Location matters: How Vale embeds nature into site-level decision-making

Company overview

Name:

Vale

Sectors:

Mining, Logistics, Energy

Company description:

Founded in 1942 and headquartered in Rio de Janeiro, Vale is a global mining leader with operations in over 20 countries and more than 174,000 workers (employees and contractors).

Vale mainly operates in the mining industry, but the company also manages integrated logistics systems, including railways, maritime terminals and ports, that connect mining sites and distribution centres to support global product delivery. The company also invests in energy, either directly or through partnerships and joint ventures.

Goal:

This case study highlights how land-intensive companies like Vale can better understand and manage local nature-related risks and opportunities associated with their operational sites. Focusing on the Carajás mineral complex in northern Brazil, it illustrates how location-specific data and partnerships can support informed decisions that balance business needs with nature action. The example of Carajás shows how Vale has integrated nature considerations into its operations over time, encouraging more risk-aware choices that take local environmental conditions into account.

Case study audience:

This case study is intended for companies in environmentally impactful sectors, such as mining, infrastructure and agriculture, as well as for management teams, operational leaders and cross-functional decision-makers. It is designed to inspire and guide those aiming to embed location-specific environmental insights into their strategies and operations.

Location context:

The case centres on location-focused decision-making in the Carajás mineral complex, in the state of Pará, Brazil. Operating since 1985, the complex produces around 180 million tonnes of iron ore per year and includes one of the world's largest iron ore mines, the S11D Eliezer Batista project.
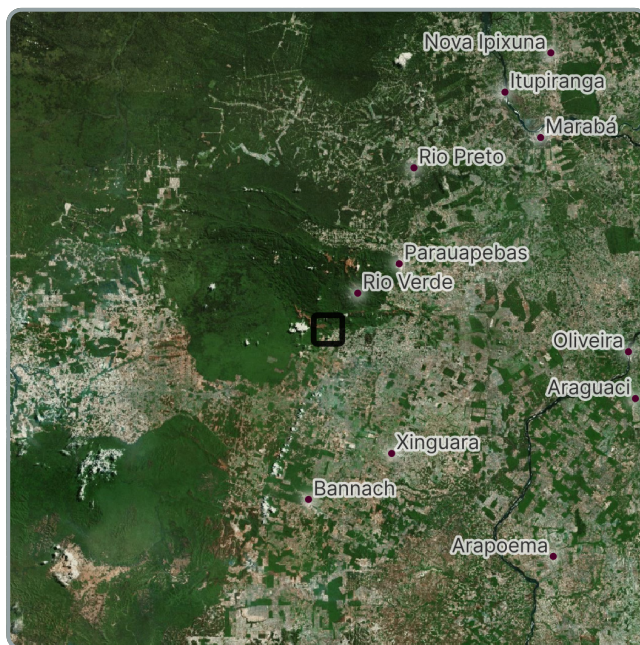
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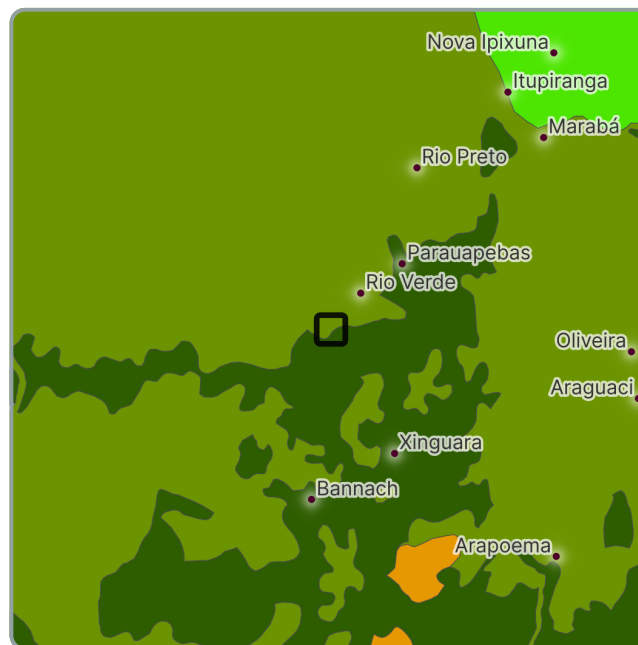
Ecoregions 2017 © Resolve

- Xingu-Tocantins-Araguaia moist forests
- Mato Grosso tropical dry forests
- Tocantins/Pindare moist forests
- Cerrado

Vale works with the Chico Mendes Institute for Biodiversity Conservation to help protect around 800,000 hectares of forest in the Carajás protected area mosaic. Restoration efforts focus on using agroforestry systems that combine planting of agricultural species and tree species to form ecological corridors.

