

Corporate Biodiversity Disclosure in the Mining Sector: A Comparative Analysis of Brazilian and European Union Companies under the CDP Framework

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ABSTRACT

This paper presents a comparative analysis of biodiversity-related disclosures by mining companies from Brazil and the European Union (EU) using the 2023 Carbon Disclosure Project (CDP) questionnaire. A qualitative content analysis was conducted with Atlas.ti, classifying corporate responses by their completeness and outcomes. The analysis examines both open-ended and closed questions, using concrete examples to illustrate the spectrum from complete to incomplete responses. Results reveal that Brazilian companies provided proportionally more complete and detailed answers than their EU counterparts, despite the EU's more stringent mandatory disclosure requirements under the CSRD. These findings suggest that regulatory obligations alone do not guarantee higher-quality reporting, emphasizing the role of contextual pressures—such as environmental licensing requirements and post-disaster accountability—in shaping corporate transparency.

1. INTRODUCTION

Biodiversity loss has become a critical global concern. The Kunming-Montreal Global Biodiversity Framework, adopted at COP15 of the Convention on Biological Diversity (CBD), established 23 targets to halt biodiversity loss by 2030. Richardson et al. (2023) identify biodiversity as a 'planetary boundary,' of which six of nine have already been crossed. The IUCN Red List indicates that approximately 28% of assessed species are threatened with extinction, with at least one million species facing the same risk globally (IPBES, 2019).

Mining is among the primary drivers of biodiversity loss affecting biodiversity across spatial scales through direct impacts (habitat loss, fragmentation, and pollution) and indirect ones such as infrastructure-driven deforestation (Sonter et al., 2018). In Brazil, the Ministry of the Environment lists 4,463 species threatened with extinction, with mining among the top threats. The depletion of conventional mineral stocks is further redirecting extraction toward ecologically sensitive areas, making robust biodiversity governance increasingly urgent (Tibbet, 2015).

Pressure on mining companies to disclose biodiversity impacts has grown substantially over the past decade, driven by international frameworks and societal demand. The Carbon Disclosure Project (CDP), a voluntary reporting platform aligned with both the Global Reporting Initiative (GRI) and the Taskforce on Nature-related Financial Disclosures

(TNFD), introduced its Biodiversity section in 2022. In 2023, only 160 mining companies responded to it, out of 4,735 total respondents. This paper analyzes the quality of those responses through a comparative lens, contrasting Brazilian and EU mining companies and examining what distinguishes a genuinely informative biodiversity disclosure from a superficial one.

2. RESEARCH METHODS

A qualitative summative content analysis (Hsieh & Shannon, 2005) was conducted in Atlas.ti on the CDP 2023 Biodiversity Questionnaire, which contains 7 main questions broken into 27 subquestions. A total of 35 mining companies were analyzed: 10 headquartered in Brazil and 25 in the EU. Excluding companies that left all responses blank, 23 provided usable answers: 6 from Brazil and 17 from the EU, with response rates of 60% and 68%, respectively.

2.1 Coding Open-Ended Questions: Depth

Open-ended questions were coded along a three-point depth scale: 'complete,' 'reasonable,' or 'incomplete.' The criteria were completeness, level of detail, and coherence of the response with the question asked. After an initial round of free coding, a second and a third rounds were conducted. To ensure consistency, one response per question was selected as a reference anchor, against which all others were compared and calibrated in the following rounds.

C15.1_C2_Is there board-level oversight and/or executive management-level responsibility for biodiversity-related issues within your organization? - Description of oversight and objectives relating to biodiversity

