption is 54 kg of water—a high amount relative to its small size and weight. Similarly, the USB-C connector makes up only 0.25% of the total, yet consumes 124 kg of water, representing a significant absolute burden. Even when combined, the speaker and earpiece contribute only 0.57% of the total water use, but together use 444 kg of water—a clear hotspot that warrants attention despite its small share in percentage terms. This demonstrates why absolute values are critical to identifying true ecological pressures in nature impact assessments.

The current tiered materiality thresholds applied to LCA indicators are based on absolute values aligned with typical ranges from GaBi/Sphera and Ecoinvent. While normalization and weighting (as recommended by the ILCD Handbook) can enhance interpretability, these methods are outside the scope of this screening-level assessment. Fairphone will consider such enhancements in future iterations to support more granular and benchmarked decision-making aligned with advanced SBTN steps.

4. Aggregation (if applicable): Where multiple LCA indicators were available for a single SBTN pressure category, a simple scoring system was used:

- Each indicator was assigned a numerical score (1–5).
- The average score was calculated, and rounded to the same 5-point scale.

This approach has been adopted in case of pressure categories - Freshwater ecosystem use and water pollutants, where there are multiple LCA impact indicators considered for the assessment.

Limitations and Rationale for Using Unweighted Averages in SBTN Pressure Category Aggregation

When combining multiple LCA indicators under a single SBTN pressure category, a differentiated weighting approach—based on each indicator's specific relevance to the pressure—can provide a more accurate reflection of environmental impact. However, in this study, due to limited evidence and the absence of robust data to define indicator-specific relevance weights (e.g. within **freshwater ecosystem use** or **water pollution**), we applied a simplified approach. All relevant indicators were combined using an **unweighted average** rather than differential weighting. This represents a limitation of the current assessment and highlights the need for future research to establish scientifically grounded relevance weights for more nuanced interpretation within each pressure category

5. Interpretation and Mapping: The ratings were used to map the overall pressure level for each SBTN category, identifying high-impact components and material hotspots. This approach enables the integration of LCA data into broader nature-related risk and opportunity assessments.

Annex II – Detailed methodology for the minerals assessment

Refining the results for commodities: Minerals assessment

With the purpose of understanding more deeply our impact on nature locally and globally, regarding commodities used in our products, we developed a methodology based on the pre-existing Fairphone Fair Materials Roadmap, and on the Science-Based Targets Network (SBTN) framework to enable us to measure and take action.

The goal was to create a quantitative profile for all the 23 Focus Materials as per Fairphone's Fair Material Roadmap 2030 and outline the results into meaningful pressure ratings. This was combined with data analysis from publicly available sources with regional evaluation, and provided a structured approach designed to evaluate the biodiversity impacts stemming from the production of specific materials.

Based on the same methodology from the Fair Materials Roadmap, we created a global overview for the 23 commodities, and using a funnel approach, we then further analysed the cumulative biodiversity impact in the main production regions for the top 11 minerals. The goal was to, based on this analysis, develop a profile for the top five hotspot regions and enable Fairphone to define action points.

Below the outlined detailed approach stepwise:

1. Establish a global overview of biodiversity impacts per commodity.
    - a. Select relevant indicators *(Identify international global indicators matching each SBTN pressure.)*
    - a. Develop rating *(Use predefined numerical thresholds to classify the global impact levels)*
    - b. Create global overview *(Collect global data to create an overview of the predicted biodiversity impact per commodity globally.)*
    - c. Map to SBTN Pressure (*Use final rating to assess impact of SBTN pressure category and create a global ranking of commodities.)*
2. Analysing cumulative biodiversity impacts in main production regions.
    - a. Create regional overview *(Create overview of cumulative biodiversity impacts in the main production regions of each commodity using publicly available data and tools: ENCORE and IBAT)*.
    - a. Apply rating *(Use predefined numerical thresholds to classify the regional impact levels)*
    - b. Select hotspot regions to conduct in depth analysis and set targets *(Use final rating to assess impact SBTN pressure category and create a hotspot list of regions.)*
3. Developing profiles for the top three hotspot regions.
4. Defining action points/targets setting.

This multi-faceted approach enables a thorough assessment of the biodiversity impacts associated with mineral production, from global impacts to specific regional considerations and detailed hotspot analyses.

