Climate Week NYC & COP 30, 2025

Nature based Solutions

Nature Forward Approaches for Mining

Columbia Climate School
Columbia Center on Sustainable Investment

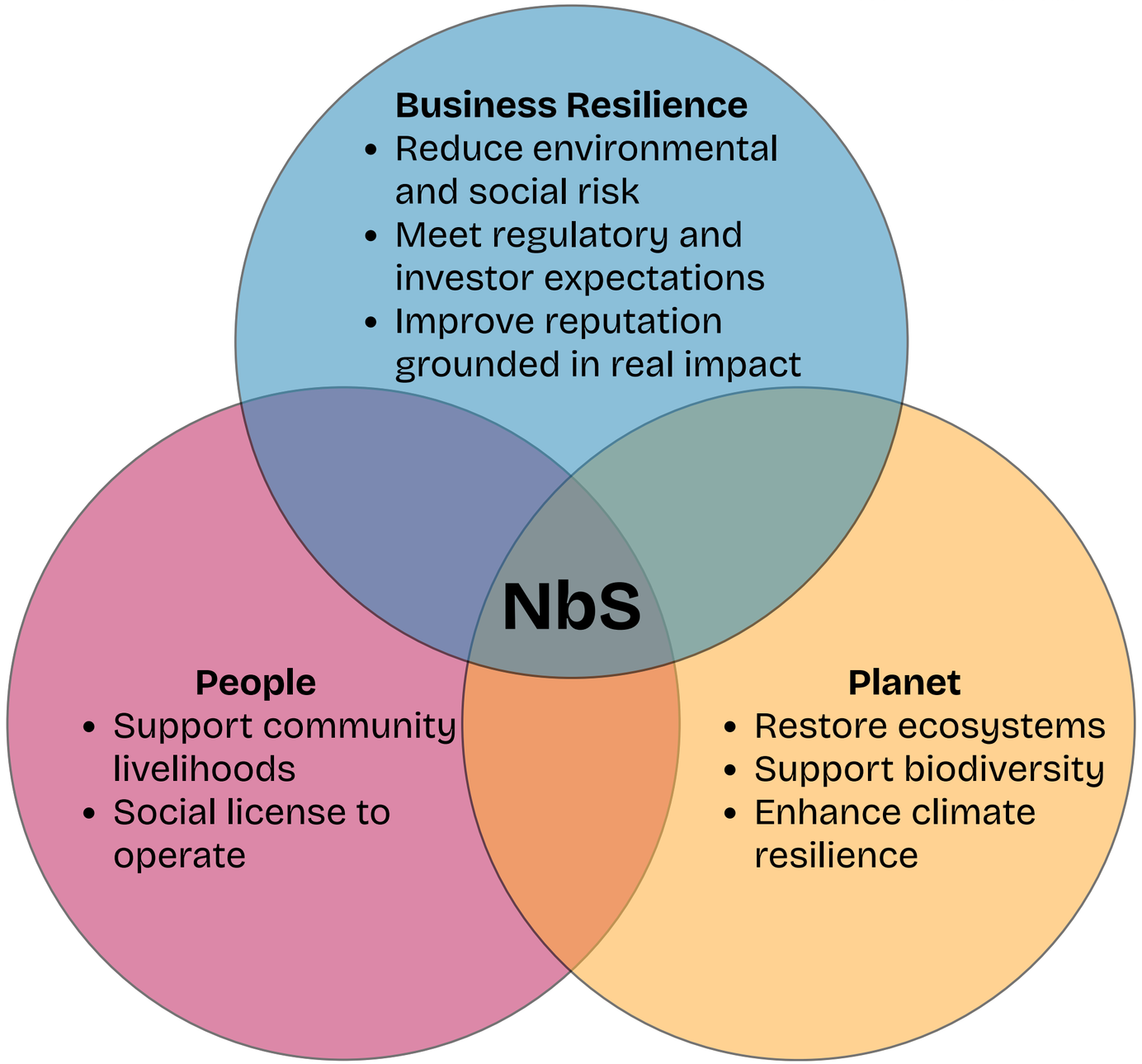
VALE

Why NbS & Mining?

Mining often overlaps with sensitive ecosystems: 7% in biodiversity hotspots, 8% in protected areas, 16% in “wilderness” areas of high ecological integrity.

Why now?

Increasing mineral demand amplifies mining’s economic, social, and environmental footprint as well as its impact on decarbonization goals.



Defining NbS

"Actions to protect, sustainably manage and restore natural or modified ecosystems, which address societal challenges* effectively and adaptively, while simultaneously providing **human well-being** and **biodiversity benefits**." (IUCN, 2016)

Key Features of NbS

***Addresses Societal Challenges**

E.g. Lack of food and water security, public health, natural disasters.