Complete The board and its executives consider biodiversity issues when reviewing and driving business strategy through the ESG committee. The ESG committee, consisting of 17 executives as last updated and approved by the Board of Directors, aims to support decision making on environmental, social and governance. The ESG committee is complemented by the ESG Integrated Management Commission, formed by the xxxx team and the Sustainability Board, and complemented by eight thematic groups, whose themes are in line with the Company's materiality matrix, coordinated by 25 ESG ambassadors. One of these thematic groups corresponds to Biodiversity and Ecosystem Services and discusses and addresses work fronts and risks and opportunities related to such theme, aiming feed the ESG Integrated Management Commission and the ESG Committee. In turn, the main function of the Commission is to standardize concepts, disseminate good practices in all segments of activity and make the connection between the eight action groups and the members of the Committee (composed by Directors and executives), focusing on the acceleration and evolution of themes and the achievement of ESG goals in a strategic and structured way. The thematic group is led by an expert who coordinates the ambassadors from various operational areas. Once a year the ESG Committee organizes a meeting in which the Thematic Group on Biodiversity and Ecosystem Services presents its results, risks and opportunities, subsidizing the board and its executives.	Reasonable Our Sustainability Committee has oversight of its biodiversity strategy and management programmes. The objectives of our biodiversity strategy, which forms part of its overall land management strategy is to: support the conservation and restoration of areas with biodiversity value and improve the biodiversity value of rehabilitated areas. The defined programmes to deliver against these objectives are as follows:- Define the requirements to conserve and restore the xxxx Forest.- Implement relevant research programmes to support biodiversity development.- Develop programmes to help promote the protection of biodiverse areas.- Continue to develop and implement Agroforestry programmes.
	Incomplete The board reviews the questionnaires that are completed, related to climate change (biodiversity).
	Negative No objectives next; however, within two years.

Fig. 1. Comparison between a 'complete', a 'reasonable', an 'incomplete' and a 'negative' answer in question C15.1_C2

Figure 1 illustrates this spectrum for question C15.1_C2, asking companies to describe their board-level oversight and objectives relating to biodiversity. A 'complete' answer details the governance structure precisely, naming specific committees, their composition, mandate, and how biodiversity topics are escalated. A 'reasonable' answer acknowledges the existence of a biodiversity strategy and lists objectives but lacks the institutional detail that would allow external verification. An 'incomplete' answer merely states that the board reviews climate-related questionnaires, conflating climate and biodiversity governance. A 'negative' answer results from a negative response to the prior gateway question.

2.2 Coding Closed Questions: Outcomes

Closed questions—structured as yes/no or multiple-choice—were coded for outcomes: 'positive,' 'could improve,' or 'negative.' For binary questions, positive responses received 'positive' and negative ones 'negative.' For multiple-choice questions, the outcome code reflects the breadth of engagement.

Figure 2 shows the question C15.3_C2, which asks which stages of the value chain companies assess for biodiversity impacts and dependencies. Here, the outcome is operationalized structurally: assessing all six possible combinations (direct operations, upstream, and downstream, for both impacts and dependencies) yields 'positive'; assessing fewer stages yields 'could improve'; and answering 'not applicable' to both dimensions yields 'negative.' This approach captures not only whether companies engage with the question but how comprehensively they do so across their operations.

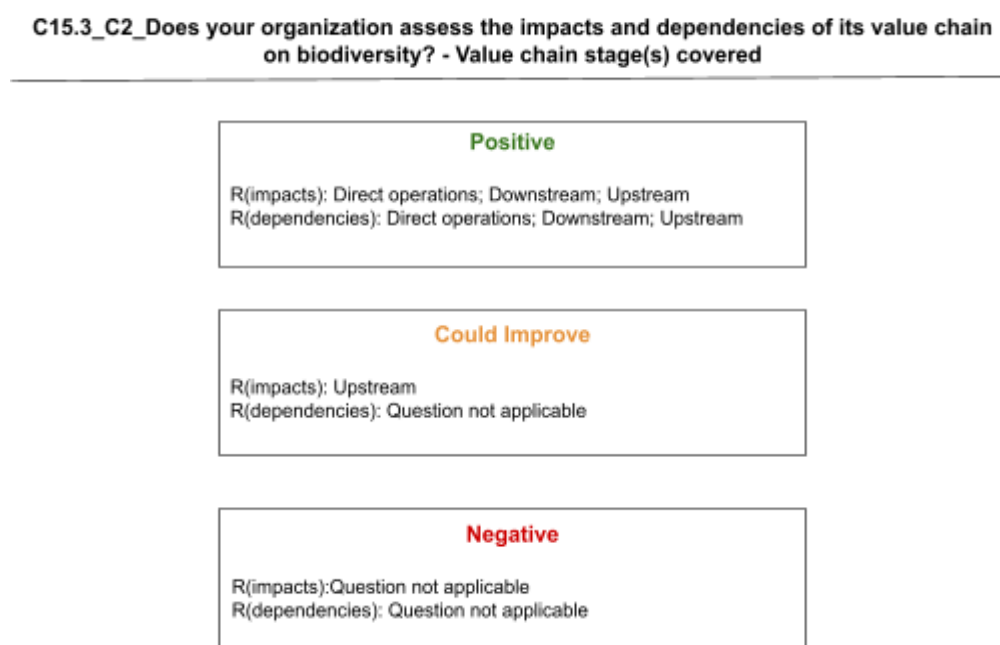


Fig. 2. Comparison between a 'positive', a 'could improve', and a 'negative' answer in question C15.3_C2.