The case highlights how nature considerations can be integrated into operational and planning decisions.

Discover the case study:

Carajás National Forest, Parauapebas, Pará (PA), Brazil, 02/12/2020. Ricardo Teles

How Vale uses location-based decision-making:

- **Ongoing assessment at every stage –** GIS tools and biodiversity risk scores identify overlaps with key habitats and protected areas.
- **Data-driven planning –** Location-specific data guides site design (e.g. helping avoid impacts such as 1,000 hectares of deforestation at S11D).
- **Continuous improvement –** Expert input helps refine methods; alignment is maintained with the Taskforce on Nature-related Financial Disclosures (TNFD).

What businesses can learn:

- Location-based data helps reduce operational, financial and reputational risks.
- Early environmental assessments prevent harm and strengthen community trust.
- Clear, science-based methods support cross-functional engagement on biodiversity.
- Partnerships are vital for long-term, nature-positive outcomes.

Embedding nature in strategy and governance

Vale's place on the nature journey

The company has taken key steps on its nature journey – identifying its most material nature-related risks, setting targets based on priority impacts and dependencies, and initiating actions across its value chain to address and restore nature loss.

Carajás National Forest. Parauapebas, Pará (PA), Brazil. Ricardo Teles
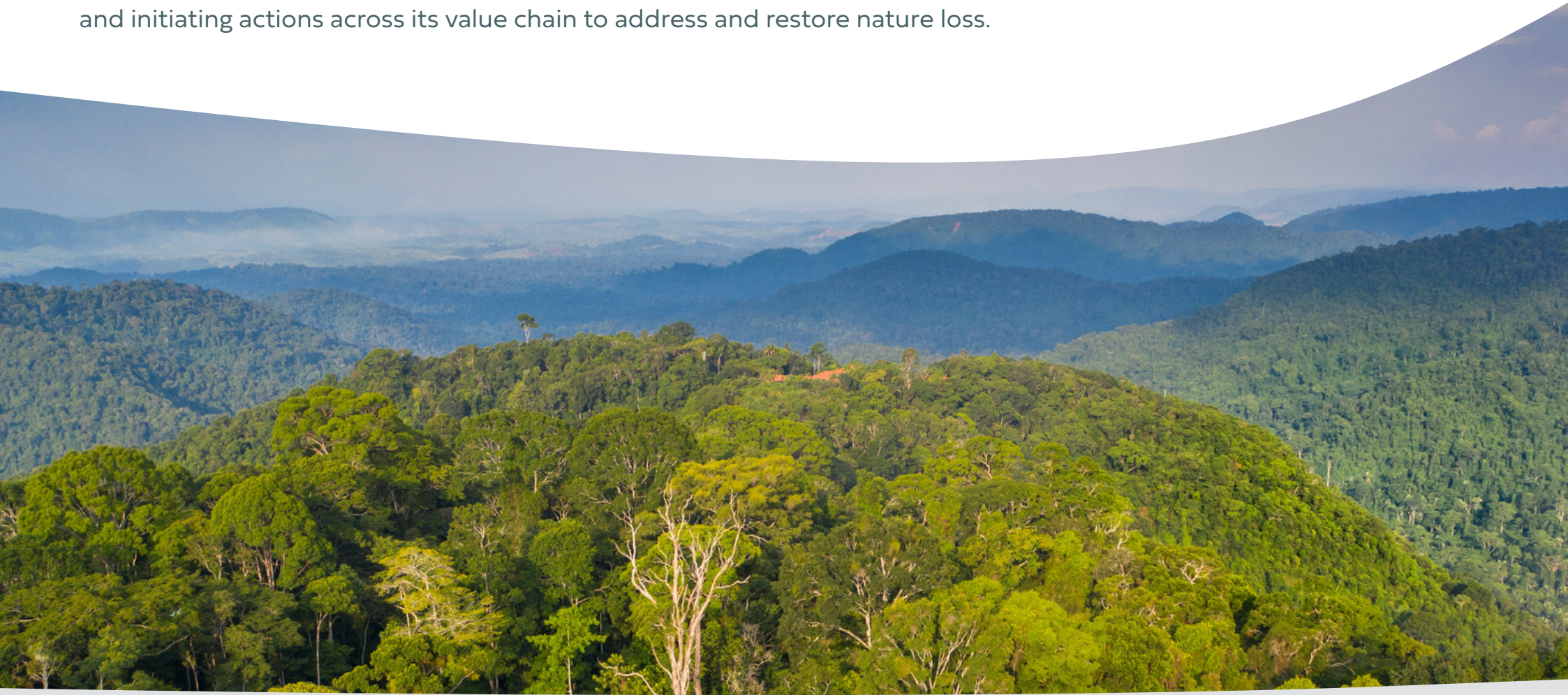
> **Our sustainability strategy aims to ensure that social and environmental dimensions are incorporated into all of Vale's practices and decisions, strengthening the competitiveness of the business and contributing to solving society's challenges.**
>
> *– Patrícia Daros, Director of Nature-Based Solutions,*
> *responsible for Vale's nature strategy*