1. Establishing a global overview of biodiversity impacts per commodity:

For each SBTN pressure category, relevant global impact indicators were identified based on their alignment with the environmental processes described in the SBTN guidance, as shown in the table below:

Pressure category	Impact sources and indicators
Terrestrial ecosystem use	• Deforestation • Degraded / fragmented landscapes Source: Material Insights. https://www.material-insights.org/material/ Accessed March and September 2025.
Freshwater ecosystem use	Considering the complexity of this category and how it will vary from region to region. This will be rated as yes for all minerals. And it should be further assessed in next steps locally.
Marine ecosystem use	Research on minerals already mined by dredging / or risk of seabed mining. Multiple sources: • Reuters: The promise and risks of deep-sea mining https://www.reuters.com/graphics/MINING-DEEPSEA/CLIMATE/zjpqezqzlpx/ Assessed March 2025. • International Seabed Authority. (2022, June). *Polymetallic nodules* (Information Sheet No. 7). https://www.isa.org.jm/wp-content/uploads/2022/06/eng7.pdf Assessed March 2025. • Center for Biological Diversity. (n.d.). *Deep-sea mining*. https://www.biologicaldiversity.org/campaigns/deep-sea_mining/ Assessed March 2025. • Beiser, V. (2017, February 27). *Sand mining: The global environmental crisis you've probably never heard of*. The Guardian. https://www.theguardian.com/cities/2017/feb/27/sand-mining-global-environmental-crisis-never-heard Assessed March 2025. • U.S. Geological Survey. (2022, June 15). *Global seabed mineral resources*. https://www.usgs.gov/centers/pcmsc/science/global-seabed-mineral-resources Assessed March 2025.
Water use	• Freshwater scarcity footprint Source: Madaka, Babbit, Ryen (2022) Opportunities for reducing the supply chain water footprint of metals used in consumer electronics, Resources, Conservation and Recycling https://doi.org/10.1016/j.resconrec.2021.105926
Other resource use	• Rock-to-metal ratio average Source: Nassar et al (2022) Rock-to-metal ratio: a foundational metric for understanding mine wastes, USGS, https://pubs.acs.org/doi/suppl/10.1021/acs.est.1c07875/suppl_file/es1c07875_si_001.pdf Nassar et al (2023) Rock-to-metal ratios of the rare earth elements, Journal of Cleaner Production, https://doi.org/10.1016/j.jclepro.2023.136958
GHG emissions	• Primary production emission factor (kgs CO2e/ kg) Source: Fairphone Fair Materials Roadmap 2030 https://link.springer.com/article/10.1007/s40831-021-00429-0 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4085040/# https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9999434/ https://www.cobaltinstitute.org/sustainability/life-cycle-assessment/

	https://core.ac.uk/download/pdf/157763387.pdf https://www.researchgate.net/publication/349748219_Global_material_flow_analysis_of_glass_From_raw_materials_to_end_of_life https://www.polybags.co.uk/environmentally-friendly/useful-numbers-for-environmental-studies.pdf https://www.sciencedirect.com/science/article/pii/S0959652622004899?via%3Dihub https://www.sciencedirect.com/science/article/abs/pii/S0959652622001172 https://www.semanticscholar.org/paper/Energy-Consumption-and-Carbon-Emission-Analysis-of-Gao-Gong/88870b4b9ce0d71ac33f1b2c36e6c52d0265db2b https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9999434/ https://www.bbc.com/future/article/20201124-how-geothermal-lithium-could-revolutionise-green-energy https://link.springer.com/article/10.1007/s11367-015-0995-3 https://link.springer.com/article/10.1007/s11367-016-1085-x https://www.plasticstoday.com/sustainability/clearing-air-understanding-scope-3-emissions-plastics https://www.nature.com/articles/s41893-021-00807-2 https://www.iea.org/reports/the-future-of-petrochemicals https://www.frontiersin.org/articles/10.3389/fenrg.2014.00045/full https://link.springer.com/chapter/10.1007/978-3-319-48768-7_12 https://link.springer.com/article/10.1007/s40831-021-00429-0 https://www.thaiscience.info/journals/Article/APER/10979994.pdf https://www.internationaltin.org/ita-publishes-new-lifecycle-assessment-of-tin-production/ https://www.aurubis.com/dam/jcr:9b7e309e-b876-4ff4-b6a2-8d382132b629/Aurubis_Factsheet%20LCA%20Tin_2022_EN.pdf https://www.sciencedirect.com/science/article/pii/S0959652618332992https://core.ac.uk/download/pdf/157763387.pdf
General pollution, including: - non GHG air pollutants - water pollutants - soil pollutants - solid waste	• Pollution Source: Material Insights. https://www.material-insights.org/material/ Accessed March and September 2025.
Specific: Water pollutants	• Freshwater eutrophication • Freshwater ecotoxicity Source: Madaka, Babbit and Ryen (2022) Opportunities for reducing the supply chain water footprint of metals used in consumer electronics, Resources, Conservation and Recycling https://doi.org/10.1016/j.resconrec.2021.105926
Specific: Water pollutants, soil pollutants	• Tailings breaches Source: Material Insights. https://www.material-insights.org/material/ Accessed March and September 2025.
Specific: Solid waste	• Release of radiation Source: Material Insights. https://www.material-insights.org/material/ Accessed March and September 2025.
Disturbances	Considering the complexity of this category and how it will vary from region to region. This will be rated as yes for all minerals. And it should be further assessed in next steps locally.
Biological alterations/ interferences	• Negative Biodiversity and conservation impact Source: Material Insights. https://www.material-insights.org/material/ Accessed March and September 2025.