Additionally, Figure 3 illustrates this breadth of engagements for question C15.2_C1, asking whether companies have made public biodiversity commitments or endorsed relevant initiatives. A company that has done both receives 'positive'; one that has done only one of the two receives 'could improve'; and one that has done neither—regardless of future intentions—receives 'negative.' This gradation allows the analysis to distinguish genuine commitment from partial engagement.

C15.2_C1_Has your organization made a public commitment and/or endorsed any initiatives related to biodiversity? - Indicate whether your organization made a public commitment or endorsed any initiatives related to biodiversity

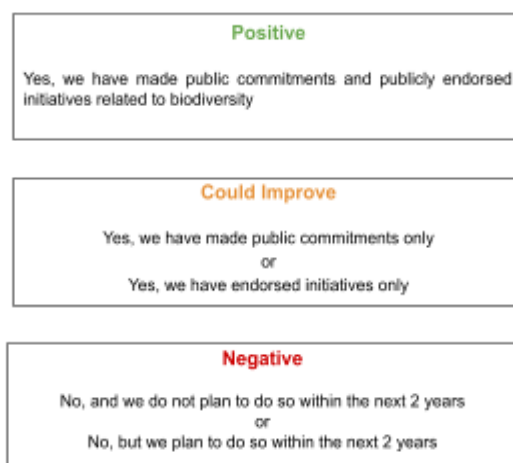


Fig. 3. Comparison between the 'outcome' codes in question C15.2_C1.

3. RESULTS

3.1 Depth of Open-Ended Responses

The depth analysis reveals a striking divergence between the two groups (Fig. 3). Approximately 50.9% of open-ended responses from Brazilian mining companies were classified as 'complete'— meaning they provided the level of specificity, structure, and coherence expected by the question. In contrast, only 14.8% of EU responses reached the same standard. The majority of EU responses (65.1%) were classified as 'incomplete,' compared to 35.1% for Brazilian companies. The 'reasonable' category was relatively similar across both groups (14.0% Brazil; 20.1% EU), suggesting that the key divergence lies not in moderate engagement but in the proportion of companies that go the extra step toward genuinely informative disclosure.

The outcome analysis shows greater convergence between the two groups, though Brazilian companies still performed better (Fig. 3). Brazilian companies reported 39.2% positive, 6.75% 'could improve,' and 54.05% negative outcomes. EU companies reported 28.2% positive, 7.8% 'could improve,' and 64.0% negative outcomes. The high negative rates in both groups reflect that many companies either have not made public biodiversity commitments, do not use biodiversity indicators, or do not assess their value chain impacts on nature. The 'could improve' category remained small for both groups, indicating that companies tend to either engage fully or not at all with the closed-question items, with relatively few occupying a partial middle ground.