Vale's overall sustainability change agenda

According to Vale's sustainability strategy, company's approach is built on the following key focus areas:

- generating nature-related knowledge
- monitoring and managing operational impacts and risks
- promoting transparency
- contributing to achieving national and global targets (e.g. Global Biodiversity Framework)
- building a positive legacy for biodiversity by recovering and conserving nature

Based on these premises, in 2019 Vale revised its 2030 agenda in line with the UN Sustainable Development Goals. Its sustainability strategy incorporates key environmental components, including biodiversity, water, climate and local communities, into its decision-making processes. The company has established long-term targets in areas such as climate change mitigation, water resource management, energy efficiency, and forest restoration and conservation.

Vale has pledged voluntary commitments, including:

- A Forest Goal to protect 400,000 hectares and restore 100,000 hectares via partnerships and the Fundo Vale initiative.
- A Water Goal targeting an additional 7% reduction in water consumption by 2030, alongside achievement of its 10% water withdrawal reduction target – already surpassed.

Vale aligns its nature approach with leading public and sectoral frameworks, including the:

- International Council on Mining and Metals Principles
- International Council on Mining and Metals Nature Position Statement
- Brazilian Business Commitment to Biodiversity

These external commitments reflect Vale's intention to align its internal practices with broader efforts to manage nature-related impacts.

Vale's overall approach to nature

The company's operations rely on vital ecosystem services like water supply, climate regulation and biodiversity. But Vale also recognises that its activities impact these same systems through land use, vegetation change and watercourse disruption.

Rethinking the business-nature relationship

Rather than seeing nature as external to the business, Vale acknowledges its role as part of the natural system. This approach is important for building long-term operational resilience.

A collaborative approach

Vale aims for active engagement with both internal teams and external partners, leading to:

- a common understanding of the importance of nature in business decisions
- clear sustainability goals rooted in science and stakeholder input
- a commitment to value creation for both business and biodiversity

How Vale is achieving its goal

Turning commitment into action

To ensure nature-related commitments are implemented consistently in all its operations, Vale has developed an Environmental Management System.

This system enables the company to identify and assess environmental risks; prevent and mitigate potential impacts; and facilitate remediation, compensation and restoration efforts.

The company also applies the Impact Mitigation Hierarchy, a structured approach that prioritises:

- avoiding environmental harm
- minimising unavoidable impacts
- restoring affected ecosystems
- compensating for any remaining loss

Furthermore, Vale has made a long-term biodiversity No Net Loss commitment, with special emphasis on high biodiversity value areas and it has also pledged not to operate in UNESCO World Natural Heritage Sites.

Forest Target: A landmark nature commitment

Vale's Forest Target outlines its goal to support ecosystem protection and restoration by:

- recovering and protecting 500,000 hectares of natural areas by 2030
- focusing efforts beyond the company's operational boundaries
- generating positive outcomes for climate, biodiversity and local communities

This voluntary initiative complements the company's carbon reduction and social impact strategies.