Important notes:

- Material insight data use: Material Insights[14] rated the importance of supply chain ESG issues for downstream users of materials based on information contained in publicly available reports. Each material was assigned a score to measure the strength of association with 19 different environmental, social or governance issues. For the present study, key elements from the Environmental rates were used. Their full definitions can be found on Material insights's official website.
- Limited data: Creating a generic overview of the impact that the extraction of a mineral can have on nature is complex. There were some categories where it was not possible to identify data for all minerals. We treat this as a living document, used to funnel to the main hotspot regions, based on available information. We aim to continue to update the assessment when new information is available and welcome further insights.

Developing quantitative rating: A consistent scale was applied across all the SBTN pressure categories to ensure consistency and comparability. A numeric value was used to measure the level of impact per pressure category where:

1 = very low
2 = low
3 = moderate
4 = high
5 = very high

Pressure category	Indicators	Explanation for ranking of data
Terrestrial ecosystem use	• Deforestation • Degraded / fragmented landscapes	Ranking as per Material Insights 1-5
Freshwater ecosystem use	This category will be rated as yes for all minerals. And it should be further assessed on step 2 and 3 locally.	
Marine ecosystem use	Research on minerals already mined by dredging / or risk of seabed mining.	Yes (= reports of possible seabed mining or already existing sea dredging): 5 No (=no reports of possible seabed mining or sea dredging): 1
Water use	Freshwater scarcity footprint	Ranking as per Fig. 2. Heat map showing the comparison of material hotspots identified. Color scale translated to very low to very high scores. For example, metals in the 90th percentile range are those with the highest impacts and are shown in the darkest color, therefore got the very high score (5).
Other resource use	Rock-to-metal ratio average	Very Low: 3 to 410.75
		Low: 410.75 to 818.5
		Moderate: 818.5 to 1226.25
		High: 1226.25 to 1634

[14] Material Insights: Materials." *Material Insights*, Responsible Minerals Initiative (RMI) and TDi Sustainability. Accessed March 2025, updated September 2025.

		Very High (Outliers): Values above 1634
GHG emissions	Primary production emission factor (kgs CO2e/ kg)	Very Low: 1 to 65.75
		Low: 65.75 to 130.5
		Moderate: 130.5 to 195.25
		High: 195.25 to 260
		Very High (Outliers): Values above 260
General pollution, including: - non GHG air pollutants - water pollutants - soil pollutants - solid waste	Pollution	Ranking as per Material Insights 1-5
Specific: Water pollutants	Freshwater eutrophication	Ranking as per Fig. 2. Heat map showing the comparison of material hotspots identified. Color scale translated to Very low to very high scores. For example, metals in the 90th percentile range are those with the highest impacts and are shown in the darkest color, therefore got the very high score (5).
	Freshwater ecotoxicity	
Specific: Water pollutants, soil pollutants	Tailings breaches	Ranking as per Material Insights 1-5
Specific: Solid waste	Release of radiation	Ranking as per Material Insights 1-5
Disturbances	Considering its complexity, this category will be rated as yes for all minerals. And it should be further assessed on step 2 and 3 locally.	
Biological alterations/interferences	Negative Biodiversity and conservation impact	Ranking as per Material Insights 1-5

Important note:

- When data was not identified for a specific mineral/ pressure category instead of a scoring, this was marked as "No data". This does not mean that this category is not relevant for the mineral, only that there was no sufficient information available at the moment of this research.