Generates Societal Impact

NbS address societal challenges and thus center on human well-being.

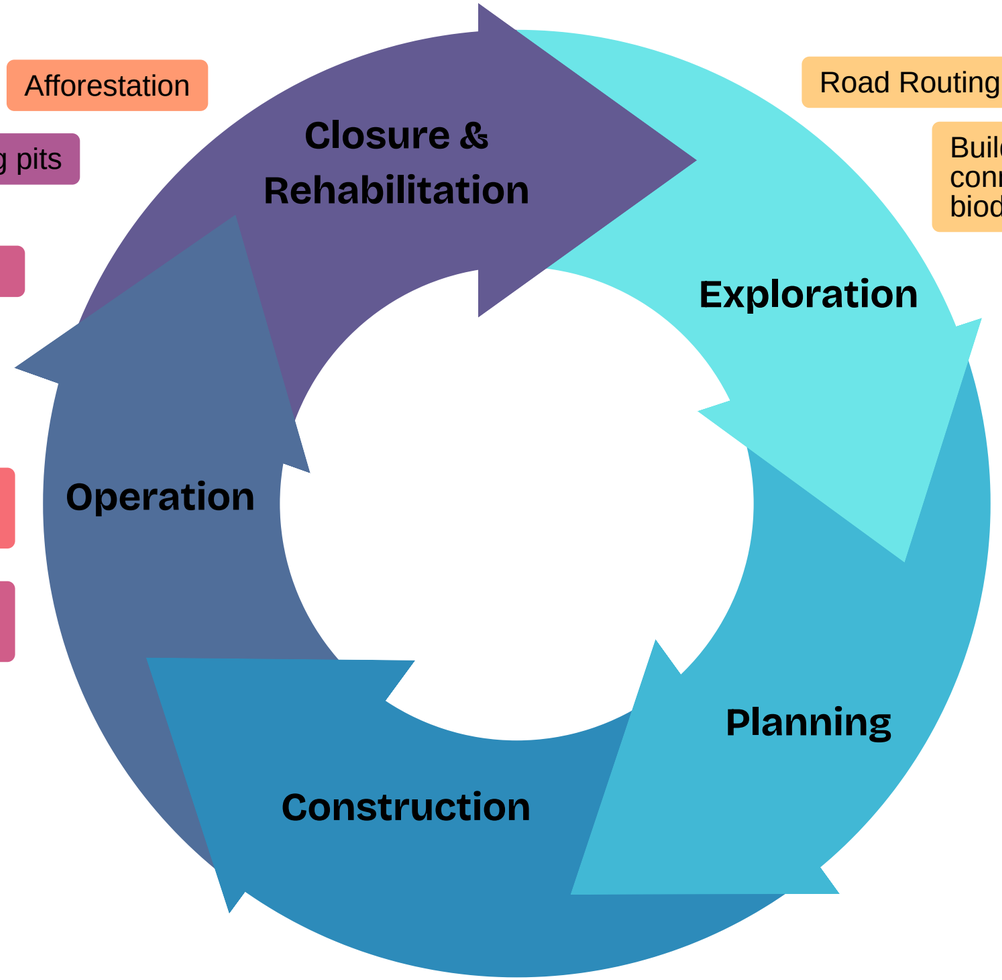
NbS Works WITH Nature

Healthy ecosystems deliver valuable services to society. Restoring nature is cost-effective.

NbS Generates Climate Co-benefits

Climate mitigation and resilience impacts generated by interrelation between nature and climate.

NbS in the Mining Lifecycle



Agroforestry

Afforestation

Quarry lakes: create reservoirs from mining pits

Phytoremediation: Plants and microbes for contaminant control in soil, water, and sediments

Road Routing

Building wildlife corridors: Designated natural pathways connecting habitats to support species movement and biodiversity

Protected areas management

Floodplain restoration: Repurposing low-lying land near the mine to hold run-off

Water bioremediation: using micro-organisms to break down contaminants

Protected areas management

Seed nursery and farming: native seedlings production for reforestation

*Cross-cutting NbS design

Revegetating drainage basins: Adding vegetation to basins for erosion control and water filtration

Vegetation screens: Planted barrier for dust, noise, erosion control, and habitat support

Fiber matting: Natural fiber mats for soil erosion control

NbS Resilience Building Function

- Water Abstraction
- Pollution Management
- Landscape Stabilization
- Landscape Recovery
- Land-use Planning
- Livelihood Management

The Planning Phase

NbS can be implemented at any phase of the mining lifecycle — but planning is the most critical.