Vale's nature process

Regulatory requirements for environmental impact assessments in Brazil began over 40 years ago, prompting Vale to implement formal processes for evaluating and mitigating its environmental effects.

Vale has adopted an integrated territory management approach that incorporates and applies principles related to the impact Mitigation Hierarchy.

Since 2007, the company has collected and reported on key nature-related indicators aligned with the Global Reporting Initiative. This includes information on its environmental footprint, interactions with regions of high biodiversity value and measures related to endangered species in areas influenced by Vale's activities. The company's *Integrated Report* and *ESG Databook* (environmental, social and governance performance) disclose the data.

Carajás National Forest. Parauapebas, Pará (PA), Brazil. Ricardo Teles

Vale submits annual disclosures to CDP (formerly known as the Carbon Disclosure Project) on climate change, water security and biodiversity.This process prioritised sites based on their impacts on biodiversity and forests.

> **CDP questionnaires offer a structured framework for reporting significant impacts and the measures taken to avoid, minimise, restore or offset them. The process also addresses governance, risk and opportunity management, and stakeholder engagement.**

As an early adopter of The Taskforce on Nature-related Financial Disclosures (TNFD), Vale continues to evaluate how its operations both affect and rely on nature. While the company only recently began formally using the TNFD framework, it has been addressing its environmental impacts for decades. The TNFD framework is helping Vale consolidate historical data and strengthen its management of biodiversity-related risks.

Embedding nature into operations:
Applying a location-based lens to decision-making

> **We have pursued greater integration between the teams involved in project planning and expansion. Assessing the interface between our areas of interest and nature and social issues during project planning, integrating teams and knowledge as early as possible, allows impacts to be avoided and mitigated more effectively, assisting in risk management and maximising opportunities for our business.**
>
> **– Letícia Guimarães,** *Corporate Biodiversity Leader*

Carajás National Forest. Parauapebas, Pará (PA), Brazil. Ricardo Teles

Applying a location-based lens:
The S11D mine case

> **The S11D project represented a transformative milestone for Vale, establishing a new standard for impact mitigation to be followed in all of the company's projects. During the design phase, measures were adopted to avoid impacts on biodiversity by using spatial datasets and metrics to inform siting of plant and the pile to a former pasture area, thus avoiding deforestation of native vegetation.**
>
> **This strategy was further enhanced by the restoration of pasture areas surrounding the plant, contributing to the ecological restoration of the region.**
>
> – *Cesar Neto, Environmental Specialist in the Licensing Department, was an environmental analyst at S11D at the time of implementation*

Vale uses location-based information across all its operations. This case study focuses on the S11D mine in Carajás, which includes mining operations, a processing plant, and integrated rail and port logistics, as part of a broader effort to drive economic and social development in the region.

At Vale's S11D mine, location-based information informed every stage of project development. Using geospatial tools and proprietary biodiversity risk analysis methodology, Vale evaluated multiple design options for the mine and plant. These options were assessed based on their overlap with protected areas, endangered species habitats and key ecosystem services. Early environmental and social impact assessments guided the planning process, while biodiversity data played a critical role in shaping the site layout, ultimately helping to minimise its environmental impact, including by avoiding deforestation, informing forest restoration efforts, and supporting stronger ties with local communities.

From awareness to action

Vale acknowledges the risks of operating within a vital ecosystem (an area designated as protected precisely because of its environmental importance). Mining in Carajás began in 1985, when the company was still owned by the Brazilian government. At that time, a scientific advisory group recommended conserving key forest areas while allowing mining development to proceed. This led to the creation of the Carajás National Forest, where conservation and mining coexist under strict oversight, established by a 1998 federal decree (Decree 2486). It permits mining within the national forest and formalises the partnership between Vale and the Brazilian governmental agency responsible for the protection and management of natural ecosystems.