To allow for quantitative comparison, we then used cumulative scoring to rank the minerals based on the severity of their impacts and the categories affected. We then compared this risk ranking with Fairphone's consumption of the materials.

For the assessment, we took the decision to cut glass from the analysis and add tin and gold instead. Mapping the impact of glass is very complex, as it is made of a variety of components such as sand, soda, limestone. This requires further investigation. Tin and gold supply chains have the highest risk to negatively impact nature and are crucial minerals for the electronics sector. Taking all these factors into account, our final list of priority materials include **Aluminum, Copper, Cobalt, Iron/Steel, Graphite, Nickel, Lithium, Magnesium, Chromium, Tin,** and **Gold.**

2. Analysing cumulative biodiversity impacts in main production regions.

For the top eleven hotspot materials, a second analysis was conducted to identify and evaluate the cumulative biodiversity impacts within their main production regions. This assessment was conducted by:

1. Selecting the top producing countries for each mineral, covering at least 50% of global production[15].
2. Identifying the biggest mining companies in the country that mines the specific mineral.
3. Identifying the key production sub-regions per mineral per country;
4. Create a holistic overview of the state of nature and the impact of mining each specific mineral on the country and regions using the ENCORE[16] biodiversity module.

The ENCORE Biodiversity Module employs two key methodologies at the asset level:

- The STAR (Species Threat Abatement and Restoration) metric, grounded in IUCN data, quantifies the significance of a location for preventing species extinctions threatened by mining, considering species range and the intensity of the threat within a defined area (10km buffer and HydroBasins).
- The Ecological Integrity Risk Methodology assesses the potential for ecological degradation by integrating the Mean Species Abundance (MSA) metric (a standardized 22% reduction for mining) with an ecoregion's ecological importance based on its remaining natural habitat.

This dual approach provides a comprehensive view, from individual species vulnerability to broader ecosystem integrity, across assets, portfolios, and regions. For each of these methodologies ENCORE gives a score, we aligned their score to match our approach from very low to very high as in the following images:

Fairphone approach	Encore Ecological Integrity Risk Score
1	(A) On track to meet target
2	(B) Protected and integrity stable or improving
3	(C) Stable or improving but insufficiently protected
4	(D) Integrity declining but protection increasing
5	(E) Integrity declining and insufficiently protected

Fairphone approach	Encore STAR Score
1	Very Low
3	Medium
5	Very High

[15] **Data source:** USGS - Mineral Commodity Summaries (2024); USGS - Historical Statistics for Mineral and Material Commodities (2023); BGS - World Mineral Statistics (2023) March & April 2025
[16] https://www.encorenature.org/en, accessed March & April 2025

When it was not possible to create a country profile with ENCORE data, as an alternative source, the IBAT Maps "Rarity Weighted Richness" and "STAR" were used.[17] The Rarity Weighted richness is a metric used to identify areas of high biodiversity significance. It's calculated for a specific area by considering not just the number of species present, but also how geographically rare those species are. An area with a high rarity-weighted richness score contains a large number of species and/or species with very small global ranges, making the metric a strong alternative for Ecological Integrity Risk Methodology. Meanwhile the STAR score on both platforms follows the same methodology.

Since the IBAT map provides the risk score in a color scheme, Fairphone translated the IBAT color scheme to 5 point scale ranging from very low to very high score as presented in the following tables:

Rarity weighted Richness	Fairphone approach
	Very Low - 1
	Low - 2
	Medium - 3
	High - 4
	Very High - 5

IBAT STAR	Fairphone approach
	Very Low - 1
	Low - 2
	Medium - 3
	High - 4
	Very High - 5

For prioritizing the sub-regions, the average grade as well as the highest risk value appearing on the two key methodologies STAR and Ecological Integrity Risk/Richness weighted Richness were reviewed.

A detailed description of our findings for each of the eleven priority minerals is provided below.