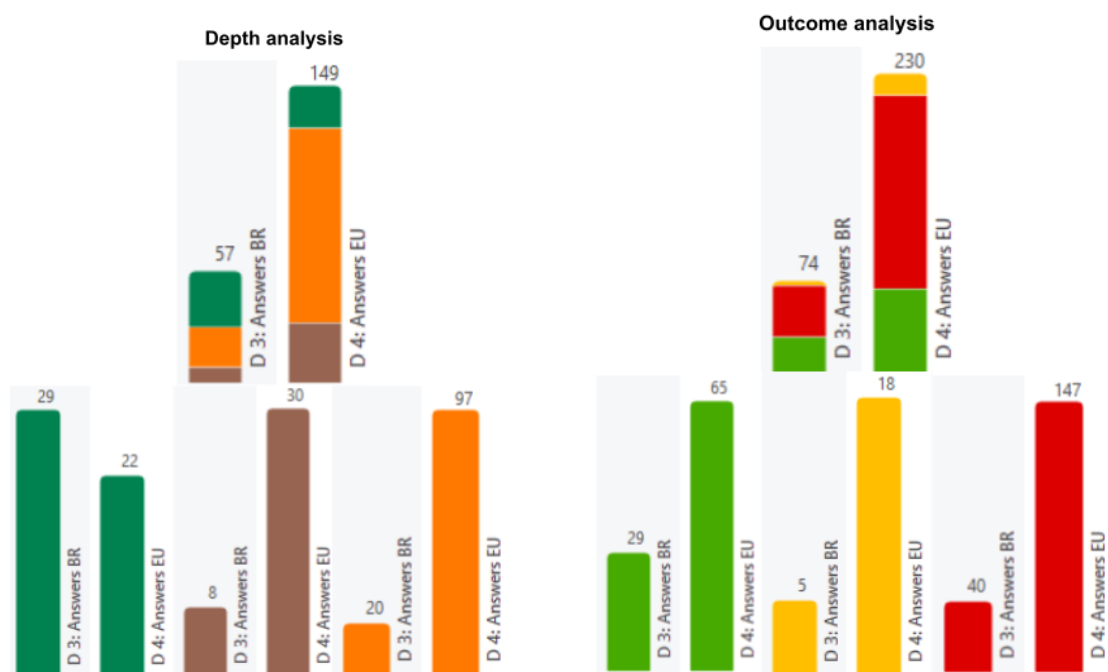


Fig. 4. Depth analysis on the left. In dark green: the classification 'complete'; in brown: 'reasonable'; and in orange: 'incomplete'. Outcome analysis on the right. In light green: the classification 'positive'; in yellow: 'could improve'; and in red: 'negative'.

3.3 Thematic Patterns Across Responses

Beyond the aggregate figures, the thematic content of responses reveals important qualitative differences. Brazilian companies more frequently referenced the mitigation hierarchy (particularly the 'Avoid' and 'Restore' steps), and provided site-specific examples of implementation. EU companies, by contrast, tended toward general statements of policy commitment without operational detail. On value chain assessment, only 4 of 23 companies assessed nature dependencies (3 Brazilian, 1 EU), and only 11 assessed nature impacts; direct operations were by far the most commonly assessed segment, while downstream impacts were evaluated by only 2 companies, both EU. On biodiversity monitoring, 66.7% of Brazilian companies reported using performance indicators, versus 23.5% of EU companies. In external sustainability reports, Brazilian companies again showed greater depth: 3 of 5 with external reports were classified as 'complete,' compared to 2 of 13 EU companies.

Mitigation Hierarchy codification: frequency and occurrence

	36: C15.4a_C7_EU 11 89	37: C15.4a_C7_BR 11 31	39: C15.4a_C8_EU 11 51	40: C15.4a_C8_BR 11 49	45: C15.5_C2_EU 11 20	52: C15.6_C2_BR 11 18	Totals
◆ Avoid 17	8	5		3			16
◆ Compensate 9	2	2	2	2	1		9
◆ Reduce 54	34	13	3	2			52
◆ Restore 22	8	3	3	7		1	22
Totals	52	23	8	14	1	1	99

Table 2. Frequency and occurrence of the Mitigation Hierarchy in the 2023 questionnaire.

Value chain codification: frequency and occurrence

	10: C15.3_C1_EU 11 26	20: C15.3_C1_BR 11 12	23: C15.3_C2_EU 11 33	24: C15.3_C2_BR 11 14
◆ Dependencies assessed 4	1	3		
◆ Direct Operations 13			7	6
◆ Downstream 2			2	
◆ Impacts assessed 11	8	3		
◆ Upstream 9			7	2
Totals	9	6	16	8

Table 3. Frequency and occurrence of Value Chain in the 2023 questionnaire.

Biodiversity monitoring codification: outcomes and indicators

	48: C15.6_C1_EU 11 17	49: C15.6_C1_BR 11 6	51: C15.6_C2_EU 11 28	52: C15.6_C2_BR 11 18	Totals
◆ Answers - Score: Negative 366	13	2	12	2	29
◆ Answers - Score: Positive 188	4	4			8
◆ Pressure 6			5	1	6
◆ Response 5			2	3	5
◆ State and benefit 8			4	4	8
Totals	17	6	23	10	56

Table 4. Codification of outcomes and indicators associated with biodiversity monitoring questions (C15.6_C1 and C15.6_C2).