1

Set direction

Defines purpose, form, and implementation of NbS

2

Craft strategy

Moves beyond singular interventions to a nature-conscious framework

3

Build trust

Integrates community interests and participation

Spectrum of Community Engagement

The host community can be engaged in a mining project in various ways. The following reflect a spectrum of community participation.

Community Information

Community is informed of the NbS initiative but has no role in shaping or implementing it.

Community Consultation

Community has a role in the planning and development of the NbS project, but does not participate in implementation. Companies mainly seek community approval.

Community Partnership

Community co-designs NbS strategies with mining parters, identifying shared goals like ecosystem restoration, water management.

Community Empowerment

Community plays a cross-cutting role in NbS implementation, including monitoring, maintenance, and management.

Leadership Transfer

Community leads NbS project. Mining company invests in community capacity building and long-term partnerships. Decentralized project model.

Roundtable Discussion

Climate Week NYC, September 2025

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Roundtable Objectives

Explore how mining can use **Nature-based Solutions (NbS)** and **Circular Economy approaches** to deliver benefits for people, climate, and ecosystems.

Climate Resilience Focus

Understand how land stewardship throughout the mining cycle can protect operations, communities and ecosystems against climate shocks.

Mining's Potential

Understanding how the mining sector can harness NbS to turn negative externalities into a nature positive contribution.

Coming Soon

COP30, Belém

Laying the groundwork of dialogue at the "Nature COP" focusing on Brazil's socio-bioeconomy vision.

Discussion Prompts

What does it mean for a mining company to be a ‘land custodian’ in practice rather than just a resource extractor? What practices and principles further this distinction?

What frameworks, practices, and planning decisions most strongly determine whether mining can deliver lasting benefits for people and nature?

What are the key challenges?

What models of landscape co-management between companies, governments, and communities can promote and maintain ecological integrity and climate benefits?

What lessons can be drawn from both successful and challenging NbS interventions across the mining lifecycle?

When NbS “fail”, what are the most common reasons?

Can we draw patterns from these factors?

How can stakeholders reconcile trade-offs when an NbS delivers ecological benefits but limited social benefits, or vice versa?

Discussion Prompts

COP 30, 2025

NbS: Sustainable Critical Minerals Value Chain

Panel Discussion, COP 30, November 2025

Columbia Climate School
Columbia Center on Sustainable Investment

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Climate Week NYC

Roundtable discussion convening ~40 experts from industry, policy, law, NGOs, start-ups, research, and finance.

Experts explored how the integration of **nature-based solutions (NbS)** and circular economy approaches can advance biodiversity, community well-being, and climate resilience; the unique role of stakeholders; and the principles for successful application and implementation.

01 Land-use Planning for People and Nature

How can land-use planning in the mining cycle support climate resilient communities, ecosystems, and operations?

02 Successful NbS Design

What conditions and/or elements inform the long-term success of NbS?

Learn more about the takeways

Why COP?

The COP30 Agenda...

01 Nature COP

Nature on the frontlines of the agenda. NbS as an opportunity to protect nature while advancing climate resilience.

02 Implementation COP

Moving from pledges to practice.

03 Sociobioeconomy

Thinking seriously about how to integrate nature, people, and climate in scalable ways.

Why this event?

Scaling NbS in mining supports COP's broader agenda of integrating climate and nature forward solutions, advancing the socio-bioeconomy, empowering communities, and strengthening the global push to protect and restore nature.

Image: Roberto Huczek via Unsplash

Panel Objectives

1. Move from urgency to implementation and governance
2. Discuss finance and opportunities for cross-sectoral partnerships and innovation
3. Look ahead to 2030: What's next?

Meet our Panelists

Jonathan Dunn
Head of Climate
Anglo American

Kirsten Hund
Head of Climate
and Nature
Vale Base Metals

Marcio Sztutman
Executive Director
The Nature
Conservancy Brazil

Lara Fornabaio
Moderator
Lead Researcher, CCSI

COP 30, 2025

Case Exercise in NbS Design

Practicioner Workshop, COP 30, November 2025

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The Scenario

Site
Nickel Mine in the Pará State, Northern Brazil.

Status
Active mine. Operational since 2015.

Landscape
Integrated in Amazon biome.
Close to forest fragments, secondary vegetation, and small holder agricultural lands.

Hydrology
Watershed which drains into locally used river.

Setting the Scene

The site is an active nickel mine in the Pará State of Northern Brazil, where there is **increasingly intense rainfall** induced by changing climate conditions.