[17] https://www.ibat-alliance.org/ , accessed March & April 2025

Annex III – Biodiversity risks of main production regions

Aluminium (Bauxite)

According to Our World in data[18], the biggest producers of Bauxite are Australia, representing 24,5% of global production, followed by Guinea, representing 24,25% of global production and China with 23.25%.
According to the Australian Aluminium Council, there are currently six bauxite mines in Australia, 2 of them located in Queensland, 3 in Western Australia and 1 in Northern Territory. Additionally, according to Mining Technology, in 2022 the major Leading producers of bauxite in Australia were Rio Tinto and Alcoa.
According to Zhang et al. (2021), the bauxite deposits in China are mainly distributed in Shanxi, Guizhou, Henan, and Guangxi Provinces, which account for 87% of the total bauxite resources in the country. The following table shows the Star and Ecological integrity risk score in country and region level, based on the assessment conducted with IBAT and ECORE biodiversity tool (accessed March – April 2025).

Country	STAR Country Level	Ecological integrity risk Country Level	(Sub-region)	STAR Sub-region Level	Ecological integrity risk Sub-region Level
Australia	Low	14% – Very Low Risk 78% – Medium Risk 2% – High Risk 5% – Very High Risk	Queensland	1	5
			Northern Territory	1	4
			Western Australia	1	3
China	Low	92% – Medium Risk 8% – Very High Risk	Henan	1	5
			Shanxi	no data	no data
			Guizhou	1	3
			Guangxi	1	3
Guinea	High	100% – Very High Risk	Boké (Bauxite Belt)	5	5
			Kindia	5	5

[18] USGS – Mineral Commodity Summaries (2024) USGS – Historical Statistics for Mineral and Material Commodities (2023) BGS – World Mineral Statistics (2023) *– with major processing by Our World in Data (Accessed March – April 2025)*

Chromium

The biggest producers of Chromium are South Africa, representing approximately 47% of global production, followed by Turkey, representing 18% of global production and Kazakhstan with 17%, according to Material Insights[19].

In South Africa, the top 5 key regions where Chromium is explored are Northwest Province, Mpumalanga, Limpopo, Gauteng and ZwaZulu-Natal. In Turkey there are three main provinces where Chromium is explored: Elazığ Province, Bursa Province and Adana Province. Moreover, in Kazakhstan, chromium exploitation is concentrated mainly in Aqtobe's region.

The following table shows the Star and Ecological integrity risk score in country and region level, based on the assessment conducted with IBAT and ECORE biodiversity tool (accessed March - April 2025).

Country	STAR Score Country Level	Ecological integrity risk Country Level	(Sub-region)	STAR Score Sub-region Level	Ecological integrity risk Sub-region Level
South Africa	Low	100% - Medium Risk	Northwest Province	1	3
			Mpumalanga	1	3
			Limpopo	1	3
			Gauteng	1	3
			KwaZulu-Natal	1	3
Kazakhstan	Low	37% - Medium Risk 64% - Very High Risk	AAktobe	1	5
Turkey	Medium	Average - Medium Risk	Elazığ Province	3	3
			Bursa Province	3	3
			Adana Province	4	3

[19] Material Insights. (n.d.). *Chromium*. https://www.material-insights.org/materials/chromium/ *(Accessed March - April 2025)*

Cobalt

According to Our World in data[20],the biggest producers of Cobalt are Democratic Republic of Congo (DRC), representing 73,91% of global production, followed by Indonesia, representing 7,3% of global production.

In DRC, the two main regions where Cobalt is mined are Lualaba and Haut-Katanga. Moreover, in Indonesia, the hotspot regions are Maluku Utara and the Saluwesi Islands of Slatan and Tenggara.

The following table shows the Star and Ecological integrity risk score in country and region level, based on the assessment conducted with IBAT and ECORE biodiversity tool (accessed March – April 2025).

Country	STAR Country Level	Ecological integrity risk Country Level	(Sub-region)	STAR Sub-region Level	Ecological integrity risk Sub-region Level
Democratic Republic of Congo	Low	100% – Very High Risk	Lualaba	1	5
			Haut-Katanga	1	5
Indonesia	High	58% – Very High Risk 42% – Medium Risk	Maluku Utara	5	5
			Sulawesi Selatan	1	5
			Sulawesi Tenggara	1	5

[20] USGS – Mineral Commodity Summaries (2024) USGS – Historical Statistics for Mineral and Material Commodities (2023) BGS – World Mineral Statistics (2023) – with major processing by Our World in Data *(Accessed March – April 2025)*

Copper

The biggest producers of Copper are Chile, representing 22.73% of global production, followed by Peru, representing 11,82%, DRC with 11,36% and China with 7,73% of global production, according to Our World in data[21].