4. DISCUSSION

4.1 Why Brazilian Companies Disclose More Completely

The results reveal a paradox: Brazilian headquartered mining companies, operating without mandatory sustainability reporting, provide proportionally more complete biodiversity disclosures than their EU counterparts, who are subject to the CSRD and ESRS standards in the upcoming years, despite efforts to flexibilize the disclosure requirements. Several structural factors can possibly explain this gap.

Brazil's environmental impact assessment and licensing regime requires continuous documentation across all project phases. The mandatory Environmental Impact Study (EIS) must cover baseline, impact prediction, and mitigation proposals, compiled by qualified professionals. Periodic monitoring reports, as well as the obligation to renew an operating license, keep companies in an ongoing cycle of environmental data collection and reporting (Sánchez, 2008). This institutional infrastructure potentially builds organizational capacity for biodiversity disclosure that naturally transfers to voluntary frameworks such as the CDP.

In contrast, the EU's EIA process (Directive 85/337/EEC, amended 2014) is comparatively flexible, with post-approval environmental monitoring only formally introduced in 2014, decades after it became embedded in Brazilian practice. Beyond regulation, the environmental disasters in Mariana (2015) and Brumadinho (2019), both involving tailings dam collapses by Vale, generated substantial societal and investor pressure on Brazilian mining companies. Huang (2022) showed that disasters increase corporate transparency particularly when driven by investor demand from affected regions. These events created accountability incentives that go beyond legal compliance. The higher Brazilian adoption of the TNFD framework, cited eight times in the responses, exclusively by Brazilian companies, also contributes, as its LEAP methodology (Locate, Evaluate, Assess, Prepare) provides a structured approach to nature-related assessment that directly maps onto CDP question logic.

The coding process reveals that the gap between 'complete' and 'incomplete' responses is not merely a matter of length. Complete responses, as shown in Fig. 2, name specific governance bodies, describe their mandate and composition, and explain how biodiversity topics flow into business decisions. Incomplete responses often conflate biodiversity with climate, offer vague commitments without timelines, or describe processes without linking them to measurable outcomes. This distinction matters because superficial disclosure, while formally meeting a reporting obligation, fails to give investors, regulators, and civil society the information needed to assess actual biodiversity performance and can stimulate greenwashing practices among companies.

4.2 Future steps

The 2025 CDP Questionnaire addresses some of these gaps with more targeted questions—on artisanal and small-scale mining (ASM), land rehabilitation, biodiversity action plans (BAPs), and mine closure. These additions push companies toward the operational specificity that distinguishes complete from incomplete responses. Therefore, a similar analysis could be conducted comparing responses from mining companies to the CDP 2025 Questionnaire.

However, the absence of third-party verification remains a structural limitation: without auditing, companies can provide detailed narratives without demonstrating that the described practices are actually implemented (Mezzanotte, 2023). Future reporting frameworks should prioritize verifiable, site-level biodiversity metrics alongside qualitative disclosures.

5. Conclusions

This study demonstrates that Brazilian mining companies provide proportionally more complete biodiversity disclosures in the CDP than their EU counterparts, despite the absence of mandatory sustainability reporting requirements. The coding framework (distinguishing 'complete,' 'reasonable,' and 'incomplete' open-ended responses, and 'positive,' 'could improve,' and 'negative' closed-question outcomes), reveals that the quality gap is not marginal: over half of Brazilian responses were complete, compared to fewer than one in seven EU responses.

We hypothesize that this paradox is explained by Brazil's more stringent environmental impact assessment and licensing regime, including monitoring obligations, as well as societal pressure after major mining tailings disasters, and voluntary TNFD adoption. The results underscore that regulatory obligation is a necessary but insufficient condition for high-quality biodiversity disclosure; contextual accountability mechanisms are equally decisive. Future research should examine how the expanded 2025 CDP Questionnaire, with its sector-specific mining questions, affects disclosure quality, and whether the introduction of audited metrics can close the gap between reported commitments and actual biodiversity outcomes.

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