Vale has been operating in the Carajás region for over 35 years (approximately 28,000 ha of operational areas) and acting in the conservation of almost 800,000 ha of natural areas (government protected areas where the company fund conservation actions and help to manage the areas) in a partnership with the current government agency that manages protected areas, the Chico Mendes Institute for Biodiversity Conservation (ICMBio). Within the scope of this partnership for conservation, Vale invests and develops actions for ecosystem protection, prevention of fire and firefighting, prevention and combat against wildlife hunting, environmental education, scientific research, promotion of local development and sustainable business. In addition to the Amazon rainforest, the company operates in the Atlantic Forest, a significant biome where Vale was founded and where it contributes to protecting approximately 180,000 hectares of land.

How location drives decisions

Vale has a process by which location-specific information can drive decision-making and prioritisation. Below is a general overview of what each step involves:

1 **Establish the methodology**

- adopted a structured biodiversity assessment approach in 2015
- used GIS tools and integrated spatial data

2 **Screen project sites**

- identify overlaps with:
  - protected areas
  - key biodiversity areas
  - conservation priority zones

3 **Gather ecological data**

- collect species-specific data:
  - endangered
  - endemic
  - migratory

4 **Calculate the biodiversity risk score**

- evaluate and compare potential project locations
- use the score to prioritise biodiversity-sensitive areas

5 **Integrate into planning processes**

- apply risk scoring in:
  - site selection
  - biodiversity management planning
  - strategic risk mitigation decisions
- analyse site biodiversity management and improve actions

6 **Focus on high-risk areas**

- prioritise geographies like Brazil and Indonesia
- apply a more detailed analysis in biodiversity-rich areas

7 **Apply across operations**

- use a company-wide method:
  - for new projects
  - for ongoing risk management

8 **Update and improve**

- engage biodiversity consultants and scientists
- continuously refine internal standards and methodologies
- ensure alignment with evolving biodiversity protection goals
- develop scientific knowledge and tools to improve biodiversity feature analyses at each site (e.g. using Biolink, a platform that integrates ecological data to support conservation planning)
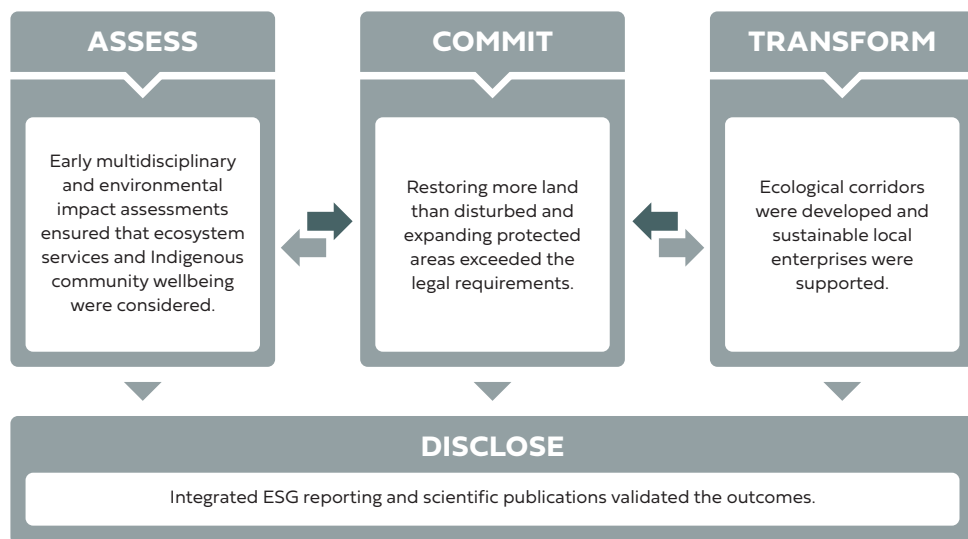
Samauma tree, Pará, Brazil.

ACT-D in practice

The ACT-D framework helps businesses integrate nature into decision-making by guiding them to assess, commit, transform and disclose their actions and impacts.

Parauapebas river, Canaã dos Carajás, Pará, (PA), Brazil. Anderson Souza

ASSESS	COMMIT	TRANSFORM
Early multidisciplinary and environmental impact assessments ensured that ecosystem services and Indigenous community wellbeing were considered.	Restoring more land than disturbed and expanding protected areas exceeded the legal requirements.	Ecological corridors were developed and sustainable local enterprises were supported.