In Chile, the largest copper mines are located in Anfogasta, Tarapacá and Cachaopal. In Peru, the key copper production areas are Arequipa, Ancash and Apurimac. In DRC copper is extracted in the "Copper belt" in the regions Lubaba and Haut-katanga. Moreover, in China the copper resources are relatively concentrated mainly in Xizang, Yunnan, Jiangxi, Xinjiang, Anhui, and Inner Mongolia.

The following table shows the Star and Ecological integrity risk score in country and region level, based on the assessment conducted with IBAT and ECORE biodiversity tool (accessed March - April 2025).

Country	STAR Country Level	Ecological integrity risk Country Level	(Sub-region)	STAR Sub-region Level	Ecological integrity risk Sub-region Level
Chile	Low	56% - Very Low Risk 20% - Medium Risk 24% - Very High Risk	Antofagasta	1	1
			Tarapacá	1	1
			Cachapoal, O'Higgins Region	1	5
Peru	High	56% - High Risk 45% - Very HIgh Risk	Arequipa	1	5
			Ancash	5	5
			Apurímac	1	5
DRC	Low	100% Very High Risk	Lualaba	1	5
			Haut-Katanga	1	5
China	Low	70% - Medium Risk 30% - Very High Risk	Xizang	1	5
			Yunnan	1	3
			Jiangxi	1	3
			Xinjiang	1	5
			Anhui	1	3
			Inner Mongolia	1	3

[21] USGS - Mineral Commodity Summaries (2024) USGS – Historical Statistics for Mineral and Material Commodities (2023) BGS – World Mineral Statistics (2023) – with major processing by Our World in Data *(Accessed March - April 2025)*

Gold

Gold is a mineral with a complex supply chain. Its production is spread around the world. China produces 12.33% of the world's gold followed by Russia with 10.33%, Australia with another 10.33%, United states with 5.67%, South Africa with 3.33% and Brazil with 2% according to Our World in data[22].

In China, the more important regions to Gold extraction are Shandong, Henan, Fujan and Lianin. In Russia, the Gold operations are concentrated in Siberia and Far Eastern Federal Districts. Moreover, In Australia the most important Gold region is Western Australia, while in the US, the main regions for gold mining are Alaska and Nevada. In South Africa, the key regions for gold extraction are Gauteng and the Free state region and in Brazil, the three main regions where gold is explored are Minas Gerais, Goias and Bhaia.

The following table shows the Star and Ecological integrity risk score in country and region level, based on the assessment conducted with IBAT and ECORE biodiversity tool (accessed March – April 2025).

Country	STAR Country Level	Ecological integrity risk Country Level	(Sub-region)	STAR Sub-region Level	Ecological integrity risk Sub-region Level
China	Low	70% – Medium Risk 30% – Very High Risk	Shandong	1	3
			Henan	1	3
			Fujian	1	3
			Liaoning	1	3
Australia	Low	70% – Very Low Risk 3% – High Risk 25% – Very High Risk	Western Australia	1	5
Russia	Low	95% – Very Low RIsk 5% – Very High Risk	Siberia	1	5
United States	Low	17% – Very Low Risk 3% – Medium Risk 6% – High Risk 75% Very High Risk	Nevada	1	5
			Alaska	1	1
South Africa	Low	100% – Medium Risk	Gauteng	1	3
			Free State	1	3
Brazil	High	100% High Risk	Minas Gerais	5	5
			Goias	1	5
			Bhaia	1	5

[22] USGS – Mineral Commodity Summaries (2024) USGS – Historical Statistics for Mineral and Material Commodities (2023) BGS – World Mineral Statistics (2023) – with major processing by Our World in Data *(Accessed March – April 2025)*

Graphite

According to Our World in data[23], the biggest graphite producer is China, dominating 76.88% of global production, followed by Mozambique and Madagascar, each with 6% of global production.

China has 4 main regions known to explore Graphite: Heilongjiang, Inner Mongolia, Sichuan Shanxi, Shandong. Mozambique graphite is explored in the Cabo Delgado region and in Madagascar Tomamasina is the key explored region.