The mine is situated in a watershed, which catches rainfall that drains into another river – a critical waterway for IPLC downstream.

Photo credits: Hector Brasil via *Unsplash*

The Challenge

During the wet season (December–April), **surface runoff** from mine roads and overburdened areas **carries sediments and heavy metals into nearby streams**.

Mining company invested in drainage, yet water quality monitoring data show continued exceedances during peak rainfall.

Impact

Periodic **flooding** damages local access roads and disrupts smallholder farms adjacent to the concession.

Photo credits: Azzedine Rouichi via *Unsplash*

The Risks

Operational Risk	Flooding and erosion lead to ore transport delays and maintenance overruns.
Regulatory Risk	The state environmental agency has issued compliance notices for sediment control failures.
Ecological Risk	Sedimentation threatens aquatic biodiversity in small forest streams. Riparian zones have been degraded.
Social and Reputational Risk	Local farmers’ cooperatives have lodged complaints with the municipal government.
Climate Risk	Future climate projections show an increase in extreme rainfall events by 2035.

Existing Responses

01 Stormwater **drains** and sediment retention **basins** across waste dumps.

02 **Rock lining** in erosion-prone channels

03 Periodic **dredging** of sediment ponds.

04 **Monitoring stations** measuring turbidity and heavy metals.

Limitations of gray infrastructure approaches:

- High maintenance cost.
- Performance degrades quickly under extreme weather.
- Lack of natural buffering capacity and biodiversity benefits.
- Limited engagement with local communities or co-benefits for livelihoods.

Opportunities for NbS

The company is exploring how NbS can complement these measures. Preliminary site assessments have identified the following opportunities:

Reforesting degraded buffer zones along the river.

Impact: stabilize soil and reduce runoff.

Wetland vegetation to naturally filter sediments and metals before discharge from sediment ponds.

Impact: reduce runoff, improve water quality.

Planting deep-rooted **native grasses** on waste pile slopes.

Impact: enhance infiltration and prevent erosion.

Create **agroforestry strips** with local farmers that combine economic crops (e.g., açaí, cocoa) with native species.

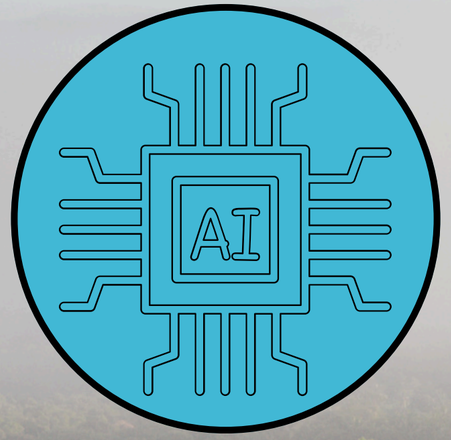
Impact: soil and water conservation.

Technologies of Interest

Other technologies the company is considering include:

Drones

Topographic mapping and erosion detection.

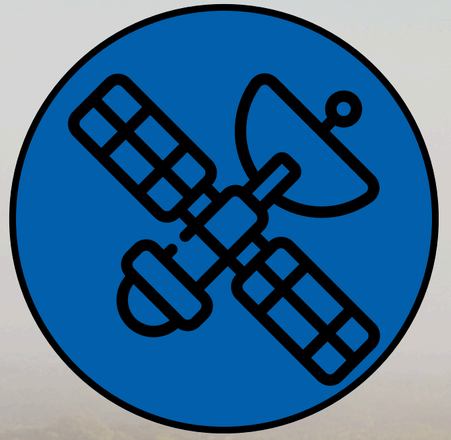


AI Models

Predict flood risks under different climate scenarios.

IoT Water Sensors

Support continuous turbidity and conduct flow monitoring in real time.



Satellite-based monitoring

Observe vegetation cover to verify NbS biodiversity and climate performance

The Case

You are a multi-disciplinary task force invited by the mining company to **design a NbS-based strategy** for **runoff and water quality management**.

Because NbS are key to this strategy, there should be benefits to:

- **Ecosystem Resilience**
- **Local Communities**

Photo credits: Curioso Photography via *Unsplash*

Questions

Your task is to propose a solution package that answers the following questions:

01 Which NbS approaches should the company prioritize?

02 How do these integrate with (or replace) existing grey infrastructure?

03 How do they deliver multiple benefits (operational, ecological, social)?

04 Which technologies could be deployed in this context?

05 Which technologies or digital tools could strengthen design and monitoring?

06 What innovative financing mechanisms could be applied?

07 What is a partnership model that could fit this NbS? And who are the right partners to bring in (company, NGOs, communities, research institutions, local government, investors)?