DISCLOSE

Integrated ESG reporting and scientific publications validated the outcomes.

Assess:

The project implementation process begins by analysing potential sites, taking into account the limitations imposed by the location of the mineral deposits. Multiple teams, such as environmental, engineering and geotechnical, are involved throughout the project, from initial planning to mine closure. Early-phase assessments help inform a more comprehensive environmental impact assessment, incorporating input from environmental authorities to support a shared, informed approach. Site selection combines technical evaluations with executive decision-making, applying biodiversity and social assessment methods.

Commit:

The company aims to meet legal requirements for impact avoidance, mitigation, restoration and environmental compensation. Beyond compliance, Vale aims to strengthen conservation and restoration efforts, seeking to restore more land than it deforests. This commitment is demonstrated by restoring over 5,000 hectares, which has expanded protected areas within the Carajás National Forest and helped to create ecological corridors.

Transform:

According to Vale, a range of actions contribute to transformation, including:

- avoiding deforestation
- reducing fuel and water consumption
- reducing greenhouse gas emissions
- restoring forests

Key transformation activities include:

- **Operational improvements:** Efforts to avoid deforestation, reduce fuel and water use, lower greenhouse gas emissions and restore forests are part of Vale's ongoing work to limit environmental impacts at the site level.

- **Management systems:** The Vale Production System is the company's management model, combining leadership, technical and operational practices to embed environmental responsibility and asset integrity into business processes.

- **Landscape restoration:** Through initiatives like Fundo Vale, the company supports pilot agroforestry and blended finance projects that restore degraded lands. These projects test commercially viable restoration models while actively involving local communities. *Fundo Vale is a philanthropic and impact-focused investment fund established by Vale in 2010. Its mission is to support sustainable, inclusive development – especially in the Amazon – through blended finance mechanisms and capacity-building for impact businesses. It operates independently from Vale while aligning with the company's broader sustainability goals.*

- **Progress to date:** Since 2020, partnerships with startups have established agroforestry systems on approximately 7,200 hectares, using diverse native species and integrating restoration with sustainable land-use practices.

Disclose:

External disclosures are available in the Vale *ESG Databook, Integrated Report* and ESG Portal. Vale also published a case study book featuring practical examples of how it implemented its strategy and the outcomes of this project.

S11D Mine, Canaã dos Carajás, Pará, Brazil. Salviano Machado

Decision outcomes

S11D serves as a learning point for how industrial operations can be integrated within fragile landscapes with minimised ecological damage – through site selection, industrial design, partnerships, and restoration efforts. S11D is one of the first outcomes of Vale's commitment to developing solutions that align with global efforts to reduce greenhouse gas emissions and ensure the sustainable management of natural resources throughout its processes.

Seedling nursery during Brazilian nut tree seed harvest – Marabá, Pará (PA), Brazil. Ricardo Teles

The company's strategic benefits from introducing innovations at the S11D sites include environmental improvements, increased operational efficiency and cost savings. These outcomes support Vale's positioning as a company integrating responsible practices into its mining operations.

Through investments in technology and innovation as well as targeted restoration efforts, the S11D site has:

- achieved a 70% reduction in fuel consumption

- achieved a 50% decrease in greenhouse gas emissions

- achieved a 93% reduction in water consumption

- connected previously islanded forest patches

- restored 5,000 hectares of forest by planting nearly 1 million seedlings

- contributed to an ecosystem balance, the presence of apex predators such as jaguars and ocelots was again observed.

Jaguar *(Panthera onca)* in Mata Grosso, Brazil.

Key challenges and solutions

→ **Challenge:** effectively communicating risks to engage diverse teams

Sustainability teams' understanding of biodiversity risks does not always resonate with other departments. To ensure these risks are properly considered, it is important to tailor communication approaches for different levels and functions across the company. Various teams, from engineers and geotechnical experts to legal staff and the board, are involved in developing initial assessments. While these assessments highlight key risks and impacts, making the most environmentally friendly decisions remains an ongoing process.

Solution:

Previously, Vale's risk analysis methodology gave limited attention to biodiversity. However, with the introduction of the TNFD, the company has improved its assessments by adopting the LEAP (Locate, Evaluate, Assess and Prepare) approach. This has allowed Vale to integrate biodiversity into its risk methodologies and include it in the company's risk map.