The following table shows the Star and Ecological integrity risk score in country and region level, based on the assessment conducted with IBAT and ECORE biodiversity tool (accessed March – April 2025).

Country	STAR Country Level	Ecological integrity risk Country Level	(Sub-region)	STAR Sub-region Level	Ecological integrity risk Sub-region Level
China	4	2	Heilongjiang	3	5
			Inner Mongolia	3	2
			Sichuan	4	5
			Shanxi	2	4
			Shandong	2	3
Mozambique	4	5	Cabo Delgado	3	5
Madagascar	5	5	Toamasina	5	5

[23] USGS – Mineral Commodity Summaries (2024) USGS – Historical Statistics for Mineral and Material Commodities (2023) BGS – World Mineral Statistics (2023) – with major processing by Our World in Data *(Accessed March - April 2025)*

Iron/Steel

According to Our World in data[24] Australia leads the iron production with 38.4% of global production. Followed by Brazil representing 17.6% of the market, China with 11.2% and India with 10.8% of global production.

In Australia, the key regions responsible for iron extraction are Western Australia, South Australia and New South Wales. In Brazil there are two main states responsible for extracting iron, Minas Gerais and Para. In China, the main provinces that explore Iron are Liaoning, Shanxi, Sichuan, and Hebei. In India Odisha, Chhattisgarh,Karnataka and Jharkhand are the main Iron ore producers.

The following table shows the Star and Ecological integrity risk score in country and region level, based on the assessment conducted with IBAT and ECORE biodiversity tool (accessed March – April 2025).

Country	STAR Country Level	Ecological integrity risk Country Level	(Sub-region)	STAR Sub-region Level	Ecological integrity risk Sub-region Level
Australia	Low	25% – Very Low Risk 63% – Medium Risk 3% – High Risk 10% Very High Risk	Western Australia	1	1
			South Australia	1	1
			New South Wales	1	5
Brazil	High	15% – High Risk 85% – Very High Risk	Minas Gerais State	5	5
			Para State	1	4
China	Low	100% – Medium Risk	Liaoning	1	3
			Hebei (North China Craton)	1	3
			Shanxi	2	4
			Sichuan	1	3
India	High	50% – Medium Risk 50% Very High Risk	Odisha	5	3
			Chhattisgarh	2	4
			Karnataka	5	5
			Jharhand	2	5

Based on the ENCORE analysis, the iron extraction regions that represent the highest risks to nature are Minas Gerais in Brazil and Karnataka in India.

[24] USGS – Mineral Commodity Summaries (2024) USGS – Historical Statistics for Mineral and Material Commodities (2023) BGS – World Mineral Statistics (2023) *– with major processing by Our World in Data (Accessed March – April 2025)*

Lithium

According to Our World in data[25], the main lithium producers are Australia with 47% of global production, followed by Chile with 25% and China with 18%.

In Australia the most important region for Lithium extraction is Western Australia. In Chile Antofagasta leads the Lithium exploitation. In China, Sichuan, Jiangxi, Xinjiang, Inner Mongolia and Qinghai provinces are relevant for Lithium extraction.

The following table shows the Star and Ecological integrity risk score in country and region level, based on the assessment conducted with IBAT and ECORE biodiversity tool (accessed March – April 2025).

<table>
<tr><th>Country</th><th>STAR Country Level</th><th>Ecological integrity risk Country Level</th><th>(Sub-region)</th><th>STAR Sub-region Level</th><th>Ecological integrity risk Sub-region Level</th></tr>
<tr><td>Australia</td><td>Low</td><td>23% - Very Low Risk
56% - Medium Risk
7% - High Risk
13% - Very high Risk</td><td>Western Australia</td><td>1</td><td>5</td></tr>
<tr><td>Chile</td><td>Low</td><td>100% - Very high Risk</td><td>Antofogasta</td><td>1</td><td>5</td></tr>
<tr><td rowspan="5">China</td><td rowspan="5">Low</td><td rowspan="5">61% - Medium Risk
39% - Very High Risk</td><td>Sichuan</td><td>1</td><td>-</td></tr>
<tr><td>Jiangxi</td><td>1</td><td>3</td></tr>
<tr><td>Xinjiang</td><td>1</td><td>5</td></tr>
<tr><td>Inner Mongolia</td><td>1</td><td>3</td></tr>
<tr><td>Qinghai</td><td>1</td><td>5</td></tr>
<tr><td rowspan="2">Argentina</td><td rowspan="2">Low</td><td rowspan="2">100% - Very High Risk</td><td>Jujuy</td><td>1</td><td>5</td></tr>
<tr><td>Catamarca</td><td>1</td><td>5</td></tr>
</table>