Trees from the Amazon rainforest found during the flooding period located in the Alter do Chão region, Pará, Brazil.
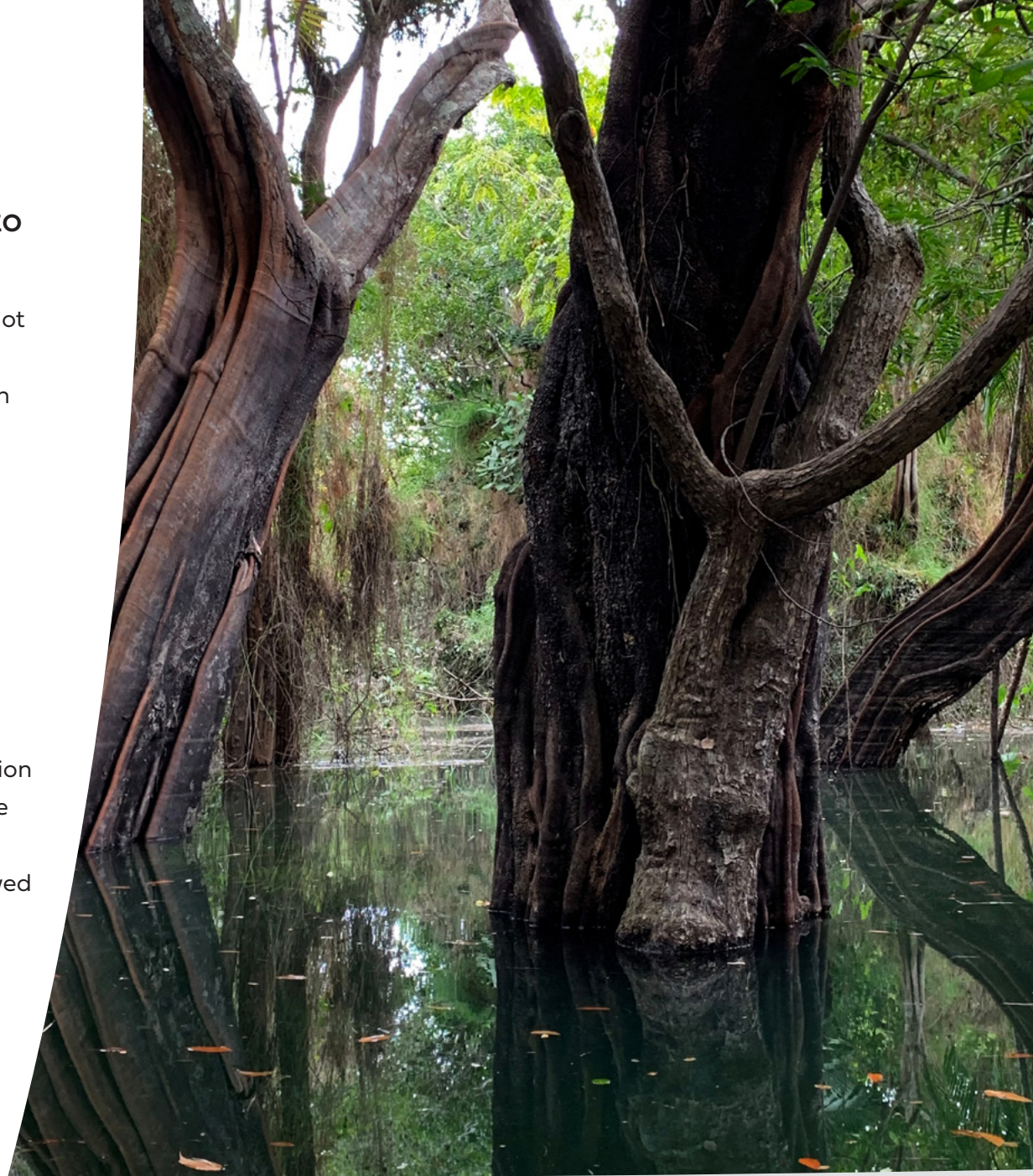
→ **Challenge:** facilitating data availability and processing

Collecting data from both internal sources and public platforms to analyse and prioritise biodiversity attributes has been complex.