[25] USGS – Mineral Commodity Summaries (2024) USGS – Historical Statistics for Mineral and Material Commodities (2023) BGS – World Mineral Statistics (2023) *– with major processing by Our World in Data (Accessed March – April 2025)*

Magnesium

The biggest producer of Magnesium is China, representing 88% of global production, according to Our World in data[26]

The main regions where magnesium is produced in China are: Shaanxi, Shanxi, Ningxia and Henan provinces. The following table shows the Star and Ecological integrity risk score in country and region level, based on the assessment conducted with IBAT and ECORE biodiversity tool (accessed March - April 2025).

Country	STAR Country Level	Ecological integrity risk Country Level	(Sub-region)	STAR Sub-region Level	Ecological integrity risk Sub-region Level
China	High	Low	Shaanxi	3	4
			Shanxi	2	5
			Henan	2	3
			Ningxia	4	5

[26] USGS - Mineral Commodity Summaries (2024) USGS - Historical Statistics for Mineral and Material Commodities (2023) BGS - World Mineral Statistics (2023) – with major processing by Our World in Data *(Accessed March - April 2025)*

Nickel

According to Our World in data[27] Indonesia represents 50% of Nickel's global production. The Philippines are also an important producer of Nickel representing 11% of global production, followed by Russia with 6% and Australia with 5%.

The main regions in Indonesia where Nickel is extracted are Saluwesi and Maluku provinces. In the Philippines, Palawan Island, Surigao del Norte and Zambales are the strongest producing Nickel regions. The two main producing regions in Russia are Krasnoyarsk Krai and Murmansk Oblast. The Australian nickel production rub is Western Australia. The following table shows the Star and Ecological integrity risk score in country and region level, based on the assessment conducted with IBAT and ECORE biodiversity tool (accessed March - April 2025).

Country	STAR Country Level	Ecological integrity risk Country Level	(Sub-region)	STAR Sub-region Level	Ecological integrity risk Sub-region Level
Indonesia	High	43% - Medium Risk 57% - Very High Risk	Sulawesi province	5	5
			North maluku province	5	5
Philippines	High	20% - Medium Risk 14% High Risk 66% - Very High Risk	Palawan Island	5	4
			Surigao del Norte	3	5
			Zambales	3	5
Russia	Low	72% Very Low Risk 28 Very High Risk	Krasnoyarsk Krai	1	1
			Murmansk Oblast	1	1
Australia	High	31% - Very Low Risk 15% - Medium Risk 4% - High Risk 50% - Very High Risk	Western Australia	1	4

[27] USGS - Mineral Commodity Summaries (2024) USGS - Historical Statistics for Mineral and Material Commodities (2023) BGS - World Mineral Statistics (2023) *- with major processing by Our World in Data (Accessed March - April 2025)*

Tin

The main four tin producers are China with 24% of global production, followed by Indonesia with 19%, Myanmar with 18% and Peru with 8% of global production, According to Our World in data[28].

The main Tin producing regions in China are Yunnan and Hunan province. In Indonesia, the main producing regions are Bangka and Belitung Islands. Moreover in Myanmar the Wa State is the largest Tin producer and in Peru San Rafael region is the most important producer.

The following table shows the Star and Ecological integrity risk score in country and region level, based on the assessment conducted with IBAT and ECORE biodiversity tool (accessed March - April 2025).

Country	STAR Country Level	Ecological integrity risk Country Level	(Sub-region)	STAR Sub-region Level	Ecological integrity risk Sub-region Level
China	3	4	Yunnan Province	3	5
			Hunan Province	3	3
Indonesia	4	5	Bangka and Belitung Islands	4	5
Myanmar	4	4	Wa State	4	5
Peru	5	5	San Rafael	4	5

[28] USGS - Mineral Commodity Summaries (2024) USGS - Historical Statistics for Mineral and Material Commodities (2023) BGS - World Mineral Statistics (2023) – with major processing by Our World in Data *(Accessed March - April 2025)*