Solution:

Vale is implementing new technologies, including artificial intelligence tools. The Vale Institute of Technology has developed Biolink, a data search and analysis platform used in the company for various processes. While some gaps remain, opportunities exist to enhance both internal processes and external reporting.

Amazon Rainforest in Brazil.

→ **Challenge:** communicating and engaging with different stakeholders

While Vale engages with a range of stakeholders, managing biodiversity-related dependencies, impacts, risks and opportunities while aligning internal strategies with external standards and ensuring stakeholder understanding remains a challenge.

Solution:

Vale addresses this challenge by investing in scientific research and biodiversity initiatives, developing clear internal guidelines for biodiversity management (associated with its No Net Loss commitment), engaging with external experts and regulators, and aligning with frameworks like the TNFD to communicate the strategic importance of nature-related actions throughout the company.

Rio Xingu, Para, Brazil.

→ **Challenge:** valuing risks associated with biodiversity

A key challenge is building awareness and acceptance of biodiversity risks across diverse functions. Without a clear method to quantify how these risks impact the business, it can be difficult for teams to understand their relevance and the need to engage.

Solution:

Establishing clear methodologies for valuing risks would strengthen the case for including biodiversity in risk management discussions. Vale is currently exploring alternatives by learning from the company's climate change team, which operates in a more mature space. The goal is to apply lessons learned from climate risk management to the context of nature.

Tapajós river, Santarém Pará, Brazil.

Final insights

Lessons learned

With 60% of Vale's production coming from Carajás, a region within a mosaic of protected areas in the Amazon, the company faces significant risks and opportunities tied to its impacts and dependencies on nature. For Vale, this is not just a reputational concern but a business imperative. Ensuring long-term sustainability requires addressing the environmental, economic and social dimensions of the region. A critical challenge for both the company and society is to accelerate restoration and conservation efforts. To be more effective and impactful in this, investing in scientific research and building partnerships is essential.

Collaboration with research institutions (e.g., Instituto Tecnológico Vale), government agencies (e.g., Chico Mendes Institute for Biodiversity Conservation; Brazilian Institute of Environment and Renewable Natural Resources), NGOs, local communities, and peer companies is essential to ensure lasting results.

Parauapebas river, at National Forest of Carajás, Pará, Brazil.

Lessons Learned for Vale

✓ **Addressing past challenges strengthened integration of nature**

Earlier environmental and community issues highlighted the need to embed biodiversity and ecosystem considerations across all project phases. These experiences led Vale to implement stricter policies, enhance risk assessments, and collaborate more closely with regulators and conservation groups.

✓ **Partnerships improve outcomes and credibility**

Working with the Chico Mendes Institute for Biodiversity Conservation (ICMBio) and other stakeholders supported Vale's efforts to align operations with conservation priorities. Partnerships contributed to improved transparency, monitoring, restoration, and stewardship.

✓ **Openness to external input drives improvement**

Local challenges motivated Vale to seek external feedback and align with international frameworks such as TNFD and CDP biodiversity. This has helped refine their nature-related risk management and reporting practices.

✓ **Technology and data improve decision-making**

Vale's use of GIS mapping, biodiversity risk scoring, and related tools has been key in enabling more precise, location-specific decisions.

Business gains from location-based nature action

Vale has identified several benefits through location-based decision-making, including:

- lower long-term operational and financial risks
- more sustainable, socially accepted projects
- improved environmental outcomes: climate mitigation, biodiversity recovery and community resilience
- an enhanced corporate reputation and improved licence to operate

Key Takeaways for Other Companies

✓ **Location-specific data supports risk management**

Detailed location assessments help anticipate and address operational, financial, and reputational risks linked to nature.

✓ **Partnerships are crucial for long-term success**

Engaging local communities, regulatory agencies, NGOs, and researchers strengthens conservation outcomes and social license to operate.

✓ **Data tools enhance analysis and planning**

GIS, biodiversity risk tools, and other technologies can improve site planning and support continuous improvement.

✓ **Cross-functional collaboration matters**

Embedding nature into decisions requires engaging different business functions and adapting communication to varied internal audiences.

A-Track

Project partners:

comms@a-track.info

a-track.info

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